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Social Relationships, Personality, and Subjective Well-Being:

Investigating Social Processes Across Different Methods and Temporal Resolutions

Dissertation

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Abstract

Based on the assumption that social relationships are universally important to human well-being, this dissertation investigates the role of individual differences in different social contexts. Three empirical studies investigate the longitudinal interplay between personality, well-being, and social relationships at different temporal resolutions and using various assessment methods.

Study I investigated the psychological consequences of becoming a grandparent, an understudied topic in personality development in late adulthood. Representative panel data from the Netherlands and the United States were used to analyze how personality and life satisfaction of first-time grandparents changed during the transition to grandparenthood. Propensity score matching was employed to address confounding. In contrast to expectations based on the social investment principle, results generally showed mean-level stability of the Big Five personality traits and life satisfaction over the transition to grandparenthood, and no consistent moderation by gender, employment, or providing grandchild care. There was no evidence of lower rank-order stability in grandparents compared to matched controls or of larger interindividual differences in change. The findings are discussed in relation to recent critical re-examinations of the social investment principle.

Study II examined the regulation of social needs during governmental contact restrictions that differed in situational strength over time. The study analyzed how changes in social contact frequency over time (personal and indirect contact) and associated well-being (life satisfaction, depressivity/anxiety) were moderated by the four social traits affiliation motive, extraversion, need to be alone, and social anxiety. Individual differences in the affiliation motive and need to be alone moderated the resumption of personal contact under loosened contact restrictions. Changes in life satisfaction and depressivity/anxiety associated with increased personal contact frequency differed depending on the need to be alone and

social anxiety. The findings provide insight into how social traits influenced the resumption of personal contact during times of contact restrictions and contribute to the understanding of individual differences in the relation between social need regulation and well-being.

Study III focused on the question how social dynamics in daily life relate to momentary affect. In confirmatory analyses, social oversatiation (i.e., being in contact but desiring to be alone) was associated with decreased positive affect (PA) and increased negative affect (NA), whereas social deprivation (i.e., being alone but desiring contact) was unrelated to affect. Exploratory analyses revealed that a higher desire to be alone was consistently related to decreased affective well-being, whereas a higher desire for social contact was related to increased affective well-being. Out of the different indicators of social contact derived from passive mobile sensing measurements, having more conversations than usual was related to higher PA even when controlling for desire to be alone. Conversely, using communication apps more frequently than usual when alone was related to higher NA. Implications for dynamics in social need regulation and the benefits of combining experience sampling and mobile sensing measures are discussed.

The findings contribute to the understanding of both long-term personality development in the context of social investment and short-term personality processes in daily-life social need regulation. It is discussed how future research can integrate the perspectives of personality processes and personality development based on the results of this dissertation and on an inclusive framework of personality along domains of affect, behavior, cognition, and desire. Finally, the dissertation demonstrates and discusses how multi-method intensive longitudinal data that combine active experience sampling and passive behavioral assessments through mobile sensing may overcome previous limitations in research on dynamic social processes, which potentially drive personality development.

Zusammenfassung

Ausgehend von der Annahme, dass soziale Beziehungen universell wichtig für menschliches Wohlbefinden sind, wird in dieser Dissertation die Rolle individueller Unterschiede in verschiedenen sozialen Kontexten untersucht. In drei empirischen Studien wurde das längsschnittliche Zusammenspiel von Persönlichkeit, Wohlbefinden und sozialen Beziehungen in unterschiedlichen zeitlichen Auflösungen und mit verschiedenen Messmethoden untersucht.

Studie I untersuchte die psychologischen Konsequenzen, wenn Eltern zum ersten Mal Großeltern werden. Repräsentative Paneldaten aus den Niederlanden und den Vereinigten Staaten wurden verwendet, um zu analysieren, wie sich Persönlichkeit und Lebenszufriedenheit von erstmaligen Großeltern während des Übergangs zur Großelternschaft verändern. Mit Hilfe von Propensity Score Matching wurde der Einfluss von Störfaktoren berücksichtigt. Im Gegensatz zu den Erwartungen auf Basis des Prinzips sozialer Investitionen zeigte sich vor allem Stabilität der Big Five Traits und der Lebenszufriedenheit während des Übergangs zur Großelternschaft und keine konsistente Moderation der Effekte durch Geschlecht, Beschäftigungsstatus oder die Betreuung der Enkelkinder. Es gab keine Hinweise auf eine geringere Rangordnungsstabilität der Großeltern im Vergleich zu den Kontrollgruppen oder auf größere interindividuelle Unterschiede in der Veränderung. Die Ergebnisse werden vor dem Hintergrund kürzlicher Kritiken und Weiterentwicklungen des Prinzips sozialer Investitionen diskutiert.

Studie II untersuchte die Regulierung sozialer Bedürfnisse während staatlicher Kontaktbeschränkungen, die sich in ihrer situativen Stärke über die Zeit unterschieden. Die Studie analysierte, wie Veränderungen in der Häufigkeit sozialer Kontakte im Zeitverlauf (persönliche und indirekte Kontakte) und das damit verbundene Wohlbefinden (Lebenszufriedenheit, Depressivität/Angst) durch die vier sozialen Traits Affiliationsmotiv, Extraversion, das Bedürfnis Allein zu sein, und soziale Ängstlichkeit moderiert wurden. Individuelle Unter-

schiede im Affiliationsmotiv und im Bedürfnis Allein zu sein moderierten die Wiederaufnahme von persönlichen Kontakten unter gelockerten Kontaktbeschränkungen. Die Veränderungen der Lebenszufriedenheit und der Depressivität/Angst, die mit einer erhöhten Häufigkeit persönlicher Kontakte einhergingen, unterschieden sich je nach dem individuallen Bedürfnis Allein zu sein und der sozialen Ängstlichkeit. Die Ergebnisse geben Aufschluss darüber, wie soziale Traits die Wiederaufnahme persönlichen Kontakts in Zeiten von Kontaktbeschränkungen beeinflussen und tragen zum Verständnis individueller Unterschiede im Zusammenspiel von sozialer Bedürfnisregulation und Wohlbefinden bei.

Studie III konzentrierte sich auf die Frage, wie soziale Dynamiken im Alltag mit momentanem Affekt zusammenhängen. In konfirmatorischen Analysen hing soziale Übersättigung (d.h. soziale Kontakte bei gleichzeitigem Bedürfnis Allein zu sein) mit verringertem positivem Affekt (PA) und erhöhtem negativem Affekt (NA) zusammen, während hingegen soziale Deprivation (d.h. Alleinsein, bei gleichzeitigem Bedürfnis nach sozialen Kontakten) nicht mit Affekt zusammenhing. Explorative Analysen ergaben, dass ein höheres momentanes Bedürfnis Allein zu sein konsistent mit geringerem affektivem Wohlbefinden assoziiert war, während ein höheres Bedürfnis nach sozialen Kontakten mit höherem affektivem Wohlbefinden zusammenhing. Von den verschiedenen Indikatoren für sozialen Kontakt, die aus passiven Smartphone-Sensing Messungen abgeleitet wurden, war eine höhere Anzahl an Gesprächen als üblich mit höherem PA verbunden, selbst wenn für das Bedürfnis allein zu sein kontrolliert wurde. Umgekehrt war die häufigere Nutzung von Kommunikations-Apps, wenn man allein war, mit höherem NA verbunden. Es werden Implikationen für Dynamiken sozialer Bedürfnisregulierung diskutiert.

Die Ergebnisse tragen zum Verständnis sowohl langfristiger Persönlichkeitsentwicklung im Zusammenhang mit sozialen Investitionen als auch kurzfristiger Persönlichkeitsprozesse bei der Regulierung sozialer Bedürfnisse im Alltag bei. Es wird erörtert, wie zukünftige Forschung die Perspektiven von Persönlichkeitsprozessen und Persönlichkeits-entwicklung auf der Grundlage der Ergebnisse dieser Dissertation und eines übergreifenden Frameworks von Persönlichkeit entlang der Domänen Affekt, Verhalten, Kognition, und Bedürfnisse integrieren kann. Außerdem wird in der Dissertation gezeigt und erörtert, wie intensive Längsschnittdaten, die aktives Experience Sampling und passive Verhaltens-messung mittels Smartphone-Sensing kombinieren, bisherige Beschränkungen in der Forschung zu dynamischen sozialen Prozessen überwinden können. Dies kann in der Zukunft auch zu einer differenzierteren Betrachtung von Persönlichkeitsentwicklung beitragen.

Chapter 1

Introduction

1. Introduction

Humans have an innate need for social contact and thrive when they engage in meaningful social relationships (e.g., Antonucci et al., 2014; Baumeister & Leary, 1995; Hofer & Hagemeyer, 2018). At the same time, an individual differences perspective and personality psychology emphasize that people differ in the amount and types of social contact they strive for, and that the well-being benefits they derive from social contact differ. For example, individuals high in extraversion tend to be in the company of others more, whereas individuals low in extraversion engage in social contact less frequently and may feel overburdened with too much social contact. Besides extraversion from the Big Five personality traits, other research traditions describe individual differences in motivational constructs such affiliative or relatedness needs (Hofer & Hagemeyer, 2018; Ryan & Deci, 2000) that also incorporate what people tend to desire in terms of social contact, whereas extraversion mostly captures behavioral aspects (i.e., how people tend to act). In personality psychology, evidence has accumulated that these tendencies we may summarize as social traits are relatively stable over time but also have the potential to change across the life span (Bleidorn et al., 2022). However, the mechanisms of development for these social traits both regarding short-term and long-term processes are still relatively unclear (Bleidorn, Hopwood, Back, et al., 2020).

This dissertation comprises three empirical studies that examine the roles of personality in social relationships at different temporal resolutions using a broad variety of assessment methods. Thereby, the dissertation contributes to research on both personality development over periods of several years and on personality processes that occur over months and within days. Study I investigates how the addition of the new social role of being a grandparent contributes to personality and well-being development in middle and old adulthood. Study II investigates how dynamics of social contact frequency and well-being over the course of changing COVID-19 contact restrictions are moderated by social traits. Study III examines affect and social dynamics in daily life in the form of states of mismatch between momentary social desire and experienced social contact across different indicators (personal or indirect contact, experience sampling or mobile sensing).

I will first introduce theories and key findings on personality and well-being and their development across the adult life span. Then, I will spell out social role transitions as potential catalysts for long-term development. Next, I will segue into the personality processes literature to describe social dynamics as a mechanism for driving behavior and affect in the short-term.

1.1 Individual Differences and their Relevance for Social Behavior

Individual differences capture relatively time-stable tendencies in affect, behavior, cognition, and desire (or motivation) that differ between people (Lubinski, 2000; Revelle et al., 2011; Wilt & Revelle, 2015). This encompasses, among others, personality traits, desires, and stable well-being components (Revelle et al., 2011).

Personality is organized hierarchically with traits on the highest level which are often represented by the Big Five traits agreeableness, conscientiousness, extraversion, neuroticism, and openness to experience (Costa & McCrae, 1992; Goldberg, 1993). At lower levels of organization, facets and nuances have recently received increased attention and might add new insights into personality structure and development (Mõttus & Rozgonjuk, 2021; Schwaba et al., 2020, 2022). The Big Five personality traits have consistently been shown to predict important life outcomes such as health, occupational success, as well as the formation and maintenance of social relationships (Beck & Jackson, 2022a; Ozer & Benet-Martínez, 2006; Roberts et al., 2007; Soto, 2019, 2021; Wright & Jackson, 2022).

For the domain of social relationships, the most relevant Big Five traits are extraversion (Breil et al., 2019; DeYoung et al., 2013), agreeableness (Côté & Moskowitz, 1998; Jensen-

Campbell & Graziano, 2001), and neuroticism (Kroencke et al., 2022; Suls & Martin, 2005). Individuals high in extraversion tend to be sociable, energetic, and assertive, those high in agreeableness tend to be compassionate, respectful, and trusting, and those high in neuroticism tend to be anxious, downcast, and emotionally volatile (Soto & John, 2017). Many situations in daily life, including in work-related contexts, are in essence social or have a strong social component. Hence, traits that are relevant for the domain of social relationships, exert a strong influence on life outcomes in general. Moreover, there are selection effects in the sense that people tend to differentially select environments that fit their personality profiles (Mehl et al., 2006; Rauthmann et al., 2015; Wrzus et al., 2016). People high in extraversion spend less time alone, visit more places associated with social contact, and spend more time in conversation (Matz & Harari, 2021; Mehl et al., 2006). Not only levels of personality traits are predictive of important life outcomes but also changes in these traits (for a summary, see Bleidorn, Hopwood, Back, et al., 2020). For example, decreases in neuroticism are predictive of greater relationship satisfaction (Deventer et al., 2019; Wagner et al., 2014). Thus, the Big Five personality traits constitute universal patterns of thought, affect, and behavior (John et al., 2008; John & Srivastava, 1999) that are highly relevant in social contexts.

Research on needs and motivation developed mostly independently of research on the Big Five (cf. McCabe & Fleeson, 2012). In this context, social needs are defined as driving forces of social behavior (Hofer & Hagemeyer, 2018; O'Connor & Rosenblood, 1996; Ryan & Deci, 2000). Humans have an innate need to seek social contact and form meaningful social relationships (Baumeister & Leary, 1995; Holt-Lunstad et al., 2017; Leary & Kelly, 2009). Some type of social need is usually included in theories on basic human needs (Dweck, 2017; Ryan & Deci, 2000; Tay & Diener, 2011). One specific operationalization of this broader social need is the affiliation motive which describes an individual's relatively time-stable desire to build, maintain, and restore positive social relationships such as friendships (Hofer & Hagemeyer, 2018; Schönbrodt & Gerstenberg, 2012). Conversely, the need to be alone is defined as the motivation to pursue time alone for spiritual, leisure, relaxation, or productivity purposes (Burger, 1995; Lay et al., 2019; Long et al., 2003). While there is some overlap in content of social needs with the Big Five traits extraversion and agreeableness, social needs are conceptually distinct because they focus on desired outcome states (or preferences) and on need satisfaction instead of on behavioral tendencies.

Lastly, subjective well-being comprises different related components of happiness (Eid & Larsen, 2008; Luhmann, Krasko, et al., 2021). Life satisfaction describes how people evaluate their lives (i.e., the cognitive-evaluative component of subjective well-being; Schimmack, 2008). In contrast, positive affect (PA) and negative affect (NA) are the affective components of subjective well-being describing both general mood and more specific emotional states (Diener & Emmons, 1984; Luhmann, Krasko, et al., 2021; Watson & Clark, 1999; Zheng et al., 2016). Studies have shown that subjective well-being aspects have both relatively stable trait components and dynamic state components (Anusic & Schimmack, 2016; Eid & Diener, 2004; Schimmack et al., 2010), both of which can be influenced by various personal and environmental factors (for a review, see Luhmann, Krasko, et al., 2021). There is also a clear relationship between the Big Five and subjective well-being: higher levels of extraversion and conscientiousness, and lower levels of neuroticism are positively associated with higher levels of subjective well-being (Anglim et al., 2020).

Across these domains, the view of traits as time-stable individual differences has undergone a paradigm shift in recent decades triggered by the accumulation of data from long-running longitudinal studies that indicated systematic patterns of development in these traits across the life span (Caspi et al., 2005; Roberts et al., 2006; Specht, 2017; Specht et al., 2014).

1.2 Psychological Development of Personality Traits and Subjective Well-Being

The stability of the Big Five personality traits over time may be explained through a genetically predisposed, heritable part of traits (Briley & Tucker-Drob, 2014; Lo et al., 2017; Penke & Jokela, 2016), but also through stability in life experiences which increases with age until middle adulthood (Briley & Tucker-Drob, 2014). Still, personality traits are subject to change over the entire life span and can be influenced by environmental factors (for recent reviews, see Bleidorn et al., 2021; Roberts & Yoon, 2022; for a recent meta-analysis, see Bleidorn et al., 2022). In terms of the magnitude of change, personality development is concentrated in adolescence and emerging adulthood (Bleidorn & Schwaba, 2017; Pusch et al., 2019; Schwaba & Bleidorn, 2018). However, as summarized by Specht (2017), "personality changes during all of adulthood with most changes occurring in young adulthood and old age" (p. 62; see also Mueller et al., 2016; Seifert et al., 2021; Wagner et al., 2016, 2019). In old age, stability of personality decreases again possibly due to increasingly severe health issues (Mõttus et al., 2012; Seifert et al., 2021; Wagner et al., 2019). With relatively high consistency across samples, mean-levels of personality traits show development towards greater maturity, that is, increases in agreeableness and conscientiousness, and decreases in neuroticism (Bleidorn et al., 2021, 2022; Costa et al., 2019; Roberts et al., 2006; Roberts & Yoon, 2022; Schwaba et al., 2022).

In comparison, subjective well-being is less stable over time and more likely to be influenced by environmental factors (Anusic & Schimmack, 2016; Kandler et al., 2014; Luhmann et al., 2012). Subjective well-being is also estimated to be slightly less heritable than personality traits (for a review, see Luhmann & Intelisano, 2018). Life span development of subjective well-being shows trajectories of decline towards the end of life (Baird et al., 2010; Bartram, 2021; Kratz & Brüderl, 2021; Luhmann & Intelisano, 2018; Wünsche et al., 2020).

Much less is known about life span development of motivational constructs like the affiliation motive which have not been as well represented in large-scale panel studies as the Big Five and subjective well-being (for related constructs such as life goals or implicit motives, see Buchinger, Richter, et al., 2022; Denzinger & Brandstätter, 2018; Hennecke & Freund, 2017; Wehner et al., 2022).

1.2.1 Theoretical Accounts of Stability and Change

There are different ways in which theoretical accounts reconcile systematic personality development with the original assumption of stable, genetically predisposed individual differences. On the one hand, five-factor theory describes personality development as a biological, genetically determined process that is mostly independent of environmental influences such as life events or experiences in social relationships (McCrae & Costa, 1999). This perspective of intrinsic or endogenous personality maturation claims that genetic predispositions drive personality development over the life span and influence the probability to experience certain life events (i.e., selection effects). Environmental influences on development are only considered insofar as they directly influence biological processes, for example, through nutrition or disease prevalence which might explain cross-cultural differences (e.g., Terracciano, 2014).

On the other hand, the most prominent psychosocial theoretical account of personality development is the social investment principle defined within neo-socioanalytic theory (Lodi-Smith & Roberts, 2007; Roberts & Nickel, 2017; Roberts & Wood, 2006). The social investment principle postulates that personality maturation occurs through the adoption of and investments in normative social roles (e.g., entering the work force or becoming a parent) which drive personality development towards greater maturity (Bleidorn et al., 2021; Roberts & Davis, 2016). In other words, taking on responsibility in normative social roles influences people to shift their behavioral tendencies towards more agreeable, conscientious, and emotionally stable (i.e., less neurotic) behavior in the short-term. People's experiences and reflections of this behavior (which are influenced by societal expectations) are then proposed to trigger long-term personality change (Lodi-Smith & Roberts, 2007; Wrzus & Roberts, 2017).

The paradoxical theory of personality coherence (Caspi & Moffitt, 1993) offers a complimentary perspective on personality development through social role transitions: It assumes that trait change is more likely whenever people transition into unknown environments where pre-existing behavioral responses are no longer appropriate and social expectations give clear indications how to behave instead. Conversely, environments that provide no clear guidance on how to behave favor trait stability. The paradoxical theory of personality coherence would therefore also predict that age-graded, normative life experiences such as parenthood or grandparenthood drive personality development (Hutteman et al., 2014; Specht et al., 2014).

Integration of these different theoretical perspectives was recently attempted by Wagner et al. (2020) who acknowledged the importance of both genetic and environmental factors for both personality stability and change. In short, their theoretical model describes interdependencies of personal (e.g., genome, biological functions, traits) and environmental (e.g., culture, social relationships, daily situations) sources of stability and change, each at different levels of malleability (Wagner et al., 2020). The model, however, does not go into detail regarding the exact preconditions that favor trait change.

Similarly, well-being theories revolve around the question whether people have a stable, genetically predisposed set-point of well-being (Luhmann, Krasko, et al., 2021; Luhmann & Intelisano, 2018). Set-point theory originally stated that subjective well-being is a stable hereditary trait that only changes temporarily in response to major live events (Diener et al., 2006; Lykken & Tellegen, 1996). Afterwards, subjective well-being returns to its baseline levels in a process of *hedonic adaptation* (see also Luhmann & Intelisano, 2018). However, tenets of set-point theory are still debated, especially, whether particularly disruptive life events cause long-term shifts in well-being (e.g., Headey, 2010).

1.2.2 Empirical State: Environmental Sources of Personality and Well-Being Change

Empirically, evidence for the social investment principle is mixed (for a review, see Bleidorn et al., 2018). In young adulthood, some life events that encompass new social roles partly affect mean-level trajectories of personality traits in ways predicted by theory (Bleidorn, 2015), that is, increasing agreeableness and conscientiousness, and decreasing neuroticism. This was found for events such as entering the first committed romantic relationship (Neyer et al., 2014; Neyer & Lehnart, 2007; Wagner et al., 2015), transitioning from high school to university, or starting the first job (Asselmann & Specht, 2021; Bleidorn, 2012; Golle et al., 2019; Lüdtke et al., 2011), although with varying degrees of consistency across samples. For other events such as parenthood or marriage, there is no consistent evidence in support of the social investment principle (Asselmann & Specht, 2020; van Scheppingen et al., 2016).

In general, effects of life events on personality are rather small and inconsistent across studies (Bleidorn et al., 2018). An investigation of how eight life events (transition to employment, childbirth, marriage, volunteering, unemployment, disability, divorce, and widowhood) longitudinally affect the Big Five traits only supported a small decrease in neuroticism following the first job but no other trait changes in line with the social investment principle (Denissen et al., 2019). For childbirth, however, neuroticism was found to already decrease before the event. In addition, some unexpected trait changes that were counter to theoretical expectations were found such as decreases in conscientiousness following childbirth (Denissen et al., 2019). Thus, the current state of research indicates that environmental sources of personality development are present but that average changes through life events and role transitions are small and not yet well understood from a theoretical perspective. These small and inconsistent effects for average change may be explained by the fact that there are large interindividual differences in intraindividual change that represent deviations from the typically investigated average change trajectories (Doré & Bolger, 2018; Schwaba & Bleidorn, 2018, 2019). In addition, initial evidence has accumulated that volitional personality change through interventions is possible (Hudson et al., 2019; Hudson & Fraley, 2015; Roberts et al., 2017; Stieger et al., 2021), although long-term follow-ups of such interventions of several years and above are still missing. Taken together, current evidence supports the notion of lifelong plasticity and that intrinsic and environmental factors are important sources of personality development (Bleidorn et al., 2014; Bleidorn, Hopwood, Back, et al., 2020; see Bleidorn et al., 2021; Briley & Tucker-Drob, 2014; cf. Costa et al., 2019).

For subjective well-being, there is evidence that permanent changes occur after disruptive events such as unemployment and disability (Lucas et al., 2004; Lucas, 2007; Luhmann, Weiss, et al., 2014). Thus, newer revisions of set-point theory stated that a person's set-point may shift gradually over the life course and more suddenly in reaction to disrupted life circumstances (Diener et al., 2006). The presence of large interindividual differences in the rate of change and adaptation following life events has also been emphasized for subjective well-being (Doré & Bolger, 2018; Lucas et al., 2003). In summary, evidence still supports hedonic adaptation for several types of life events, especially for events with a positive valence like marriage, but also for divorce and widowhood—at least in the average trajectories (Denissen et al., 2019; Infurna et al., 2017; Krämer et al., 2023; Luhmann et al., 2012; Luhmann, Krasko, et al., 2021; Luhmann & Intelisano, 2018). Only when life events drastically worsen life circumstances without (hope of) recovery (Lucas et al., 2004; i.e., permanent states of disability or unemployment; Lucas, 2007; Luhmann, Weiss, et al., 2014), is there evidence that no complete adaptation occurs for most people.

1.2.3 Empirical Gaps and Open Questions in Personality and Well-Being Change

There are still many unanswered questions in the study of how environmental factors such as life events affect personality development (Bleidorn et al., 2018, 2021). Previous mixed findings for many life events need to be reassessed using data that is more comprehensive in terms of the sampling of individuals, time points, and cultural backgrounds, and that features assessments methods beyond self-reports of traits. Further, prospective designs that control for the presence of selection effects are needed (Luhmann, Orth, et al., 2014).

Despite lifelong plasticity of personality, research on environmental sources of personality development has initially neglected the period of old adulthood compared to early and middle adulthood (Hutteman et al., 2014). Recently, research has caught up to some extent: Transitioning from working life to retirement was associated with temporarily lowered conscientiousness (Asselmann & Specht, 2021) or, in another study, with decreases in neuroticism as well as sudden increases in agreeableness and openness followed by decreases in these two traits (Schwaba & Bleidorn, 2019). This has been suggested as evidence for potential mechanisms of personality relaxation (vs. maturation; Asselmann & Specht, 2021) or social divestment (vs. social investment; Schwaba & Bleidorn, 2019). In part, these results fit findings on mean-level changes in old age characterized by decreased agreeableness, extraversion, and conscientiousness and increased neuroticism (Graham et al., 2020). Further, health-related changes in physical and cognitive functioning in old adulthood have been identified as correlates of personality trait changes (Chereches et al., 2022; Jokela et al., 2014; Kornadt et al., 2018; Mueller et al., 2018; Wagner et al., 2016). For example, experiencing elevated difficulties in instrumental activities of daily living was related to decreases in extraversion and increases in neuroticism (Chereches et al., 2022).

Still, a lot remains unknown about personality development in this later phase of the life span. This is especially true regarding positive, gain-based life events or experiences. Therefore, it might be crucial to examine a positive life event that adds a social role to gain a better understanding of the role of social relationships (and social investment in them) in old adulthood. The transition to grandparenthood is a life event that creates a new social role in old adulthood (typically above age 60). Grandparents can invest[1] in this new social role in terms of time, responsibility, and emotional involvement potentially leading to increases in agreeableness, conscientious, and emotional stability.

1.2.4 Understanding Trait Change Beyond the Effects of Life Events

However, as hinted at above and further outlined in recent reviews (Baumert et al., 2017; Bleidorn et al., 2018; Luhmann, Krasko, et al., 2021), small effects prevail in research on life events and psychological development and inconsistencies in results frequently arise across studies or data sources. This has several reasons including (a) large interindividual differences in person-environment interactions that cause differential change trajectories, (b) confounding introduced by other life events and experiences (see Krämer et al., 2023), (c) temporal unfolding of effects that common panel study designs are unable to model (Bleidorn, Hopwood, Back, et al., 2020; Hopwood et al., 2022; Luhmann, Orth, et al., 2014), and (d) a narrow focus on the higher-order behavioral dimensions of the Big Five traits plus life satisfaction that neglects affective and motivational factors. Therefore, it can be argued that the knowledge that can be gained from research on life events and personality

[1] Grandparental investment can also be viewed from the perspective of evolutionary advantages that maternal grandmothers gain in providing help to their daughters and thereby increasing the survival chances of their offspring (Coall et al., 2018; Coall & Hertwig, 2011). In modern societies, grandparents fill these niche roles of helping their children with childcare or other duties in times of need to an increasing extent, again (Fingerman et al., 2020).

development using these types of longitudinal data—typically with assessments of few, select traits every year or every four years—is limited.

There are different possibilities to extend knowledge on environmental sources of personality development beyond the average effects that were the focus of many prior studies using yearly panel data. Recently, researchers have started to investigate how the subjective perception of characteristics of a life event (e.g., the event's valence, predictability, or emotional significance) relates to personality and well-being changes when experiencing that event (Haehner et al., 2022, 2023; Luhmann, Fassbender, et al., 2021). For example, perceiving a life event as more positive in terms of valence was associated with slightly more positive changes in agreeableness (Haehner et al., 2022). In summary, this line of research has so far been somewhat inconclusive on how interindividual differences in event perception relate to trait change, and it still requires future replication because the few observed effects were quite small and not always consistent across studies. Other researchers have adopted a person-centered, idiographic perspective that examines unique systems of personality structure within each person and consistency of these systems over time and in response to life events (Beck & Jackson, 2020, 2022b, 2022c; Wright & Jackson, 2023). For a few life events like retirement, the experience of the event was associated with small, short-term disruptions that lowered personality profile consistency (Wright & Jackson, 2023).

Another route that is further removed from life event research but may ultimately also aid the investigation of environmental sources of personality development is reaching a better understanding of the ways that personality functions in daily-life processes and across different environmental conditions (Bleidorn, Hopwood, Back, et al., 2020). Based on the assumption of the inherent connection of personality structure, processes, and development (Baumert et al., 2017; see also Wagner et al., 2020), the current dissertation zooms into daily-life social dynamics and investigates short-term personality processes and their interrelations with well-being. Taking this route, the present dissertation can aid future research to connect the different personality research perspectives more closely.

1.3 Personality Processes

It has been argued that a better understanding of personality processes is required to understand personality development, ideally with multi-method data beyond using only self-reports (Baumert et al., 2017; Wagner et al., 2020). Personality process research subsumes different theoretical frameworks (see Jayawickreme et al., 2021; Kuper et al., 2021b), many of which rely on the concept of personality states (prominently proposed in whole trait theory; Fleeson, 2001; Fleeson & Jayawickreme, 2015; Jayawickreme et al., 2021). Personality states are defined as specific momentary expressions or manifestations of traits in daily life that fluctuate around a person's trait level depending on situational (e.g., constraints and affordances) and motivational factors (e.g., long-term goals, short-term desires). That means, for example, that in some situations an individual may act more extraverted than typically to attain the goal of making a specific social connection. Over aggregated time and situations, the central tendency of the density distribution of extraversion states is assumed to reflect the person's trait level of extraversion. These central tendencies are quite stable over time (correlations above .90 over several weeks; Fleeson, 2001; Jayawickreme et al., 2019). At the same time, process models of personality development hypothesize that enduring shifts in the distribution of states that accumulate over longer time periods and form habits can induce long-term personality development (Roberts, 2018; Wrzus & Roberts, 2017).

Personality states can refer to any of the ABCD-domains (affect, behavior, cognition, and desire; Wilt & Revelle, 2015). State changes in one domain may be closely connected to changes in other domains and over time generalize more broadly in terms of domains and contexts if enduring habits are formed (Bleidorn, Hopwood, Back, et al., 2020; Bleidorn et al., 2021). For this dissertation, I focus on personality states related to processes of social dynamics, mostly in the domains of affect (e.g., as a consequence of increased social contact), behavior (e.g., in-person social contact quantity), and desire (e.g., momentary desire for social contact).

1.3.1 Theoretical Perspectives on Personality Processes in the Social Domain

Different theories on the relation between processes of social relationships and personality exist (e.g., Geukes et al., 2018; Hopwood, 2018; Kuper et al., 2021b; Roberts, 2018). Here, I first briefly introduce two complimentary theoretical perspectives that are broader in scope and then move on to the more specific theoretical background of the studies conducted for this dissertation.

The first perspective—based on the PERSOC model (Back et al., 2011)—focuses on individual differences in social interaction processes, their relation to personality traits, and their consequences for social relationship outcomes (Back et al., 2011; Back, 2015, 2021; Back & Vazire, 2015). Social interaction processes are defined as changes in the experiential or behavioral psychological reactions during social interactions (Back, 2021). This framework groups personality traits that are of central importance to social interactions along two goal dimensions: getting along (e.g., agreeableness, honesty/humility) and getting ahead (agency, dominance, narcissism) with some traits playing important roles for both (e.g., neuroticism, sociability, conscientiousness). Importantly, these trait evaluations might differ in self- and other-perception, and the observed variance in relationship outcomes can be divided into actor, partner, and relationship components (Back, 2015; Back et al., 2023). In the PERSOC model, personality and social relationships are theorized to influence each other over time (Back & Vazire, 2015) through processes comprising chains of repeated social interaction units (e.g., meetings, chats, or common activities). Over time, repeated shifts in social interaction processes are hypothesized to drive personality development in a bottom-up fashion—with additional emphasis in the PERSOC model placed on amplification mechanisms through social evaluation and feedback by others (Back, 2021). Empirical evidence for the PERSOC model was found for the co-development of friendships and extraversion through selection, bonding, and assimilation mechanisms (van Zalk et al., 2020).

The second, complementary perspective is based on the TESSERA framework (Wrzus & Roberts, 2017) and focuses on the explanation of personality development processes. Traits are hypothesized to develop when repeated sequences of reactions to specific situations occur. The precondition is that situations occur repeatedly in which personality states manifest in a way that ultimately shifts the overall distribution of states and, thus, the trait level (Wrzus, 2021; Wrzus & Roberts, 2017). These sequences can be elicited by triggering situations that are governed by expectancies of appropriate behavior (as a whole, they are referred to as Triggering situations, Expectancies, States/State expressions, and Reactions [TESSERA] sequences; Wrzus & Roberts, 2017). To give an example, starting university education might introduce triggering situations with a new set of situational affordances (i.e., opportunities to express behavior; de Vries et al., 2016) based on new social encounters. Coupled with the expectancy that university students are expected to make diverse new experiences and to get to know many people, these situations might elicit elevated openness and extraversion states (Wrzus, 2021).

For long-term trait change, several additional mechanisms have been proposed such as self-reflection and assimilation (i.e., reflective processes), or habit formation and reinforcement learning (e.g., associative processes). While not per se a theory on social relationships, the TESSERA framework explains the development of social traits through shifts in states experienced in contexts that serve a social function. A first empirical tests in the form of a measurement burst design (Sliwinski, 2008) assessed memorable daily-life experiences and demonstrated initial support for the TESSERA framework for conscientiousness, agreeableness, and extraversion but only limited support for the role of reflective processes (which only mattered for conscientiousness; Quintus et al., 2021; see also Sander et al., 2021). Importantly, Quintus et al. (2021) concluded for future research that "momentary states (e.g., behavior) should not be considered in isolation, but in the context of situational, motivational (e.g., expectations) and affective (e.g., reactions) processes" (p. 1068).

This conclusion fits the aims of Studies II and III of this dissertation that investigate motivational processes of social interactions and their relation to well-being reactions. It has been proposed that motivational constructs derived from basic needs (e.g., need for acceptance) are important for social relationship and personality research (e.g., Neubauer, Voss, et al., 2018; Zygar et al., 2018) and should be integrated more closely into theoretical frameworks of personality. Goal formulations based on these needs can form the basis of personality development which potentially allows goal achievement (Dweck, 2017; Quirin et al., 2020; see also McCabe & Fleeson, 2012; Buchinger, Entringer, et al., 2022). Further, Baumert et al. (2017) emphasize the importance of assessing motivational processes along with behavioral and affective constructs for the attempt to integrate personality structure, processes, and development literatures. They define motivation as the selective approach or avoidance of situations depending on their expected outcome in terms of reward or punishment. Translated to the social context, this means that people have a high motivation (or desire) to pursue social contact when they perceive potential rewards of an interaction to be high—often operationalized as increases in subjective well-being (e.g., Wichers et al., 2015).

1.3.2 Social Dynamics and Need Regulation

Even though social needs are referred to as basic human needs, there are interindividual differences in the trait-like strength of these needs and in the ways in which people strive to satisfy them in daily life. Need regulation in the social domain is influenced by both static individual differences in personality traits or motives (Back & Vazire, 2015; DeYoung et al., 2013; Hill, 2009; Neyer et al., 2014; Ryan & Deci, 2000) and by dynamic within-person processes based on recent experiences or situational constraints (Hall, 2017; Nezlek, 2001; O'Connor & Rosenblood, 1996; Read et al., 2010). Here, I refer to social interaction processes related to need regulation as social dynamics[2].

How can need regulation in the social domain be described? Dynamic theoretical approaches emphasize the temporal aspect of need regulation and conceptualize it as an ongoing internal process: individuals compare how much social contact (of which quality) they desire with how much social contact they have recently experienced (Hall & Davis, 2017; Nezlek, 2001; Quirin et al., 2022; Sheldon, 2011). Thus, people desire an ideal level of social contact for the satisfaction of their social needs and in the moment, this social desire is regulated by homeostatic balance, for example, when the expected rewards of social contact increase after being socially deprived for a while (Hall, 2017; Stijovic et al., 2023).

There are several operationalizations of social traits, which empirically often overlap to a considerable extent (Wrzus et al., 2023). Different candidates for a motive or trait chiefly regulating social behavior have been proposed, for example, the need to belong (Baumeister & Leary, 1995) or the relatedness need (Ryan & Deci, 2000). Theory and scale development distinguish between appetence (or approach) and aversion (or avoidance) components of this social need (Hagemeyer et al., 2013; Read et al., 2010). The appetitive component concerns reactions that occur if the level of experienced social contacts and closeness falls below the ideal level, while the aversive component concerns reactions that occur if the actual level surpasses the ideal level. Thus, in the same situation, people with different ideal levels can show both types of behavioral response.

[2] The term social dynamics subsumes both interdependencies between different relationships and processes within or between these relationships over time (Wrzus et al., 2023).

Extraversion, especially its sociability facet (DeYoung et al., 2007, 2013), is the most relevant appetence-related Big Five trait. There is also a clear link between extraversion and well-being that can mostly be attributed to the energy level facet (Anglim et al., 2020; Margolis et al., 2020), and is not mediated by extraverts' higher social activity (Lucas et al., 2008). Danvers et al. (2020) demonstrated that extraversion was associated with the amount of time spent in conversation with someone. Another important appetence-related trait is the affiliation motive, which can be described as the need to initiate and maintain close, satisfying relationships with others (Hofer & Hagemeyer, 2018). The affiliation motive also predicted verbal socializing behavior (Hagemeyer et al., 2016).

While humans have innate social desires, they also seek solitude for many reasons, for example, to pursue creative or spiritual activities (Lay et al., 2019; Long et al., 2003). The strength of this need to be alone varies between individuals (Burger, 1995; Coplan et al., 2019) and can be conceptualized as an aversion-related component of social needs. In addition, aversion can be motivated by the experience of distress and anxiety in anticipation of social situations, especially encountering strangers. Subclinically severe degrees of social anxiety are present among the general population (L. Peters et al., 2012). Compared to the need to be alone, social anxiety can represent an involuntary state of solitude.

Besides the influence of relatively time-stable dispositions, there is also a procedural component of need regulation involving different psychological states such as momentary social desire and affect (the focus of Study III). Early theoretical treatments described social dynamics as mainly driven by planned (i.e., goal-directed) everyday social activities. The planning of social interactions involves a person's traits and motivation, as well as past experiences and normative obligations (Nezlek, 2001). For example, throughout the week, work-related obligations may either bring people to endure less social contact than they desire (e.g., writing up a report alone) or engage in more interactions than they desire (e.g., long meetings or conferences), depending on the current work context. From a personality processes perspective, people are hypothesized to actively seek experiences to adjust the level of social contact up- or downwards to fit their current state of social needs if the situation allows it (Blum et al., 2018; Quirin et al., 2020). Being above or below the ideal level for extended periods of time is theorized to cause decreases in affective well-being (Hall & Davis, 2017; Read et al., 2017; Sheldon, 2011). Conversely, systematic increases to momentary affect in the context of social need regulation might indicate need satisfaction (conceptualized as goal achievement in McCabe & Fleeson, 2012).

In summary, theories of need regulation in the social domain incorporate individual differences in social needs in setting an individual's ideal level of social contact, and describe the regulation of momentary social desire and the well-being effects of need (dis-)satisfaction as dynamic, homeostatic personality processes.

1.3.3 Empirical State: Social Need Regulation

Empirical research on social dynamics is sparse. Using experience sampling data, Wrzus et al. (2016) analyzed how daily activities and interaction partners varied with age and personality traits (for life span changes, see also Sander et al., 2017). They found that social contact with family and friends varied to roughly the same extent between and within persons (see also Heller et al., 2007; Schönbrodt et al., 2021), and that higher extraversion increased the likelihood to go from solitude to social contact (in two-hour assessment intervals). Another experience sampling study suggested that social interactions are regulated on a day-to-day basis depending on the state manifestation of social needs, that is, the desire for contact or to be alone (Hall, 2017).

Studies have also demonstrated that need satisfaction in the social domain is linked to subjective well-being, both on the between- and the within-person level (Demir & Özdemir, 2010; Reis et al., 2000; Tay & Diener, 2011). Warm, supportive, and meaningful social interactions and relationships generally have positive effects on subjective well-being (Diener et al., 2018; Liu et al., 2019; Roshanaei et al., 2023; Siedlecki et al., 2014) and mental health (Teo et al., 2013; Umberson & Karas Montez, 2010), whereas social exclusion can have detrimental consequences (DeWall et al., 2011; Holt-Lunstad et al., 2015). Quantity and quality of daily social interactions are associated with well-being (Liu et al., 2019; J. Sun et al., 2020; cf. Carmichael et al., 2015; Nezlek, 2001), with both friendships (van der Horst & Coffé, 2012) and weak-tie relationships playing important roles (Huxhold et al., 2020; Sandstrom & Dunn, 2014). Using Electronically Activated Recorder data (EAR; Tackman et al., 2020), J. Sun et al. (2020) showed that both quantity and quality of recorded conversations were related to well-being.

1.3.4 Empirical Gaps and Open Questions in Social Need Regulation

There are several open questions in research on social need regulation that this dissertation aims to address. First, there is little research on specific temporal sequences of the social dynamics described above. With the advent of ambulatory assessment methods with a high temporal resolution (e.g., hourly experience sampling assessments, Wrzus & Mehl, 2015; Wrzus & Neubauer, 2022), it has now become possible to examine social dynamics on a more fine-grained level and with a focus on within-person processes. Recent research has already utilized this technological advancement. Neubauer et al. (2018) examined need dissatisfaction of the basic psychological needs, relatedness, competence, and autonomy (according to Ryan & Deci, 2000) across and within several days and found that effects of need motivation on need satisfaction differed depending on the level of analysis. In the social domain, affiliative motivation on one day was associated with increased social need satisfaction on the following day (but not within days). Zygar et al. (2018) examined social dynamics in couples and concluded that affiliative motivational states are associated with subsequent behavior that fulfills this social need and in turn with more satisfying relationship evaluations. Still, a lot remains unknown about how social need regulation processes play out in daily life (e.g., outside of romantic relationships), how different types of situations are related to seeking company or solitude, and how these processes differ between persons. Specifically, the role of affect as a consequence of failing to regulate social needs has not yet been investigated comprehensively.

Second, it is still debated whether the relation between social need satisfaction or dissatisfaction and affective well-being depends on a person's traits. Contrary to Sheldon's (2011) hypothesis that individuals experience equal affective benefits when they satisfy their needs (to the same extent) regardless of their dispositions, recent empirical evidence indicated that people differ in how (dis-)satisfying need (dis-)satisfaction is depending on their social traits such as affiliation motive or extraversion (Dufner et al., 2015; Hofer & Busch, 2011; Kersten et al., 2022). This finding is more in line with assumptions of motive disposition theory that people can expect differential benefits from affiliative experiences depending on learning processes of reward and punishment, mostly in childhood (McClelland, 1987). Support for these so-called affective contingencies was also found by Zygar et al. (2018), although only for momentary relationship satisfaction and not for general affect. At the same time, research with a focus on the Big Five traits has failed to support the related hypothesis of differential well-being reactivity to social contact depending on extraversion levels (Lucas et al., 2008; Milek et al., 2018; J. Sun et al., 2020). Thus, the question whether social need (dis-)satisfaction generally feels the same for people regardless of their social traits requires further investigation.

Third, research is inconclusive whether and to what degree indirect contact, that is, computer-mediated communication (e.g., calls, videocalls, texting), contributes to need satisfaction and well-being gains. Hall and Davis (2017) have proposed that humans have evolved to optimize the balance in their social interactions between time or energy spent and need satisfaction rewards. Thus, humans tend to favor relationships that offer high returns in terms of satisfying social needs but require low social energy. However, there is mixed evidence where indirect contact falls on this spectrum when compared to personal contact. Research on the effects of indirect contact—and mobile phone use more generally—on our lives is hotly debated (e.g., Orben & Przybylski, 2019, 2020). Some have argued that phone use and online communication through social media disrupt daily life and supplant personal interactions leading to decreased well-being and even a marked increase in teenage depression prevalence (Haidt, 2023; Kafetsios et al., 2017; Kushlev et al., 2019; Shakya & Christakis, 2017; Twenge, 2023). However, others have pointed out that moderate use of these technologies is not harmful and can alleviate social isolation (Nowland et al., 2017; Przybylski & Weinstein, 2017), and that social media usage only has comparatively small effects on well-being (Appel et al., 2020; Vuorre et al., 2021). Regarding depression, panel data showed that decreased in-person contact was the only contact mode that predicted depressive symptoms in older adults (Teo et al., 2015). Recently, large-scale experience sampling data on university students' different modes of social contact showed that indirect contact through mobile phones generally had negative effects on momentary well-being which were exacerbated for people with vulnerable dispositions (Roshanaei et al., 2023; Vaid et al., 2023). One important caveat, however, is that most previous studies have relied exclusively on self-report data to test differences between contact modes. This over-reliance on self-reports potentially produced biased results from evaluative and recall biases (Ellis et al., 2019; Shaw et al., 2020) and may have inflated shared variance due to common-methods bias (Podsakoff et al., 2003). Thus, self-reports of social contact may be a bad proxy for actual behavior (see Study III). It also must be noted that, during the COVID-19 pandemic, indirect contact might have played a different role by substituting personal contact no longer attainable due to contact restrictions (see Study II). On the one hand, there is evidence that indirect contact was used successfully to cope with the lockdown situation (Gabbiadini et al., 2020; Heyman & Kushlev, 2023; Moore & March, 2022; cf. Boursier et al., 2020). On the other hand, daily diary data indicates that only personal contact was robustly related to affective well-being whereas indirect contact was less beneficial and passive social media use even harmful (Lades et al., 2020; Monninger et al., 2023; R. Sun et al., 2022).

Fourth, interactions between situations and personality processes have recently received increased attention (Kuper, Breil, et al., 2022; Kuper et al., 2021a; Kuper, Garrel, et al., 2022; Rauthmann & Sherman, 2020). For example, contingencies between psychologically relevant situation characteristics and personality states (i.e., patterns in how people usually react to situations of specific types) were shown to be moderately reliable and stable, although few consistent associations of these contingencies with person characteristics emerged (Kuper, Breil, et al., 2022). The importance of person-environment interactions is also reflected in theories of personality development. The corresponsive principle describes self-selection into certain environments due to trait predispositions (Roberts & Jackson, 2008). It was also recently proposed to comprehensively assess and study the environment and its constraints alongside personality states (Bleidorn, Hopwood, Back, et al., 2020) because the "environmental context provides natural affordances and boundaries for what people can experience, pursue, and do in any moment" (p. 289). In research on social dynamics, it is still mostly unclear to what degree situational constraints impede the regulation of social needs and whether individual differences in social traits (e.g., strength of the affiliation motive) still matter in a constrained situation. Here, COVID-19-related social contact restrictions offered a unique opportunity to study how strong situational constraints potentially pose barriers to the manifestation of individual differences in social behavior and associated affective states (see Study II).

1.4 Interim Summary and Objectives of Empirical Studies

This dissertation investigates the interplay of social relationships and personality on different levels of examination. Interrelations between different temporal levels have been described in theoretical work with respect to short-term personality processes acting as mechanisms of long-term personality development (e.g., Wrzus & Roberts, 2017). So far, little empirical work has examined dynamic social processes in daily life and, even less so, their connection to long-term development of social traits (cf. Quintus et al., 2021). Taking a closer look at the more fine-grained motivational and affective processes that underly social behavior and unfold over shorter time scales can help generate important insights on preconditions and mechanisms of change. Understanding how social behavior is regulated in daily life may help gain a better understanding of personality functioning and, ultimately (in future studies), personality development in the social domain. The "importance of motivation and self-regulation for trait development" (Hennecke et al., 2014, p. 289) can be understood through the accumulation of changes in personality processes over time that shift the distribution of state experiences (leading to habit formation; Wrzus & Roberts, 2017). These changes in personality processes are assumed to be goal-directed (Dweck, 2017).

1.4.1 Motivation and Goals: Study I

Family relationships spanning more than one generation have have gained increased interest in psychological and sociological research because of an aging demographic and increased childcare responsibilities taken on by grandparents (Bengtson, 2001; Coall & Hertwig, 2011; Dorry et al., 2023; Hayslip et al., 2019). The transition to grandparenthood has been proposed as a developmental task in middle adulthood and old age contributing to personality development through this new role adoption (Hutteman et al., 2014)—in line with the social investment principle (Lodi-Smith & Roberts, 2007). In the first study of this dissertation, my coauthors and I used panel data from the Netherlands and the United States to comprehensively analyze first-time grandparents' Big Five and life satisfaction development in comparison with two matched control groups, parents and nonparents. This study addressed the following research questions:

1. What are the effects of the transition to grandparenthood on mean-level trajectories of the Big Five traits and life satisfaction?
2. How large are interindividual differences in intraindividual change for the Big Five traits and life satisfaction over the transition to grandparenthood?
3. How does the transition to grandparenthood affect rank-order stability of the Big Five traits and life satisfaction?

1.4.2 Motivation and Goals: Study II

The second study focused on social need regulation processes as they manifested in social contact quantity and well-being during the COVID-19 pandemic. In the context of the first wave of the COVID-19 pandemic in Germany in 2020, my coauthors and I expected differential need regulation processes depending on people's social traits. Presumably, amidst governmental contact restrictions and risk of infection through personal interactions, motivational processes of social need regulation play an important role in how individuals react to the pandemic situation behaviorally and affectively. Here, we investigated these social dynamics, specifically asking whether social contact frequency and the effects of contact on well-being differed depending on social traits and motives such as the affiliation motive or need to be alone.

Past research has often focused on static aspects of relationships (e.g., Harris & Vazire, 2016; Neyer et al., 2011) or their long-term development (e.g., Sander et al., 2017; Wrzus et al., 2017). The current study addressed social interactions and need regulation as dynamic processes in the context of changing contact restrictions due to the COVID-19 pandemic (Cucinotta & Vanelli, 2020), which initially required a population-wide reduction in personal social contacts in order to reduce transmissions (Aravindakshan et al., 2020; Del Fava et al., 2021; Flaxman et al., 2020; Tomori et al., 2021).

Over time, contact restrictions were loosened and people were successively free to resume in-person meetings. Thus, an initially very strong situation with restrictions in place that curb the regular person-situation interaction (i.e., the situation is kept constant to a degree, see Read et al., 2010) gradually retransformed into a situation where a more normal interplay of person and situation characteristics was possible again (Blum et al., 2018; Schmitt et al., 2013). In this conceptualization, effects of the person (i.e., effects of social traits) are conditional on effects of the situation, and are expected to be more pronounced once the situation becomes "weaker" (Cooper & Withey, 2009; Schmitt et al., 2013).

Our group collected longitudinal data online over several months starting during the first COVID-19 lockdown. We investigated how social traits were associated with social contact frequency and changes in well-being. In this longitudinal study, we considered multiple social traits, distinguished personal and indirect social contact, and made use of the strong situation of the COVID-19 pandemic. Thus, this study aimed to illuminate individual differences in the motivational personality processes that regulate social behavior by addressing the following research questions:

1. Do social traits moderate the resumption of social contact over several months when contact restrictions are gradually loosened?
2. Do social traits moderate well-being consequences associated with resumed social contact?

1.4.3 Motivation and Goals: Study III

Finally, the third study of this dissertation zooms in temporally to examine short-term social dynamics and their relation to momentary affect in an intensive longitudinal data set. My coauthors and I assessed participants of an age- and gender-heterogeneous sample.

Participants answered a baseline online survey and over the following two days up to 20 questionnaires about their social interactions and affect while also providing passive mobile sensing data (Harari et al., 2015) on their calls, app usage, and conversations (among other parameters of their phone use).

We investigated how dynamics in social interactions relate to subjective well-being in everyday life. Specifically, we analyzed how momentary positive and negative affect was influenced by social deprivation (i.e., being alone but desiring to be in contact with others), and social oversatiation (i.e., being in contact with others but desiring to be alone). We hypothesized that such mismatches between state social desire and experienced social contact are associated with decreased momentary affective well-being. Using experience sampling and mobile sensing data to form different indices of social contact, we analyzed how momentary affect changed in relation to these behavioral and motivational states in a series of confirmatory and exploratory models. We also tested whether these effects on momentary affect were moderated by social traits.

Chapter 2

The Transition to Grandparenthood: No Consistent Evidence for Change in the Big Five Personality Traits and Life Satisfaction (Study I)

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The Transition to Grandparenthood: No Consistent Evidence for Change in the Big Five Personality Traits and Life Satisfaction

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Abstract

Intergenerational relations have received close attention in the context of population aging and increased childcare provision by grandparents. However, few studies have investigated the psychological consequences of becoming a grandparent. In a preregistered test of grandparenthood as a developmental task in middle and older adulthood, we used representative panel data from the Netherlands (N = 563) and the United States (N = 2,210) to analyze first-time grandparents' personality and life satisfaction development. We tested gender, employment, and grandchild care as moderators. To address confounding, we employed propensity score matching using two procedures: matching grandparents with parents and nonparents to achieve balance in different sets of carefully selected covariates. Multilevel models demonstrated mean-level stability of the Big Five personality traits and life satisfaction over the transition to grandparenthood, and no consistent moderation effects—contrary to the social investment principle. The few small effects of grandparenthood on personality development did not replicate across samples. We found no evidence of larger interindividual differences in change in grandparents compared to the controls or of lower rank-order stability. Our findings add to recent critical re-examinations of the social investment principle and are discussed in light of characteristics that might moderate grandparents' personality development.

Keywords: grandparenthood, Big Five, life satisfaction, personality development, propensity score matching

The Transition to Grandparenthood: No Consistent Evidence for Change in the Big Five Personality Traits and Life Satisfaction

Becoming a grandparent is an important life event for many people in midlife or old age (Infurna et al., 2020). In an era of population aging, the time that grandparents are alive and in good health is prolonged compared to previous generations (Bengtson, 2001; Leopold & Skopek, 2015; Margolis & Wright, 2017). In addition, grandparents fulfill an increased share of childcare responsibilities (Hayslip et al., 2019; Pilkauskas et al., 2020). In recent years, intergenerational relations have received heightened attention from psychological and sociological research (Bengtson, 2001; Coall & Hertwig, 2011; Fingerman et al., 2020). In research on personality development, the transition to grandparenthood has been proposed as an important developmental task arising in old age (Hutteman et al., 2014). However, empirical research on the psychological consequences of grandparenthood remains sparse. Using data from two nationally representative panel studies, we investigate whether the transition to grandparenthood affects the Big Five personality traits and life satisfaction. We test hypotheses derived from neo-socioanalytic theory (Roberts & Wood, 2006) in a prospective quasi-experimental case-control design (see Luhmann et al., 2014).

Personality Development in Middle and Older Adulthood

The life span perspective conceptualizes aging as a lifelong process of development and adaptation (Baltes et al., 2006). Research embedded in this perspective has found personality traits to be subject to change across the entire life span (Costa et al., 2019; Graham et al., 2020; Specht, 2017; Specht et al., 2014; for recent reviews, see Bleidorn et al., 2021; Roberts & Yoon, 2022). Although a majority of personality development takes place in adolescence and emerging adulthood (Bleidorn & Schwaba, 2017; Pusch et al., 2019; Schwaba & Bleidorn, 2018), personality traits also change in middle and older adulthood (e.g., Allemand et al., 2008; Damian et al., 2019; Kandler et al., 2015; Lucas & Donnellan, 2011; Mõttus et al., 2012; S. Mueller et al., 2016; Seifert et al., 2021; Wagner et al., 2016; for a review, see Specht, 2017).

Here, we examine the Big Five personality traits—agreeableness, conscientiousness, extraversion, neuroticism, and openness to experience—which constitute a broad categorization of universal patterns of thought, affect, and behavior (John et al., 2008; John & Srivastava, 1999). Changes over time in the Big Five occur both in mean trait levels (i.e., mean-level change, Roberts et al., 2006) and in the ordering of people relative to each other on trait dimensions (i.e., rank-order stability, Anusic & Schimmack, 2016; Roberts & DelVecchio, 2000). A lack of observed changes in mean trait levels does not necessarily mean that individual trait levels are stable over time, and perfect rank-order stability does not preclude mean-level changes. Mean-level changes in early to middle adulthood (circa 30–60 years old, Hutteman et al., 2014) are typically characterized by greater maturity, as evidenced by increased agreeableness and conscientiousness and decreased neuroticism (Damian et al., 2019; Roberts et al., 2006). In old age (circa 60 years and older, Hutteman et al., 2014), research is generally more sparse. But there is some evidence of a *reversal* of the maturity effect following retirement (sometimes termed *la dolce vita* effect, Asselmann & Specht, 2021a; Marsh et al., 2013; cf. Schwaba & Bleidorn, 2019) and at the end of life when health problems arise (Wagner et al., 2016).

In terms of rank-order stability, most prior studies have shown support for an inverted U-shape trajectory (Ardelt, 2000; Lucas & Donnellan, 2011; Seifert et al., 2021; Specht et al., 2011; Wortman et al., 2012): Rank-order stability rises until it reaches a plateau in midlife, and decreases in old age. However, evidence is mixed on whether rank-order stability decreases again in old age (see Costa et al., 2019; Wagner et al., 2019). We are not aware of any study investigating trait rank-order stability over the transition to grandparenthood. Other life events are associated with rank-order stability of personality and well-being, although only certain events and traits (e.g., Denissen et al., 2019; Hentschel et al., 2017; Specht et al., 2011). Still, the previously held view that personality is stable or "set like plaster" (Specht, 2017, p. 64) after one reaches adulthood (or leaves emerging adulthood behind, Bleidorn & Schwaba, 2017) has been largely abandoned (Specht et al., 2014).

Theories explaining the mechanisms of personality development in middle and older adulthood emphasize genetic influences and life experiences as interdependent sources of stability and change (Bleidorn et al., 2021; Specht et al., 2014; Wagner et al., 2020). We conceptualize the transition to grandparenthood as adopting a new social role according to the social investment principle of neo-socioanalytic theory (Lodi-Smith & Roberts, 2007; Roberts & Wood, 2006). The social investment principle states that normative life events or transitions such as entering the work force or becoming a parent lead to personality maturation through adopting new social roles (Roberts et al., 2005). These new roles encourage or compel people to act in a more agreeable, conscientious, and emotionally stable (i.e., less neurotic) way. People's experiences in these roles as well as societal expectations towards them are hypothesized to drive long-term personality development (Lodi-Smith & Roberts, 2007; Wrzus & Roberts, 2017).

Empirical research on life events entailing new social roles has focused on young adulthood: A first romantic relationship (Wagner et al., 2015), the transition from high school to university, or a first job (Asselmann & Specht, 2021a; Golle et al., 2019; Lüdtke et al., 2011) co-occur with mean-level changes that are (partly) consistent with the social investment principle (for a review, see Bleidorn et al., 2018). However, recent findings on the transition to parenthood fail to support the social investment principle (Asselmann & Specht, 2021b; van Scheppingen et al., 2016). An analysis of trajectories of the Big Five before and after different life events produced limited support for the social investment principle: Small increases in emotional stability occurred following the transition to employment but not in the other traits or following marriage or childbirth (Denissen et al., 2019).

Age-graded, normative role transitions may drive personality development across the entire lifespan but they are understudied in middle and older adulthood. Recent research indicates that retirement contributes to personality change following a period of relative stability in midlife (Bleidorn & Schwaba, 2018; Schwaba & Bleidorn, 2019). These results are only partly in line with the social investment principle regarding mean-level changes and display substantial interindividual differences in change trajectories. Schwaba and Bleidorn described retirement as a "divestment" of social roles (2019, p. 660; for *personality relaxation*, see Asselmann & Specht, 2021a) that functions differently than *social investment*, which adds a role. The grandparent role is one of only a few new normative roles available in middle and older adulthood. It is perceived as highly important and represents a psychologically meaningful role investment (Mahne & Motel-Klingebiel, 2012; Thiele & Whelan, 2006)—given that grandparents have regular contact with grandchildren and take part in childcare (Lodi-Smith & Roberts, 2007). Mechanisms of grandparents' personality change remain unexplored. However, grandparental role investment may not be linearly related to changes in well-being and health (see section *Life Satisfaction and Grandparenthood*). Instead, moderate levels of grandchild care and contact appear most beneficial. At the same time, even if grandparents do not provide substantial grandchild care, grandparenthood might alter their everyday lives and activities considerably by changing the social structure imposed by kinship bonds (M. Mueller & Elder, 2003; Tanskanen, 2017). For example, grandchildren might bring about frequent family gatherings, which eventually contribute to grandparents' personality development in a bottom-up fashion.

Grandparenthood

The transition to grandparenthood is a time-discrete life event—the beginning of one's status as a grandparent (Luhmann et al., 2012). In terms of characteristics of major life events (Luhmann et al., 2021), the transition to grandparenthood stands out in that it is externally caused (by one's children, see also Arpino, Gumà, et al., 2018; Margolis & Verdery, 2019), but also predictable as soon as children reveal their family planning or pregnancy. The transition to grandparenthood has been labeled a countertransition due to this lack of direct control over its timing (Hagestad & Neugarten, 1985; as cited in Arpino, Gumà, et al., 2018). Grandparenthood is also generally positive in valence and emotionally significant if the grandparent maintains a good relationship with their child. Grandparents' investments in their grandchildren are beneficial in terms of the evolutionary, economic, and sociological advantages they provide (Coall et al., 2018; Coall & Hertwig, 2011).

Grandparenthood is a developmental task (Hutteman et al., 2014) that generally takes place in (early) old age, although this varies considerably both within and between cultures (Leopold & Skopek, 2015; Skopek & Leopold, 2017). Still, the period in which parents experience the birth of their first grandchild coincides with the end of (relative) personality stability in midlife (Specht, 2017), when retirement, shifting social roles, and initial cognitive and health declines can disrupt life circumstances, setting processes of personality development in motion (e.g., S. Mueller et al., 2016; Stephan et al., 2014). As a developmental task, grandparenthood is considered part of a normative sequence of aging that is subject to societal expectations and values that differ across cultures and historical time (Baltes et al., 2006; Hutteman et al., 2014). Mastering developmental tasks (i.e., fulfilling roles and expectations) is hypothesized to drive positive personality development similarly to propositions of the social investment principle, that is, leading to higher levels of agreeableness and conscientiousness, and lower levels of neuroticism (Roberts et al., 2005; Roberts & Wood, 2006).

In comparison to the transition to parenthood, which is ambivalent in terms of both personality maturation and changes in life satisfaction (Aassve et al., 2021; Johnson & Rodgers, 2006; Krämer & Rodgers, 2020; van Scheppingen et al., 2016), Hutteman et al. (2014) hypothesized that the transition to grandparenthood is positive because it (usually) does not impose the stressful demands of daily childcare on grandparents. However, societal expectations about how grandparents should behave are less clearly defined than expectations around parenthood. There is considerable heterogeneity in how intensely grandparents are involved in their grandchildren's lives and care (Meyer & Kandic, 2017). The degree of possible grandparental investment differs depending on a variety of factors: how close grandparents live to their children, the quality of their relationship, and sociodemographic factors that create conflicting role demands such as paid work or other caregiving responsibilities (Arpino & Bellani, 2022; Arpino & Gómez-León, 2020; Lumsdaine & Vermeer, 2015; Silverstein & Marenco, 2001). In the entire population of first-time grandparents, this diversity of possible and desired role investments could generate role conflicts for some grandparents (according to role strain theory, Goode, 1960). Subsequently, pronounced interindividual differences in intraindividual personality change might then emerge.

Life Satisfaction and Grandparenthood

Although few studies on the Big Five and grandparenthood exist, there is some evidence for life satisfaction, which we define as the general, cognitive appraisal of one's well-being in life based on subjective criteria (Eid & Larsen, 2008). Life satisfaction is generally considered less stable than the Big Five and more prone to changes due to environmental influences but still trait-like in its characteristics (Anusic & Schimmack, 2016; Kandler et al., 2014; Luhmann et al., 2012), and robustly related to the Big Five (Anglim et al., 2020).

Longitudinal studies on grandparents' life satisfaction have produced conflicting conclusions: Studies using data from the Survey of Health, Ageing and Retirement in Europe (SHARE) showed that the birth of a grandchild was followed by improvements in quality of life and life satisfaction, but only among women (Tanskanen et al., 2019) and only in first-time grandmothers via their daughters (Di Gessa et al., 2019). Several studies demonstrated that grandparents who were actively involved in childcare experienced larger increases in life satisfaction (Arpino, Bordone, et al., 2018; Danielsbacka et al., 2019;

Danielsbacka & Tanskanen, 2016). On the other hand, fixed effects regression models[1] using SHARE data did not find any effects of first-time grandparenthood on life satisfaction regardless of grandparental investment and only minor decreases in depressive symptoms in grandmothers Ates (2017).

Studies of grandparents' life satisfaction, and well-being and health more generally, have often contrasted role strain theory and role enhancement theory (e.g., Di Gessa et al., 2016a; Xu et al., 2017; see also Kim et al., 2017). Role strain theory (Goode, 1960) predicts that investing in grandparenthood alongside other existing roles can produce role conflicts and psychological demands exceeding one's resources. Altogether, these factors prevent adaptive development and lower life satisfaction. Role enhancement theory (Sieber, 1974), conversely, anticipates adaptive development and well-being benefits because the added social role provides grandparents with status security, social support, and psychological meaning. Empirically, providing grandchild care is, on the one hand, associated with decreased marital satisfaction (Wang & Mutchler, 2020) and increased depressive symptoms if grandparents perceive caregiving as burdensome (Xu et al., 2017). On the other hand, it is associated with increased social contact (Quirke et al., 2021; Tanskanen, 2017; cf. Arpino & Bordone, 2017) and a higher quantity (but not quality) of leisure activities (Ates et al., 2021), whereby social engagement serves as a buffer for mental health decreases (Notter, 2022).

Research on well-being and health has found evidence for both role strain theory and role enhancement theory depending on the degree of grandparental role investment (Danielsbacka et al., 2022; Kim et al., 2017). Whereas no investment or being a grandchild's primary caregiver are associated with adverse effects in most studies, there is evidence that moderate levels of grandchild care have beneficial life satisfaction and health effects for non-coresiding grandparents. This provides preliminary support for the inverted

[1] Fixed effects regression models rely exclusively on within-person variance (see Brüderl & Ludwig, 2015; McNeish & Kelley, 2019).

U-shape between investment and utility proposed by Coall and Hertwig (2011). However, multiple authors have recently emphasized that the literature is still at an early stage and that prior studies often lack representativeness, longitudinal data, and appropriate control for selection effects (Coall et al., 2018; Danielsbacka et al., 2022; Kim et al., 2017).

In summary, evidence is lacking on the Big Five and inconclusive on life satisfaction (and related measures) which is partly due to different methodological approaches that do not account for confounding (i.e., selection effects).

Methodological Considerations

Effects of life events on psychological traits tend to be small and need to be analyzed using robust, prospective designs and appropriate control groups (Bleidorn et al., 2018; Luhmann et al., 2014). This is necessary because pre-existing differences between prospective grandparents and non-grandparents in variables related to the development of the Big Five or life satisfaction introduce confounding bias when estimating the effects of the transition to grandparenthood (VanderWeele et al., 2020). The impact of adjusting for pre-existing differences was recently emphasized in predicting life outcomes from personality (Beck & Jackson, 2022). Propensity score matching is one technique to account for confounding bias by equating groups in their estimated propensity to experience the event (Thoemmes & Kim, 2011). This propensity is calculated from regressing the so-called treatment variable (whether someone experienced the event) on covariates related to the likelihood of experiencing the event and to the outcomes. This approach addresses confounding bias by creating balance between groups in the covariates used to calculate the propensity score (Stuart, 2010).

We adopt a prospective design that tests the effects of becoming first-time grandparents against two propensity-score-matched control groups separately: first, parents (but not grandparents) with at least one child, and, second, nonparents. This allows us to disentangle potential effects of becoming a grandparent from effects of already being a parent (i.e., parents who eventually become grandparents might share additional similarities with parents who do not). Thus, we can address selection effects into grandparenthood more comprehensively than previous research. We cover the first two of three causal pathways to not experiencing grandparenthood pointed out in demographic research (Margolis & Verdery, 2019): childlessness, childlessness of one's children, and not living long enough to become a grandparent. Our comparative design controls for average age-related and historical trends in the Big Five traits and life satisfaction (Luhmann et al., 2014). The design also enables us to report effects of the transition to grandparenthood unconfounded by instrumentation effects, which describe the tendency of reporting lower well-being scores with each repeated measurement (Baird et al., 2010).

We match at a specific time point before the transition to grandparenthood (i.e., at least two years beforehand) and not based on individual survey years. This design choice ensures that the covariates involved in the matching procedure are not already influenced by the event or anticipation of it (Greenland, 2003; Rosenbaum, 1984; VanderWeele, 2019; VanderWeele et al., 2020), thereby reducing the risk of introducing confounding through collider bias (Elwert & Winship, 2014). Similar approaches in the study of life events have been adopted recently (Balbo & Arpino, 2016; Krämer & Rodgers, 2020; van Scheppingen & Leopold, 2020).

Current Study

In the current study, we examine the development of the Big Five personality traits across the transition to grandparenthood in a prospective, quasi-experimental design, thereby extending previous research on the effects of this transition on well-being to psychological development in a more general sense. We also revisit life satisfaction development, which allows us to anchor our model results. With the literature on grandparenthood and well-being in mind, the current results for life satisfaction constitute a benchmark for the Big Five outcomes. Three research questions motivate the current study which—to our knowledge—is the first to analyze Big Five personality development over the transition to grandparenthood:

1. What are the effects of the transition to grandparenthood on mean-level trajectories of the Big Five traits and life satisfaction?
2. How large are interindividual differences in intraindividual change for the Big Five traits and life satisfaction over the transition to grandparenthood?
3. How does the transition to grandparenthood affect rank-order stability of the Big Five traits and life satisfaction?

To address these questions, we used two nationally representative panel data sets and compared grandparents' development over the transition to grandparenthood with that of matched respondents who did not become grandparents during the study period (Luhmann et al., 2014). Informed by the social investment principle, previous research on personality development in middle and older adulthood, and the literature on grandparenthood and well-being, we preregistered the following hypotheses (see https://osf.io/a9zpc):

- H1a: Following the birth of their first grandchild, grandparents increase in agreeableness and conscientiousness, and decrease in neuroticism compared to the matched control groups of parents (but not grandparents) and nonparents. We do not expect the groups to differ in their trajectories of extraversion and openness to experience.
- H1b: Grandparents' post-transition increases in agreeableness and conscientiousness, and decreases in neuroticism are more pronounced among those who provide substantial grandchild care.
- H1c: Grandmothers increase in life satisfaction following the transition to grandparenthood compared to the matched control groups but grandfathers do not.

The heterogeneity in the degree of possible and desired grandparental investment in our samples leads us to expect pronounced interindividual differences in intraindividual change (i.e., deviations from the average trajectories).

- H2: Individual differences in intraindividual change in the Big Five and life satisfaction are larger in the grandparent group than the control groups.

Consequently, assuming that grandparents' personality is rearranged through the experience of the event, we also expect decreases in rank-order stability over the transition to grandparenthood.

- H3: Compared to the matched control groups, grandparents' rank-order stability of the Big Five and life satisfaction over the transition to grandparenthood is smaller.

Finally, commitments to other institutions and roles possibly constrain the amount of possible grandparental investment in line with role strain theory. Alternatively, the added grandparental role could complement existing roles inducing positive psychological development according to role enhancement theory. Thus, exploratorily, we probe the moderator *performing paid work*, which could constitute a role conflict among grandparents. In another exploratory analysis, suggested by an anonymous reviewer, we examine *ethnicity* as a moderator, which is associated with differences in the demography of grandparenthood (Hayslip et al., 2019; Margolis & Verdery, 2019) and in grandparents' well-being (Goodman & Silverstein, 2006).

Methods

Samples

We used data from two population-representative panel studies: the Longitudinal Internet Studies for the Social Sciences (LISS) panel from the Netherlands, and the Health and Retirement Study (HRS) from the United States.

The LISS panel is a representative sample of the Dutch population initiated in 2008 with data collection still ongoing (Scherpenzeel, 2011; van der Laan, 2009). It is administered by Centerdata (Tilburg University). The survey population is a true probability sample of households drawn from the population register (Scherpenzeel & Das, 2010). Data collection was carried out online, and respondents were provided technical equipment if needed. We included yearly assessments from 2008 to 2021 as well as basic demographics assessed monthly. For later coding of covariates from these monthly demographic data we used the first available assessment each year.

The HRS is an ongoing population-representative study of older adults in the United States (Sonnega et al., 2014) administered by the Survey Research Center (University of Michigan). Initiated in 1992 with a first cohort of individuals aged 51-61 and their spouses, the study has since been expanded through additional cohorts (see https://hrs.isr.umich.edu/documentation/survey-design/). In addition to the biennial in-person or telephone interview, since 2006 the study has included a leave-behind questionnaire covering psychosocial topics including personality traits. These topics, however, were only administered every four years starting in 2006 for one half of the sample and in 2008 for the other half. We included personality data from 2006 to 2018, all available data for the coding of the transition to grandparenthood from 1996 to 2018, as well as covariate data from 2006 to 2018 including variables drawn from the Imputations File and the Family Data (only available up to 2014).

These two panel studies provided the advantage that they contained several waves of personality data as well as information on grandparent status and a broad range of covariates. While the HRS provided a large sample with a wider age range, the LISS was smaller and younger but provided more frequent personality assessments spaced every one to two years. Included grandparents from the LISS were younger because grandparenthood questions were part of the Work and Schooling module and—for reasons unknown to us—filtered to respondents performing paid work. Thus, older, retired first-time grandparents from the LISS could not be identified. Even though we have published using the LISS and HRS data before (see https://osf.io/a9zpc), these publications do not overlap with the current study on grandparenthood. The present study used de-identified archival data available in the public domain, which meant that it was not necessary to obtain ethical approval from an IRB.

Measures

Personality

In the LISS, the Big Five personality traits were assessed using the 50-item version of the IPIP Big Five Inventory scales (Goldberg, 1992). For each trait, respondents answered ten 5-point Likert-scale items (1 = *very inaccurate*, 2 = *moderately inaccurate*, 3 = *neither inaccurate nor accurate*, 4 = *moderately accurate*, 5 = *very accurate*). Example items included “like order” (conscientiousness), “sympathize with others’ feelings” (agreeableness), “worry about things” (neuroticism), “have a vivid imagination” (openness), and “start conversations” (extraversion). In each wave, we took a respondent’s mean of each subscale as their trait score. Internal consistencies at the time of matching, as indicated by ω_h (McNeish, 2018), averaged $\omega_h = 0.70$ over all traits ($\omega_t = 0.89$; $\alpha = 0.83$; see Table S1). Other studies have shown measurement invariance for these scales across time and age groups, and convergent validity with the Big Five Inventory (Denissen et al., 2020; BFI-2, Schwaba & Bleidorn, 2018). The Big Five and life satisfaction were administered yearly but with planned missingness in some years for certain cohorts (see Denissen et al., 2019).

In the HRS, the Midlife Development Inventory (MIDI) scales measured the Big Five (Lachman & Weaver, 1997) with 26 adjectives (five each for conscientiousness, agreeableness, and extraversion; four for neuroticism; seven for openness). Respondents were asked to rate on a 4-point scale how well each item described them (1 = *a lot*, 2 = *some*, 3 = *a little*, 4 = *not at all*). Example adjectives included “organized” (conscientiousness), "sympathetic" (agreeableness), "worrying" (neuroticism), "imaginative" (openness), and "talkative" (extraversion). For better comparability with the LISS panel, we reverse-scored all items so that higher values corresponded to higher trait levels and, in each wave, took the mean of each subscale as the trait score. Big Five trait scores showed satisfactory internal consistencies at the time of matching that averaged $\omega_h = 0.63$ over all traits ($\omega_t = 0.80$; $\alpha = 0.72$; see Table S1).

Life Satisfaction

In both samples, life satisfaction was assessed using the 5-item Satisfaction with Life Scale (SWLS, Diener et al., 1985) which respondents answered on a 7-point Likert scale (1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *slightly disagree*, 4 = *neither agree or disagree*, 5 = *slightly agree*, 6 = *somewhat agree*, 7 = *strongly agree*). An example item was "I am satisfied with my life". Internal consistency at the time of matching was between $\alpha = 0.88$ and $\alpha = 0.91$ in the four analysis samples (see Table S1).

Transition to Grandparenthood

The procedure to obtain information on the transition to grandparenthood generally followed the same steps in both samples. This coding was based on items that differed slightly, however: In the LISS, respondents performing paid work were asked "Do you have children and/or grandchildren?" and were offered the answer categories "children", "grandchildren", and "no children or grandchildren". In the HRS, all respondents were asked to state their total number of grandchildren: "Altogether, how many grandchildren do you (or your husband / wife / partner, or your late husband / wife / partner) have? Include as grandchildren any children of your (or your [late] husband's / wife's / partner's) biological, step- or adopted children".

In both samples, we tracked grandparenthood status over time using all available longitudinal information (including HRS waves 1996-2018). Due to longitudinally inconsistent data in some cases, we included in the grandparent group only respondents with one transition from 0 (*no grandchildren*) to 1 (*at least one grandchild*) in this status variable, and no transitions backwards (see Figure 1). We marked respondents who consistently indicated that they had no grandchildren as potential members of the control groups.

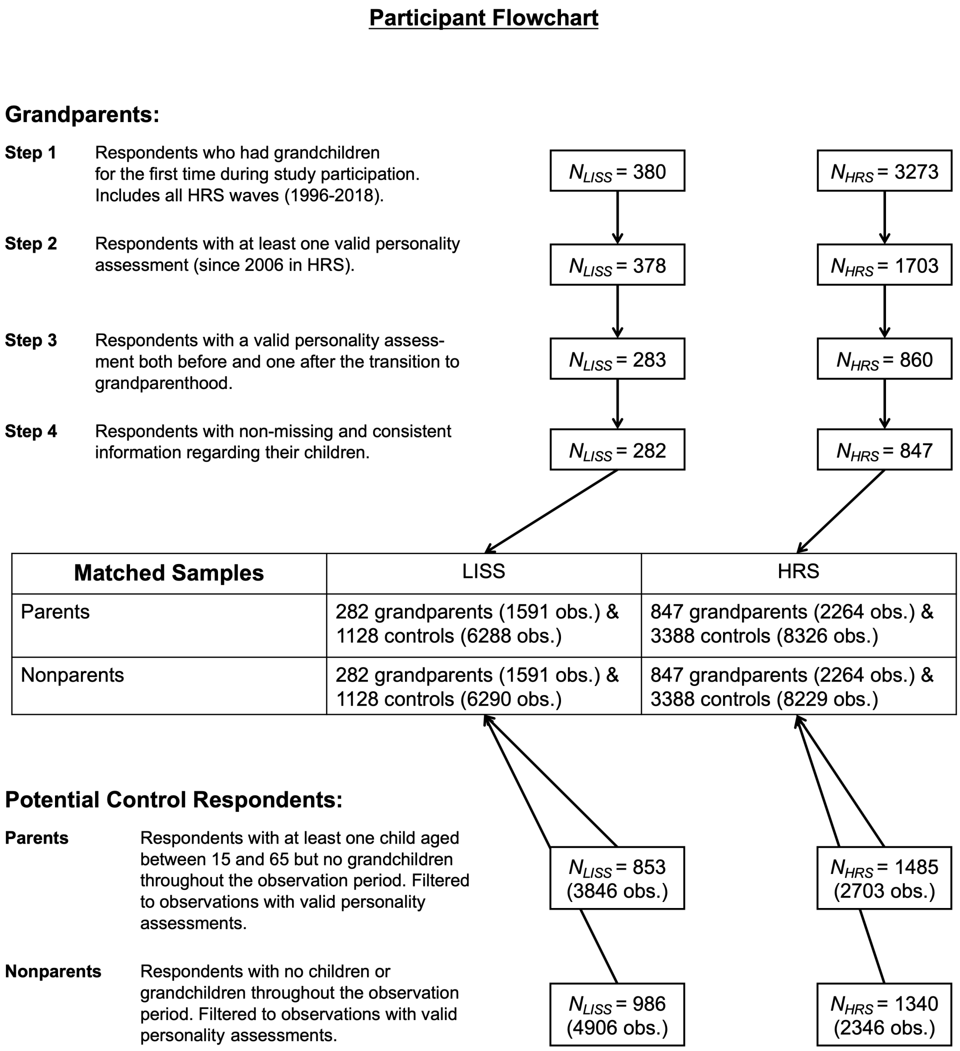

Figure 1

Participant flowchart demonstrating the composition of the four analysis samples via matching (1:4 matching ratio with replacement). obs. *= longitudinal observations.*

Moderators

We tested four variables as potential moderators of the mean-level trajectories of the Big Five and life satisfaction over the transition to grandparenthood: First, we analyzed whether female gender (0 = *male*, 1 = *female*) acted as a moderator as indicated by research on life satisfaction (Di Gessa et al., 2019; Tanskanen et al., 2019).

Second, we tested whether performing paid work (0 = *no*, 1 = *yes*) was associated with divergent trajectories of the Big Five and life satisfaction (Schwaba & Bleidorn, 2019). Since the LISS subsample consisted solely of respondents performing paid work, we performed these analyses only in the HRS. This served two purposes. On the one hand, it allowed us to test how respondents in the workforce differed from those not working, which might shed light on role conflict and have implications for social investment mechanisms. On the other hand, these moderation analyses allowed us to assess whether potential differences in results between the LISS and HRS samples could be accounted for by including performing paid work as a moderator in HRS analyses. In other words, perhaps HRS respondents performing paid work were similar to those in the LISS sample—those conditioned on this variable through questionnaire filtering.

Third, we examined how involvement in grandchild care moderated trajectories of the Big Five and life satisfaction (Arpino, Bordone, et al., 2018; Danielsbacka et al., 2019; Danielsbacka & Tanskanen, 2016). We coded a moderator variable (0 = *provided less than 100 hours of grandchild care*, 1 = *provided 100 or more hours of grandchild care*) based on the question "Did you (or your [late] husband / wife / partner) spend 100 or more hours in total since the last interview / in the last two years taking care of grand- or great grandchildren?". [2] This information was only available for grandparents in the HRS (43% *yes*); in the LISS, too few respondents answered respective follow-up questions to be included in analyses.

[2] Dichotomization of a continuous construct (hours of care) is not ideal for moderation analysis (MacCallum et al., 2002). However, there were too many missing values in the variable assessing hours of care continuously (variables *E063).

Fourth, in the HRS, we compared Black/African American respondents with White respondents.

Procedure

Drawing on all available data, three main restrictions defined the analysis samples of grandparents (see Figure 1): First, we identified respondents who indicated having grandchildren for the first time during study participation ($N_{LISS} = 380$; $N_{HRS} = 3273$, including HRS waves 1996-2004 before personality assessments were introduced). Second, we restricted the sample to respondents with at least one valid personality assessment (valid in the sense that at least one of the six outcomes was non-missing; $N_{LISS} = 378$; $N_{HRS} = 1703$).[3] Third, we included only respondents with both one valid personality assessment before and one after the transition to grandparenthood ($N_{LISS} = 283$; $N_{HRS} = 860$). Finally, a few respondents were excluded because of inconsistent or missing information regarding their children resulting in the final analysis samples of first-time grandparents, $N_{LISS} = 282$ (54.61% female; age at transition to grandparenthood $M = 58.29$, $SD = 4.87$) and $N_{HRS} = 847$ (54.90% female; age at transition to grandparenthood $M = 61.80$, $SD = 6.87$).

We defined two mutually exclusive pools of potential control subjects for matching: The first comprised parents who had at least one child (given that $15 \leq age_{firstborn} \leq 65$) but no grandchildren during the observation period ($N_{LISS} = 853$ with 3846 longitudinal observations; $N_{HRS} = 1485$ with 2703 longitudinal observations). The second comprised respondents who reported being childless throughout the observation period ($N_{LISS} = 986$ with 4906 longitudinal observations; $N_{HRS} = 1340$ with 2346 longitudinal observations).

[3] We also excluded $N = 30$ HRS grandparents in a previous step who reported unrealistically high numbers of grandchildren (> 10) in their first assessment following the transition to grandparenthood.

Covariates

We used propensity score matching to match each grandparent with a control respondent from each pool of potential controls who was most similar in terms of the included covariates.

Although critical to the design, covariate selection is seldom explicitly discussed in studies estimating effects of life events (e.g., in matching designs). We see two (in part conflicting) traditions that address covariate selection: First, classic recommendations from psychology are to include all available variables that are associated with both the treatment assignment process (i.e., selection into treatment) and the outcome (e.g., Steiner et al., 2010; Stuart, 2010). Second, recommendations from a structural causal modeling perspective (Elwert & Winship, 2014; Rohrer, 2018) are more cautious, aiming to avoid pitfalls such as conditioning on a pre-treatment collider (collider bias) or a mediator (overcontrol bias). However, structural causal modeling requires advanced knowledge of the causal structures underlying the involved variables (Pearl, 2009).

In selecting covariates, we followed the guidelines of VanderWeele et al. (2019; 2020), which reconcile both views and offer practical guidance when the underlying causal structures are not completely understood and when using large archival datasets. The "modified disjunctive cause criterion" (VanderWeele, 2019, p. 218) recommends selecting all available covariates which are assumed to be causes of the outcomes, treatment exposure (i.e., the transition to grandparenthood), or both, as well as any proxies for an unmeasured common cause of the outcomes and treatment exposure. Variables that are assumed to be instrumental variables (i.e., assumed causes of treatment exposure that are unrelated to the outcomes except through the exposure) and collider variables (Elwert & Winship, 2014) should be excluded from this selection. Because all covariates we used for matching were measured at least two years before the first grandchild's birth, we judge the risk of introducing collider bias or overcontrol bias to be relatively small. In addition, as mentioned above, the transition to grandparenthood is not planned by or under the direct control of the grandparents, which further reduces the risk of these biases.

Following these guidelines, we selected covariates covering respondents' demographics (e.g., age, education), economic situation (e.g., income), and health (e.g., mobility difficulties). We also included the pre-transition outcome variables as covariates—as recommended in the literature (Cook et al., 2020; Hallberg et al., 2018; Steiner et al., 2010; VanderWeele et al., 2020), as well as wave participation count and assessment year in order to control for instrumentation effects and historical trends (e.g., 2008/2009 financial crisis, Baird et al., 2010; Luhmann et al., 2014). To match grandparents with the parent control group, we additionally selected covariates containing information on fertility and family history (e.g., number of children, age of first three children) which were causally related to the timing of the transition to grandparenthood (Arpino, Gumà, et al., 2018; Margolis & Verdery, 2019).

An overview of all covariates can be found in the supplemental materials (see Tables S2 & S3). Importantly, as part of our preregistration we justified each covariate, explaining whether we assumed it to be related to the treatment assignment, the outcomes, or both (see *gp-covariates-overview.xlsx* on https://osf.io/75a4r/). In this document, we provided references supporting our assumptions on whether a specific covariate is related to these causal processes. For example, we justified the inclusion of *religion* as a covariate with its relation to fertility (Hayford & Morgan, 2008; L. Zhang, 2008), which is often passed down to the child's family (Götmark & Andersson, 2020), and its relation to the Big Five and life satisfaction (Diener et al., 2018; Gebauer et al., 2014). We tried to find substantively equivalent covariates in both samples but had to compromise in a few cases.

Estimating propensity scores required complete covariate data. Therefore, we performed multiple imputations to address missingness in the covariates (Greenland & Finkle, 1995). Using five imputed data sets computed by classification and regression trees (CART, Burgette & Reiter, 2010) in the *mice* R package (van Buuren & Groothuis-Oudshoorn, 2011), we predicted treatment assignment (i.e., the transition to grandparenthood) five times per observation in logistic regressions with a logit link function.[4] We averaged these five scores per observation to compute the final propensity score used for matching (Mitra & Reiter, 2016). We used imputed data only for propensity score computation and not in later analyses because nonresponse in the outcome variables was negligible.

Propensity Score Matching

The time of matching preceded the survey year in which the transition to grandparenthood was first reported by at least two years (aside from that choosing the smallest available gap between matching and transition). This ensured that the covariates were not affected by the event itself or anticipation thereof (i.e., matching occurred well before children would have announced that they were expecting their first child, Greenland, 2003; Rosenbaum, 1984; VanderWeele et al., 2020). Propensity score matching was performed using the *MatchIt* R package (Ho et al., 2011) with exact matching on gender combined with Mahalanobis distance matching on the propensity score. Four matchings were performed; two per sample (LISS; HRS) and two per control group (parents; nonparents). We matched 1:4 with replacement because of the relatively small pools of available controls.[5] We did not specify a caliper because our goal was to find matches for all grandparents, and because we achieved good covariate balance this way.

We evaluated the matching procedure in terms of covariate balance and graphically (Stuart, 2010). Covariate balance as indicated by the standardized difference in means

[4] In these logistic regressions, we included all covariates listed above as predictors except for *female*, which was later used for exact matching, and health-related covariates in LISS wave 2014, which were not assessed in that wave.

[5] In the LISS, 282 grandparent observations were matched with 1128 control observations; these control observations corresponded to 561 unique person-year observations stemming from 281 unique respondents for the parent control group, and to 523 unique person-year observations stemming from 194 unique respondents for the nonparent control group. In the HRS, 847 grandparent observations were matched with 3388 control observations; these control observations corresponded to 1363 unique person-year observations stemming from 978 unique respondents for the parent control group, and to 1039 unique person-year observations stemming from 712 unique respondents for the nonparent control group.

between grandparents and controls after matching was good (see Tables S2 & S3), lying below 0.25 as recommended in the literature (Stuart, 2010), and below 0.10 with few exceptions (Austin, 2011). Graphically, group differences in the propensity score distributions were small and indicated no substantial missing overlap (see Figure S1).

After matching, each matched control observation was assigned the same value as the matched grandparent in the *time* variable describing the temporal relation to treatment, and the control respondent's other longitudinal observations were centered around this matched observation. We thus coded a counterfactual transition time frame for each control respondent. Due to left- and right-censored longitudinal data (i.e., panel entry or attrition), we restricted the final analysis samples to six years before and six years after the transition, as shown in Table 1.

The final LISS analysis samples (see Figure 1) contained 282 grandparents with 1591 longitudinal observations, matched with 1128 control respondents with either 6288 (parent control group) or 6290 longitudinal observations (nonparent control group). The final HRS analysis samples contained 847 grandparents with 2264 longitudinal observations, matched with 3388 control respondents with either 8326 (parent control group) or 8229 longitudinal observations (nonparent control group). In the HRS, there were a few additional missing values in the outcomes ranging from 19 to 99 longitudinal observations, which were listwise deleted in the respective analyses.

Table 1

Longitudinal Sample Size in the Analysis Samples and Coding Scheme for the Piecewise Regression Coefficients.

	Pre-transition years						Post-transition years						
	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
LISS: Analysis samples													
Grandparents: obs.	105	99	122	137	171	155	170	149	130	117	91	74	71
Grandparents: % women	50.48	52.53	54.92	51.09	57.89	60.00	48.82	53.69	53.08	52.99	50.55	62.16	59.15
Parent controls: obs.	337	469	465	675	838	486	483	532	452	446	457	331	317
Parent controls: % women	57.57	52.88	56.99	51.26	56.56	55.56	53.42	55.26	53.54	50.45	52.30	57.40	58.04
Nonparent controls: obs.	313	445	456	699	863	470	495	558	400	522	470	307	292
Nonparent controls: % women	42.81	55.73	55.04	53.36	56.43	54.68	51.72	54.12	52.25	57.09	50.21	46.91	56.51
LISS: Coding scheme													
Before-slope	0	1	2	3	4	5	5	5	5	5	5	5	5
After-slope	0	0	0	0	0	0	1	2	3	4	5	6	7
Shift	0	0	0	0	0	0	1	1	1	1	1	1	1
HRS: Analysis samples													
Grandparents: obs.	162		389		461		381		444		195		232
Grandparents: % women	57.41		54.24		55.53		54.07		55.41		56.41		53.45
Parent controls: obs.	647		1544		1844		1230		1492		703		866
Parent controls: % women	51.62		54.15		55.53		54.55		56.90		52.77		58.08
Nonparent controls: obs.	666		1545		1845		1203		1464		687		819
Nonparent controls: % women	56.61		54.17		55.50		56.36		58.13		57.21		61.66
HRS: Coding scheme													
Before-slope	0		1		2		2		2		2		2
After-slope	0		0		0		1		2		3		4
Shift	0		0		0		1		1		1		1

Note. obs. = observations. *time* = 0 marks the first year where the transition to grandparenthood has been reported. The number of grandparent respondents included in the final samples is $N_{LISS} = 282$ and $N_{HRS} = 847$.

Transparency and Openness

We used R (Version 4.0.4; R Core Team, 2021) and the R-packages *lme4* (Version 1.1.27.1; Bates et al., 2015), and *lmerTest* (Version 3.1.3; Kuznetsova et al., 2017) for multilevel modeling, as well as *tidyverse* (Wickham et al., 2019) for data wrangling, and *papaja* (Aust & Barth, 2020) for reproducible manuscript production (see supplement for complete package information). The preregistration and scripts for data wrangling, analyses, and to reproduce this manuscript[6] can be found on the OSF (https://osf.io/75a4r/) and GitHub (https://github.com/mdkraemer/gp-personality). LISS and HRS data are available after registering accounts. We deviate from the preregistration in using new waves of data released in the meantime (2020/2021 LISS) as well as updated datasets (HRS). Following Benjamin et al. (2018), we set the α-level for confirmatory analyses to .005.

Analytical Strategy

Our design can be referred to as an interrupted time series with a "nonequivalent no-treatment control group" (Shadish et al., 2002, p. 182) where treatment, that is, the transition to grandparenthood, is not deliberately manipulated. First, to analyze mean-level changes (research question 1), we used linear piecewise regression coefficients in multilevel models with person-year observations nested within respondents and households (Hoffman, 2015). To model change over time in relation to the transition to grandparenthood, we coded three piecewise regression coefficients: a *before-slope* representing linear change in the years leading up to the transition to grandparenthood, an *after-slope* representing linear change in the years after the transition, and a *shift* coefficient, shifting the intercept directly after the transition was first reported, thus representing sudden changes that go beyond changes already modeled by the *after-slope*

[6] We also provide instructions to aid reproducing the manuscript.

(see Table 1 for the coding scheme of these coefficients).[7] Other studies of personality development have recently adopted similar piecewise coefficients (Krämer & Rodgers, 2020; e.g., Schwaba & Bleidorn, 2019; van Scheppingen & Leopold, 2020).

All effects of the transition to grandparenthood on the Big Five and life satisfaction were modeled as deviations from the matched control groups by interacting the three piecewise coefficients with the treatment variable (0 = *control*, 1 = *grandparent*). In additional models, we interacted these coefficients with the moderator variables, resulting in two- and three-way interactions. To test differences in the growth parameters between two groups in cases where these differences were represented by multiple fixed-effects coefficients, we defined linear contrasts using the *linearHypothesis* command from the *car* package (Fox & Weisberg, 2019). All models of mean-level changes were estimated using maximum likelihood and included random intercepts but no random slopes. Simultaneous random slopes of change parameters frequently lead to convergence issues. Fixed slopes models are appropriate to model average trajectories, which vary systematically with the person-level treatment variable (Hoffman & Walters, 2022). We included the propensity score as a level-2 covariate for a double-robust approach (Austin, 2017). The equation for the basic (i.e., unmoderated) model reads:

$$
\begin{aligned}
y_{ti} =& \beta_{0i} + \beta_{1i} before_{ti} + \beta_{2i} after_{ti} + \beta_{3i} shift_{ti} + e_{ti} \\
& \beta_{0i} = \gamma_{00} + \gamma_{01} grandparent_i + \gamma_{02} pscore_i + \upsilon_{0i} \\
& \beta_{1i} = \gamma_{10} + \gamma_{11} grandparent_i \\
& \beta_{2i} = \gamma_{20} + \gamma_{21} grandparent_i \\
& \beta_{3i} = \gamma_{30} + \gamma_{31} grandparent_i \ ,
\end{aligned}
\tag{1}
$$

[7] As a robustness check, we re-estimated the mean-level trajectories after further restricting the time frame by excluding time points earlier than two years before the transition (i.e., before the latest time of matching). This served the purpose of assessing whether including time points from before matching (as preregistered) would distort the trajectories in any way. However, results were highly similar (see *gp_restricted_models.pdf* on https://osf.io/75a4r/).

where at time t for person i $e_{ti} \sim N(0, \sigma_e^2)$ and $\upsilon_{0i} \sim N(0, \tau_{00})$ (ignoring the additional nesting in households applied to the majority of models). y_{ti} represented one of the Big Five or life satisfaction. Separate models were computed for each analysis sample. The other model equations can be found in the supplemental materials.

Second, to assess interindividual differences in change (research question 2), we added random slopes. In other words, we allowed for differences between individuals in their trajectories of change to be modeled, that is, differences in the *before-slope*, *after-slope*, and *shift* coefficients. Because simultaneous random slopes are often not computationally feasible, we added random slopes one at a time and used likelihood ratio tests to determine whether the addition of the respective random slope led to a significant improvement in model fit. To test differences in the random slope variance between the grandparent group and each control group, we respecified the models as heterogeneous variance models using the *nlme* R package (Pinheiro et al., 2021). This allowed for separate random slope variances to be estimated in the grandparent group and the control group within the same model. We compared the fit of these heterogeneous variance models to corresponding models with a homogeneous (single) random slope variance using likelihood ratio tests.

Third, to examine rank-order stability in the Big Five and life satisfaction over the transition to grandparenthood (research question 3), we computed the test-retest correlation of measurements prior to the transition to grandparenthood (at the time of matching) and the first available measurement afterward. To test differences in test-retest correlations between grandparents and either of the control groups, we entered the pre-treatment measure, the treatment variable (0 = *control*, 1 = *grandparent*), and their interaction into regression models predicting the Big Five and life satisfaction. The interaction tests for significant differences in the rank-order stability between those who experienced the transition to grandparenthood and those who did not (see Denissen et al., 2019; McCrae, 1993).

Results

Throughout the results section, we referred to statistical tests with $.005 < p < .05$ as *suggestive evidence* as stated in our preregistration.

Descriptive Results

Means and standard deviations of the Big Five and life satisfaction over the analyzed time points are presented in Tables S4 and S5. Visually represented (see Figures S2-S7), all six outcomes display marked stability over time in both LISS and HRS. Intra-class correlations (see Table S6) show that large portions of the total variance in the Big Five could be explained by nesting in respondents (*median* = 0.75), while nesting in households only accounted for minor portions of the total variance (ICC_{hid}, *median* = 0.03). For outcome-subsample combinations with ICC_{hid} below 0.05 we omitted the household nesting factor from all models to bypass computational errors—a small deviation from our preregistration. For life satisfaction, the nesting in households accounted for slightly larger portions of the total variance (*median* = 0.37) than nesting in respondents (*median* = 0.30). Across all outcomes, the proportion of variance due to within-person factors was relatively low (*median* = 0.23).

Mean-Level Changes

Figures 2 and 3 summarize the effects of the basic models and those including the gender interaction for all outcomes and across the four analysis samples.

Agreeableness

In the basic models, we found no evidence that grandparents increased in agreeableness as compared to the controls (see Tables S7 & S8 and Figure 4). The models including the gender interaction (see Tables 2 & S9 and Figure 4) indicated that grandfathers increased slightly in agreeableness after the transition to grandparenthood as compared to the parent controls (LISS: $\hat{\gamma}_{21} = 0.02$, 95% CI $[0.01, 0.04]$, $p = .002$; suggestive

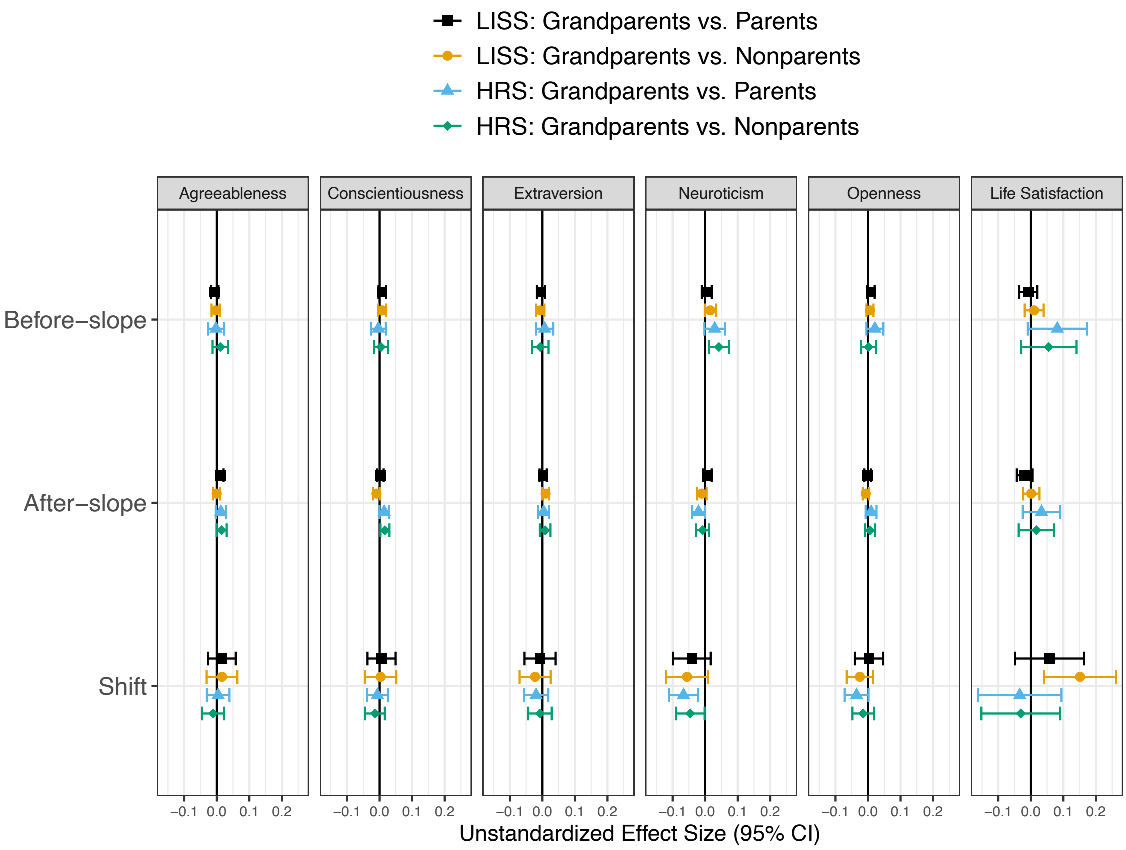

Figure 2

Unstandardized Effect Sizes of the Basic Models Across Analysis Samples (Regression Coefficients $\hat{\gamma}$ or Linear Contrasts $\hat{\gamma}_c$ From Multilevel Models, see Tables S7, S8, S16, S17, S24, S25, S34, S35, S44, S45, S54, S55). Error Bars Represent 95% Confidence Intervals.

evidence in the HRS: $\hat{\gamma}_{21} = 0.03$, 95% CI $[0.01, 0.05]$, $p = .008$), whereas grandmothers did not differ from the female controls.

There was no consistent evidence for moderation by paid work (see Tables S10 & S11 and Figure S8), providing grandchild care (see Tables S12 & S13 and Figure S9), or ethnicity (see Tables S14 & S15 and Figure S10).

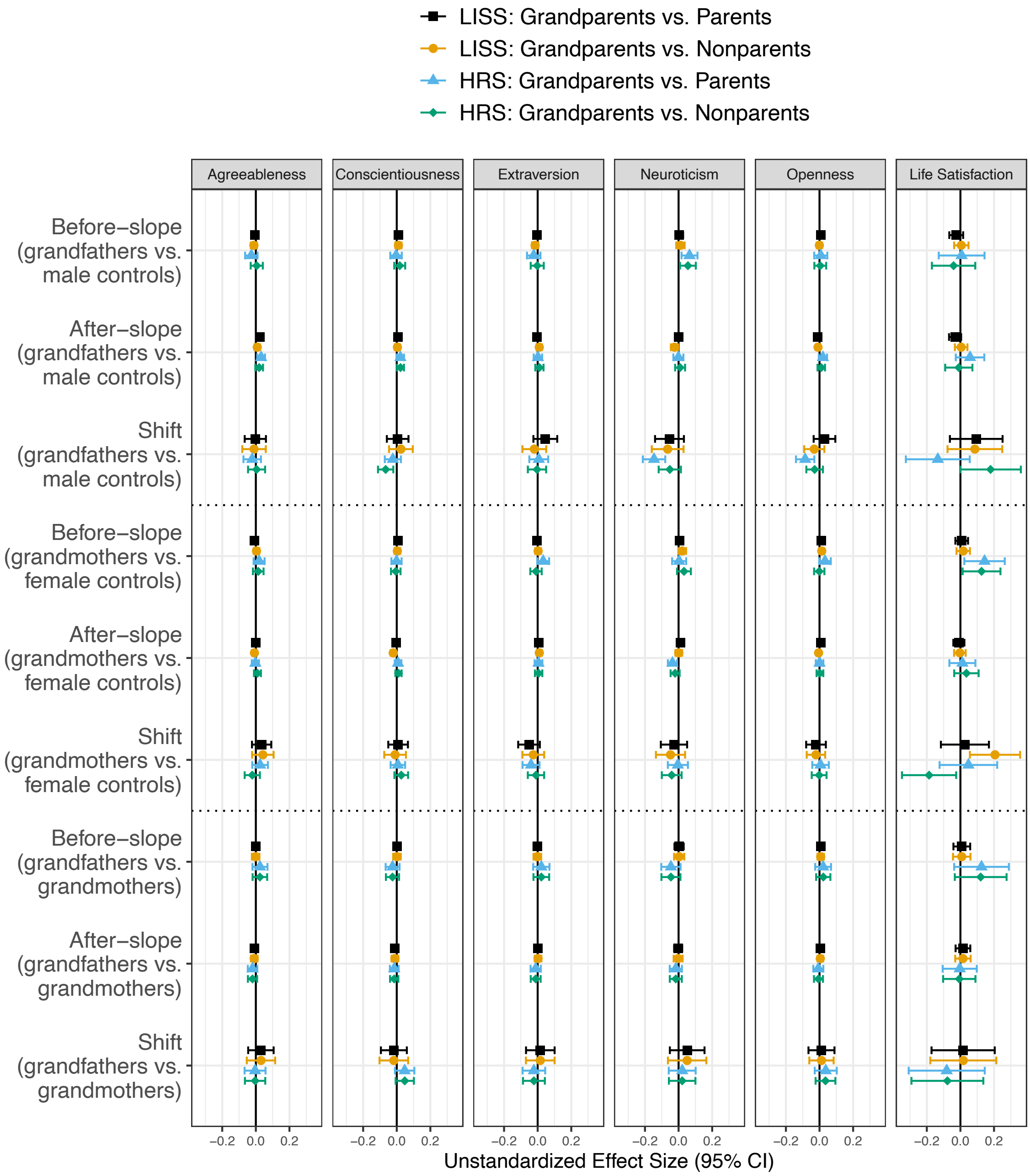

Figure 3

Unstandardized Effect Sizes of the Models Including the Gender Interaction Across Analysis Samples (Regression Coefficients $\hat{\gamma}$ or Linear Contrasts $\hat{\gamma}_c$ From Multilevel Models, see Tables 2, S9, S18, S19, S26, S27, S36, S37, S46, S47, S56, S57). Error Bars Represent 95% Confidence Intervals.

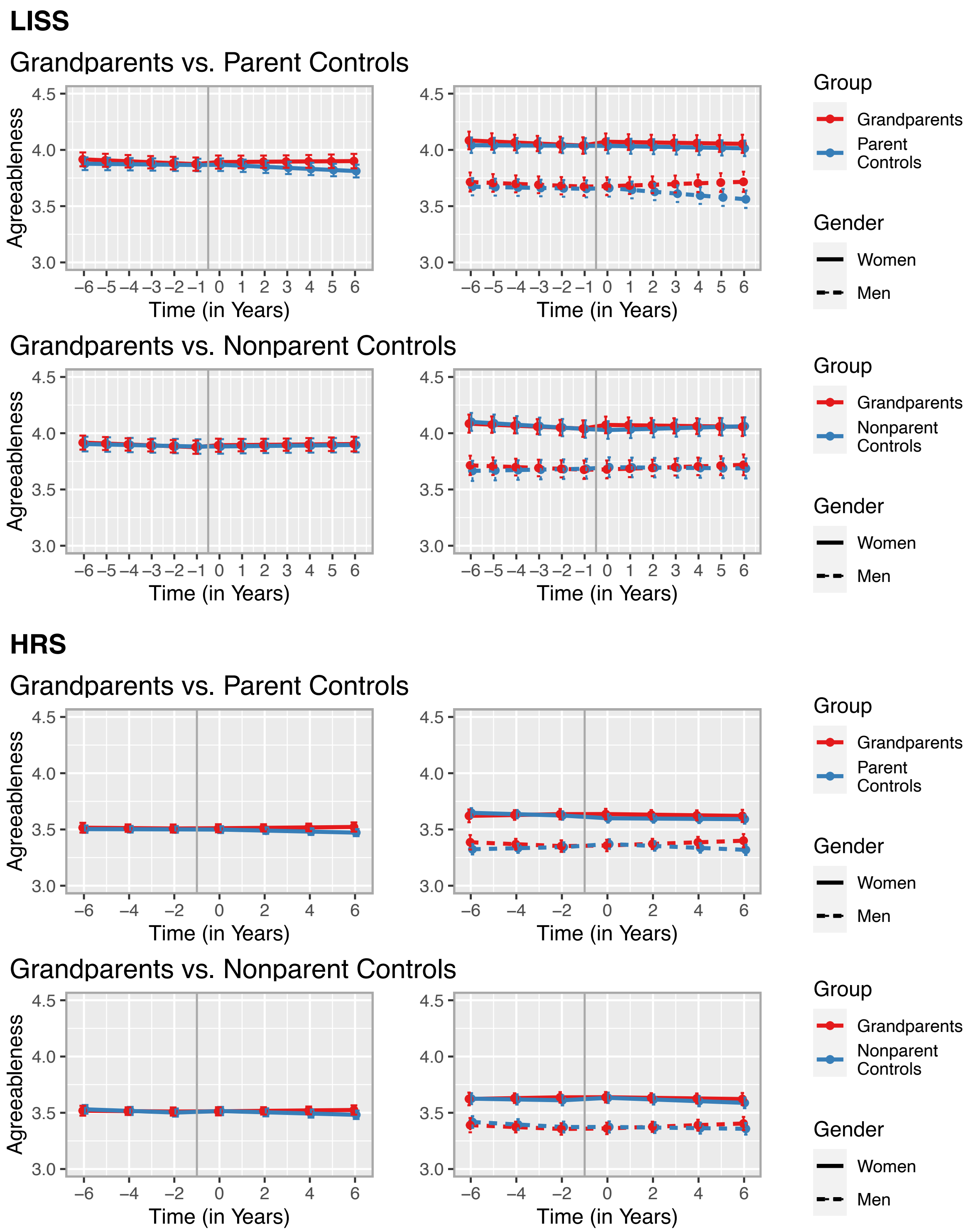

Figure 4

Change trajectories of agreeableness based on the basic models (left column) and the models including the gender interaction (right column). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood.

Table 2

Fixed Effects of Agreeableness Over the Transition to Grandparenthood Moderated by Gender.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.65	[3.58, 3.73]	93.57	< .001	3.65	[3.56, 3.74]	79.53	< .001
Propensity score, $\hat{\gamma}_{04}$	0.07	[0.01, 0.12]	2.37	.018	0.04	[-0.02, 0.10]	1.37	.172
Before-slope, $\hat{\gamma}_{10}$	0.00	[-0.01, 0.00]	-0.97	.333	0.00	[0.00, 0.01]	0.91	.364
After-slope, $\hat{\gamma}_{20}$	-0.02	[-0.02, -0.01]	-5.09	< .001	0.00	[-0.01, 0.01]	-0.49	.625
Shift, $\hat{\gamma}_{30}$	0.02	[-0.01, 0.06]	1.37	.172	0.01	[-0.02, 0.05]	0.81	.417
Grandparent, $\hat{\gamma}_{01}$	0.04	[-0.07, 0.16]	0.72	.473	0.05	[-0.07, 0.17]	0.78	.434
Female, $\hat{\gamma}_{02}$	0.37	[0.27, 0.47]	7.09	< .001	0.44	[0.32, 0.56]	7.24	< .001
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.02, 0.01]	-0.52	.602	-0.01	[-0.03, 0.01]	-1.22	.221
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.02	[0.01, 0.04]	3.11	.002	0.01	[-0.01, 0.02]	1.03	.301
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.03	[-0.10, 0.05]	-0.71	.475	-0.02	[-0.10, 0.06]	-0.48	.635
Before-slope * Female, $\hat{\gamma}_{12}$	0.00	[-0.01, 0.01]	0.54	.592	-0.02	[-0.03, -0.01]	-2.82	.005
After-slope * Female, $\hat{\gamma}_{22}$	0.01	[0.00, 0.02]	2.94	.003	0.01	[0.00, 0.02]	1.51	.132
Shift * Female, $\hat{\gamma}_{32}$	-0.02	[-0.07, 0.02]	-0.88	.377	-0.03	[-0.08, 0.02]	-1.16	.244
Grandparent * Female, $\hat{\gamma}_{03}$	0.00	[-0.15, 0.16]	0.03	.977	-0.07	[-0.23, 0.10]	-0.78	.436
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.00	[-0.03, 0.02]	-0.32	.751	0.02	[-0.01, 0.04]	1.20	.231
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	-0.02	[-0.04, 0.00]	-2.24	.025	-0.02	[-0.04, 0.00]	-1.51	.130
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.06	[-0.04, 0.16]	1.21	.227	0.07	[-0.04, 0.18]	1.26	.209
HRS								
Intercept, $\hat{\gamma}_{00}$	3.29	[3.24, 3.34]	135.53	< .001	3.39	[3.34, 3.44]	124.23	< .001
Propensity score, $\hat{\gamma}_{04}$	0.09	[0.03, 0.15]	2.97	.003	0.06	[-0.01, 0.12]	1.77	.076
Before-slope, $\hat{\gamma}_{10}$	0.01	[-0.01, 0.03]	1.22	.223	-0.02	[-0.04, -0.01]	-2.86	.004
After-slope, $\hat{\gamma}_{20}$	-0.02	[-0.03, -0.01]	-3.20	.001	-0.01	[-0.02, 0.01]	-0.99	.320
Shift, $\hat{\gamma}_{30}$	0.04	[0.01, 0.08]	2.83	.005	0.01	[-0.02, 0.04]	0.39	.700
Grandparent, $\hat{\gamma}_{01}$	0.06	[-0.02, 0.14]	1.57	.116	-0.03	[-0.11, 0.05]	-0.65	.514
Female, $\hat{\gamma}_{02}$	0.32	[0.26, 0.38]	10.44	< .001	0.21	[0.14, 0.27]	6.08	< .001
Before-slope * Grandparent, $\hat{\gamma}_{11}$	-0.03	[-0.06, 0.01]	-1.42	.157	0.01	[-0.03, 0.04]	0.29	.772
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.03	[0.01, 0.05]	2.65	.008	0.02	[0.00, 0.04]	1.71	.087
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.05	[-0.12, 0.01]	-1.53	.126	-0.02	[-0.08, 0.05]	-0.46	.648
Before-slope * Female, $\hat{\gamma}_{12}$	-0.02	[-0.04, 0.00]	-2.01	.044	0.02	[-0.01, 0.04]	1.46	.145
After-slope * Female, $\hat{\gamma}_{22}$	0.01	[0.00, 0.03]	2.05	.040	-0.01	[-0.02, 0.00]	-1.35	.178
Shift * Female, $\hat{\gamma}_{32}$	-0.07	[-0.11, -0.03]	-3.16	.002	0.03	[-0.01, 0.07]	1.50	.135

Table 2 continued

Parameter	Parent controls				Nonparent controls			
	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Grandparent * Female, $\hat{\gamma}_{03}$	-0.09	[-0.19, 0.02]	-1.66	.098	0.03	[-0.08, 0.13]	0.48	.632
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.05	[0.00, 0.10]	1.84	.067	0.01	[-0.04, 0.06]	0.37	.713
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	-0.03	[-0.07, 0.00]	-2.14	.033	-0.01	[-0.04, 0.02]	-0.66	.512
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.08	[-0.01, 0.17]	1.74	.082	-0.02	[-0.10, 0.07]	-0.34	.737

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Conscientiousness

We found no differences between grandparents and both parent and nonparent controls in their trajectories of conscientiousness (see Tables S16 & S17 and Figure S11). There was only inconsistent evidence for gender moderation (see Tables S18 & S19 and Figure S11): Grandfathers' conscientiousness decreased immediately following the transition to grandparenthood as compared to male nonparents in the HRS, $[\hat{\gamma}_{21} + \hat{\gamma}_{31}] =$ -0.07, 95% CI [-0.11, -0.02], $p = .004$, but not in any of the other three analysis samples.

There were significant differences in conscientiousness trajectories depending on grandparents' work status (see Tables 3 & S20 and Figure 5): non-working grandparents saw more pronounced increases in conscientiousness in the years before the transition to grandparenthood compared to non-working parents, $\hat{\gamma}_{21} = 0.08$, 95% CI $[0.03, 0.13]$, $p <$ .001, and nonparent controls, $\hat{\gamma}_{21} = 0.06$, 95% CI $[0.02, 0.11]$, $p = .004$, and compared to working grandparents (difference in *before* parameter; parents: $[\hat{\gamma}_{30} + \hat{\gamma}_{31}]$ = -0.08, 95% CI [-0.13, -0.03], $p = .002$; nonparents: $[\hat{\gamma}_{30} + \hat{\gamma}_{31}]$ = -0.08, 95% CI [-0.12, -0.03], $p = .001$). Grandparents providing grandchild care increased in conscientiousness to a greater degree than the matched controls (difference in *after* parameter; parents: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}] = 0.04$, 95% CI [0.02, 0.06], $p < .001$; nonparents: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}] = 0.04$, 95% CI [0.02, 0.06], $p < .001$; see Tables 4 & S21 and Figure 6). There was only suggestive evidence that grandparents who provided grandchild care increased more strongly in conscientiousness after the transition than grandparents who did not (difference in *after* parameter; parents: $[\hat{\gamma}_{30} + \hat{\gamma}_{31}] = 0.03$, 95% CI [0.00, 0.06], $p = .029$; nonparents: $[\hat{\gamma}_{30} + \hat{\gamma}_{31}] = 0.03$, 95% CI [0.01, 0.06], $p =$ .020). Conscientiousness trajectories were not moderated by ethnicity (see Tables S22 & S23 and Figure S12).

Extraversion

The trajectories of grandparents' extraversion closely followed those of the matched controls. There were no significant effects indicating differences between grandparents and

Table 3

Fixed Effects of Conscientiousness Over the Transition to Grandparenthood Moderated by Performing Paid Work.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.40	[3.36, 3.44]	169.21	< .001	3.39	[3.34, 3.43]	151.26	< .001
Propensity score, $\hat{\gamma}_{02}$	0.06	[0.01, 0.12]	2.17	.030	0.13	[0.07, 0.19]	4.35	< .001
Before-slope, $\hat{\gamma}_{20}$	-0.01	[-0.03, 0.01]	-1.24	.215	0.00	[-0.01, 0.02]	0.48	.634
After-slope, $\hat{\gamma}_{40}$	0.00	[-0.01, 0.00]	-1.07	.284	-0.01	[-0.02, 0.00]	-2.59	.009
Shift, $\hat{\gamma}_{60}$	0.00	[-0.03, 0.03]	-0.07	.943	-0.05	[-0.08, -0.02]	-3.41	.001
Grandparent, $\hat{\gamma}_{01}$	-0.09	[-0.17, 0.00]	-2.04	.042	-0.10	[-0.19, -0.02]	-2.49	.013
Working, $\hat{\gamma}_{10}$	-0.01	[-0.05, 0.03]	-0.52	.600	-0.04	[-0.08, -0.01]	-2.41	.016
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.08	[0.03, 0.13]	3.41	.001	0.06	[0.02, 0.11]	2.89	.004
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.02	[0.00, 0.04]	1.54	.124	0.02	[0.00, 0.04]	2.29	.022
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.07	[-0.14, 0.00]	-1.96	.050	-0.02	[-0.08, 0.05]	-0.47	.636
Before-slope * Working, $\hat{\gamma}_{30}$	0.03	[0.01, 0.05]	3.13	.002	0.00	[-0.02, 0.02]	0.02	.982
After-slope * Working, $\hat{\gamma}_{50}$	0.01	[-0.01, 0.02]	0.80	.422	0.01	[0.00, 0.03]	2.34	.019
Shift * Working, $\hat{\gamma}_{70}$	-0.02	[-0.06, 0.02]	-0.80	.422	0.07	[0.03, 0.11]	3.53	< .001
Grandparent * Working, $\hat{\gamma}_{11}$	0.16	[0.07, 0.25]	3.57	< .001	0.19	[0.10, 0.27]	4.41	< .001
Before-slope * Grandparent * Working, $\hat{\gamma}_{31}$	-0.11	[-0.16, -0.06]	-4.04	< .001	-0.08	[-0.13, -0.03]	-2.98	.003
After-slope * Grandparent * Working, $\hat{\gamma}_{51}$	0.00	[-0.03, 0.03]	-0.27	.784	-0.01	[-0.04, 0.02]	-0.91	.363
Shift * Grandparent * Working, $\hat{\gamma}_{71}$	0.07	[-0.02, 0.16]	1.48	.140	-0.02	[-0.10, 0.07]	-0.44	.658

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *working* = 1 indicates being employed in paid work.

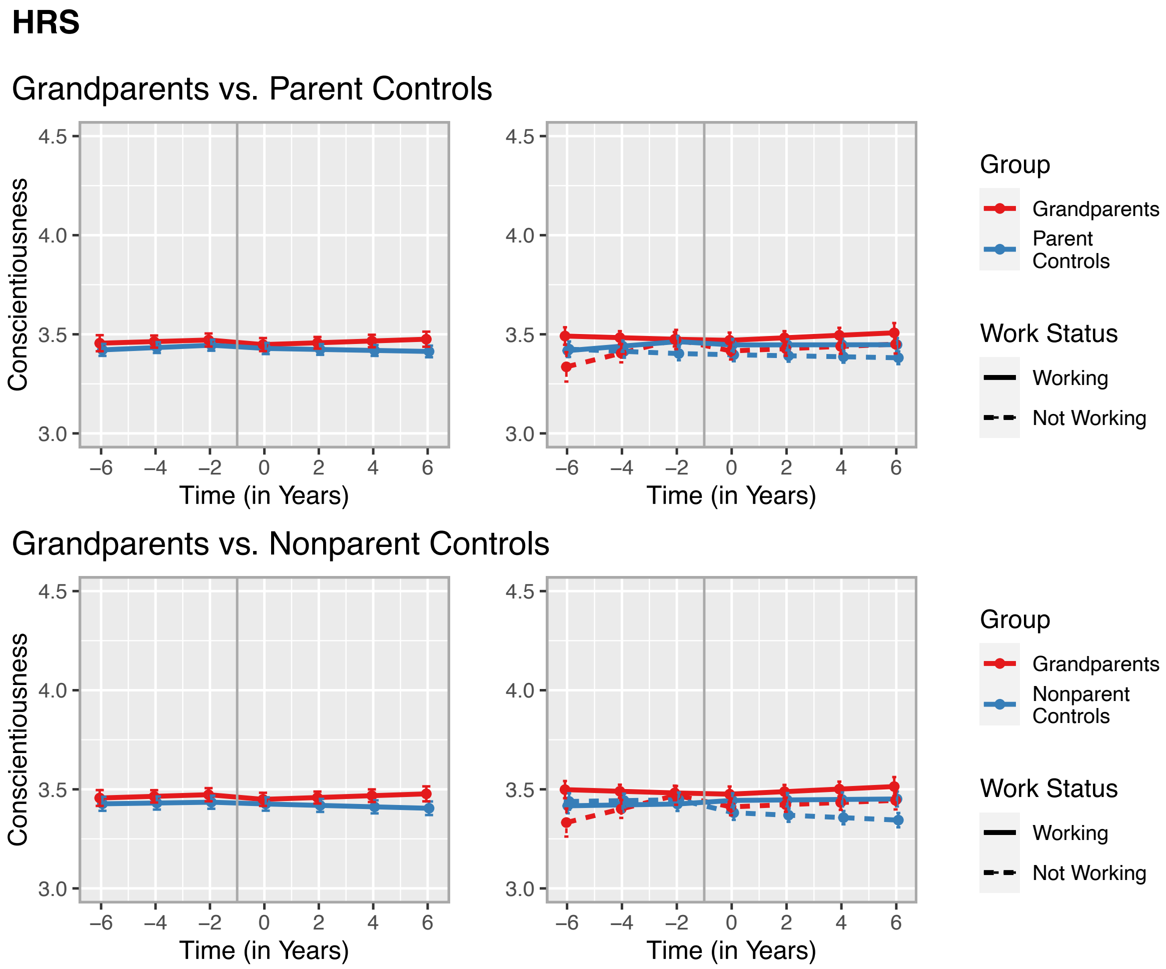

Figure 5

Change trajectories of conscientiousness based on the models of moderation by paid work (see Table 3). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S11 (basic models) and added here for better comparability.

Table 4

Fixed Effects of Conscientiousness Over the Transition to Grandparenthood Moderated by Grandchild Care.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.43	[3.39, 3.47]	169.73	< .001	3.38	[3.33, 3.42]	140.60	< .001
Propensity score, $\hat{\gamma}_{02}$	0.03	[-0.04, 0.10]	0.82	.411	0.24	[0.16, 0.31]	6.16	< .001
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.01]	-0.66	.510	-0.01	[-0.02, 0.00]	-2.38	.017
Grandparent, $\hat{\gamma}_{01}$	0.01	[-0.05, 0.07]	0.44	.659	-0.03	[-0.09, 0.03]	-0.88	.380
Caring, $\hat{\gamma}_{10}$	0.02	[-0.01, 0.06]	1.46	.143	0.01	[-0.02, 0.04]	0.75	.455
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.02, 0.02]	-0.16	.877	0.01	[-0.01, 0.02]	0.56	.573
After-slope * Caring, $\hat{\gamma}_{30}$	-0.01	[-0.02, 0.00]	-1.51	.131	0.00	[-0.01, 0.01]	-0.24	.807
Grandparent * Caring, $\hat{\gamma}_{11}$	-0.06	[-0.14, 0.02]	-1.54	.125	-0.06	[-0.14, 0.02]	-1.49	.136
After-slope * Grandparent * Caring, $\hat{\gamma}_{31}$	0.04	[0.01, 0.07]	2.63	.009	0.03	[0.00, 0.06]	2.20	.028

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *caring* = 1 indicates more than 100 hours of grandchild care since the last assessment.

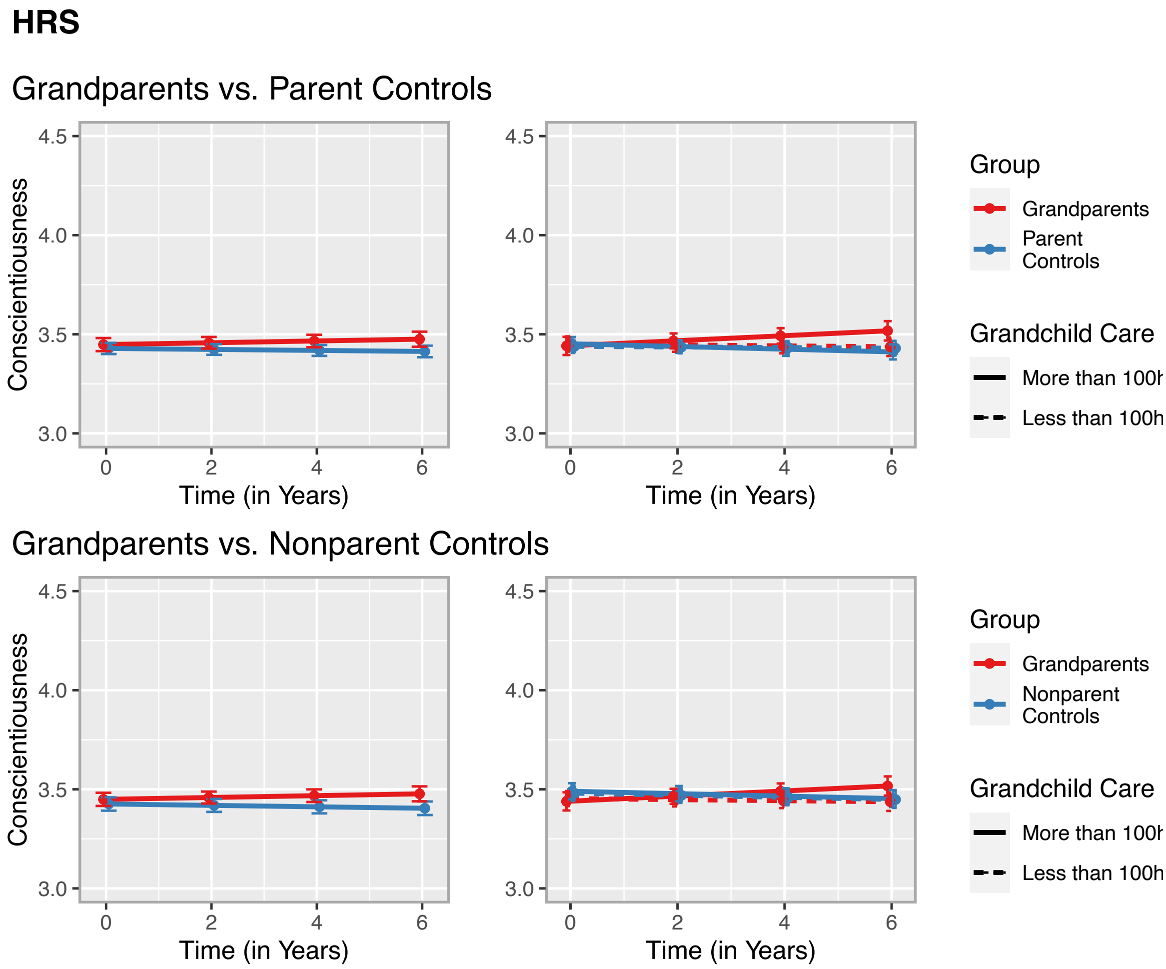

Figure 6

Change trajectories of conscientiousness based on the models of moderation by grandchild care (see Table 4). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The plots in the left column are the same as in Figure S11 (basic models) but restricted to the post-transition period for better comparability.

controls in the basic models (see Tables S24 & S25 and Figure S13) or the models including the gender interaction (see Tables S26 & S27 and Figure S13). We also found no evidence for moderation by paid work (see Tables S28 & S29 and Figure S14), grandchild care (see Tables S30 & S31 and Figure S15), or ethnicity (see Tables S32 & S33 and Figure S16).

Neuroticism

The basic models for neuroticism (see Tables S34 & S35 and Figure S17) showed only minor differences between grandparents and matched controls: Compared to HRS parent controls, HRS grandparents shifted slightly downward in their neuroticism immediately after the transition to grandparenthood (difference in *shift* parameter: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = -0.07, 95% CI [-0.11, -0.02], p = .003; suggestive evidence in the nonparent sample: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = -0.05, 95% CI [-0.09, 0.00], p = .042), which was not the case in the LISS samples. The models including the gender interaction (see Tables S36 & S37 and Figure S17) showed one significant effect in the comparison of grandparents and controls: In the HRS, grandfathers, compared to male parent controls, shifted downward in neuroticism directly after the transition to grandparenthood (difference in *shift* parameter: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = -0.15, 95% CI [-0.21, -0.08], $p < .001$). Thus, the effect present in the basic models seemed to be mostly due to differences in the grandfathers (vs. male controls).

Grandparents' trajectories of neuroticism as compared to the controls were significantly moderated by paid work in one instance (see Tables S38 & S39 and Figure S18): Compared to working controls, working grandparents increased more strongly in neuroticism in the years before the transition to grandparenthood (difference in *before* parameter; parents: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = 0.06, 95% CI [0.02, 0.10], p = .001; nonparents: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = 0.06, 95% CI [0.02, 0.09], p = .002). There was no evidence that grandparents providing grandchild care differed in neuroticism from grandparents who did not (see Tables S40 & S41 and Figure S19). Neuroticism trajectories were not moderated by ethnicity (see Tables S42 & S43 and Figure S20).

Openness

For openness, we found a high degree of similarity between grandparents and matched control respondents in their trajectories based on the basic models (see Tables S44 & S45 and Figure S21) and models including the gender interaction (see Tables S46 & S47 and Figure S21). Grandfathers in the HRS shifted downward in openness in the first assessment after the transition to grandparenthood to a greater extent than the male parent controls (difference in *shift* parameter: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = -0.09, 95% CI [-0.14, -0.03], p = .002). However, this was not the case in the other three analysis samples.

The analysis of moderation by performing paid work revealed only one significant effect for openness trajectories (see Tables S48 & S49 and Figure S22): Non-working grandparents increased more strongly in openness post-transition than non-working parent controls ($\hat{\gamma}_{41} = 0.04$, 95% CI $[0.02, 0.06]$, $p < .001$; suggestive evidence in the nonparent sample: $\hat{\gamma}_{41} = 0.03$, 95% CI $[0.01, 0.05]$, $p = .015$). We found that grandparents providing grandchild care increased more strongly in openness than matched parent controls (difference in *after* parameter: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = 0.04, 95% CI [0.01, 0.06], p = .005; suggestive evidence in the nonparent sample: $[\hat{\gamma}_{21} + \hat{\gamma}_{31}]$ = 0.03, 95% CI [0.00, 0.05], p = .025). However, grandparents who provided grandchild care did not differ significantly from grandparents who did not (see Tables S50 & S51 and Figure S23). We found no evidence for moderation of openness by ethnicity (see Tables S52 & S53 and Figure S24).

Life Satisfaction

We found no consistent evidence that grandparents' life satisfaction trajectories differed significantly from those of the controls in either the basic models (see Tables S54 & S55 and Figure S25) or the models including the gender interaction (see Tables S56 & S57 and Figure S25). There was also no evidence of a moderation of life satisfaction by performing paid work (see Tables S58 & S59 and Figure S26) or grandchild care (see Tables S60 & S61 and Figure S27).

Black/African American grandparents increased to a higher degree in life satisfaction after the transition to grandparenthood than Black/African American nonparent controls (difference in *after* parameter: $[\hat{\gamma}_{41} + \hat{\gamma}_{51}]$ = 0.37, 95% CI [0.14, 0.59], p = .001; suggestive evidence in the parent sample: $[\hat{\gamma}_{41} + \hat{\gamma}_{51}]$ = 0.28, 95% CI [0.06, 0.50], p

= .013; see Tables S62 & S63 and Figure S28). In addition, there was suggestive evidence that Black/African American grandparents' post-transition increases were more pronounced than those of White grandparents (difference in *after* parameter; parents: $[\hat{\gamma}_{50} + \hat{\gamma}_{51}] =$ 0.28, 95% CI [0.07, 0.49], $p = .009$; nonparents: $[\hat{\gamma}_{50} + \hat{\gamma}_{51}] = 0.29$, 95% CI [0.08, 0.49], $p =$ .006). However, the model uncertainty regarding these effects was comparatively high.

Interindividual Differences in Change

First, we conducted model fit comparisons between the random intercept models reported previously and models where a random slope variance was estimated, separately for each change parameter because joint random effects modeling frequently led to model nonconvergence. These comparisons showed a substantial amount of interindividual differences in change for all random slopes in all models, as indicated by increases in model fit significant at $p < .001$.

Second, we estimated models with heterogeneous random slope variances of the grandparents and each control group to test whether interindividual differences in change were significantly larger in the grandparents. Contrary to hypothesis H2, for agreeableness, conscientiousness, extraversion, and neuroticism, interindividual differences in intraindividual change were greater in the control group for all tested effects (see Tables S64, S65, S66, & S67). In the two HRS samples, assuming group heterogeneity in the random slope variances led to significant improvements in model fit in all model comparisons. In the two LISS samples, this was the case for around half the tests.

For openness, interindividual differences in change before the transition to grandparenthood were significantly greater in the HRS grandparents than the nonparent controls (random slope variances of the *before* parameter), *likelihood ratio* = 57.57, $p <$ .001. This result could not be replicated in the other three samples. The other parameters of change either did not differ between groups in their random slope variances or had significantly larger random slope variances in the respective control group (see Table S68).

We found larger interindividual differences in grandparents' changes in life satisfaction before the transition to grandparenthood compared to the nonparent controls in the HRS (random slope variances of the *before* parameter), *likelihood ratio* = 115.87, $p <$ .001 (see Table S69). This was not corroborated in the other three analysis samples. Overall, most tests for heterogeneous random slope variances in life satisfaction indicated either non-significant differences or significantly larger random slope variances in the control sample.

Rank-Order Stability

We computed test-retest correlations for the Big Five and life satisfaction for the matched sample and separately for grandparents only and controls only (see Table 5). In 5 out of 24 comparisons, grandparents' test-retest correlation was lower than the respective control group's. However, differences in rank-order stability between grandparents and control respondents did not reach significance in any of these comparisons. Overall, we found no confirmatory evidence in support of hypothesis H3.[8]

[8] In addition to the preregistered retest interval, we computed a maximally large interval between the first available assessment before and the last assessment after the transition. Here, 3 out of 24 comparisons indicated that rank-order stability was lower in the grandparents. There was only one significant difference supporting our hypothesis: HRS grandparents' rank-order stability in openness was lower than that of the nonparents, $p < .001$ (see Table S70). Another analysis also failed to provide convincing evidence that grandparents' rank-order stability was lower: We excluded duplicate control respondents resulting from matching with replacement who might bias results towards greater stability in the controls. Descriptively, 10 out of 24 comparisons showed lower rank-order stability in the grandparents (see Table S71). However, group differences were small and nonsignificant.

Table 5

Rank-Order Stability.

	Parent controls				Nonparent controls			
Outcome	Cor_{all}	Cor_{GP}	Cor_{con}	p	Cor_{all}	Cor_{GP}	Cor_{con}	p
LISS								
Agreeableness	0.78	0.81	0.77	.506	0.73	0.81	0.71	$<$ .001
Conscientiousness	0.79	0.80	0.79	.289	0.79	0.80	0.78	.212
Extraversion	0.80	0.87	0.78	.080	0.85	0.87	0.84	.311
Neuroticism	0.73	0.77	0.71	.038	0.72	0.77	0.70	.164
Openness	0.73	0.80	0.71	.023	0.79	0.80	0.79	.382
Life Satisfaction	0.70	0.66	0.71	.059	0.61	0.66	0.60	.263
HRS								
Agreeableness	0.67	0.70	0.67	.523	0.71	0.70	0.72	.750
Conscientiousness	0.70	0.69	0.70	.196	0.70	0.69	0.70	.362
Extraversion	0.71	0.75	0.70	.011	0.73	0.75	0.73	.001
Neuroticism	0.66	0.71	0.65	.936	0.69	0.71	0.68	.867
Openness	0.70	0.73	0.69	.150	0.76	0.73	0.77	.123
Life Satisfaction	0.49	0.55	0.48	.021	0.54	0.55	0.54	.892

Note. Test-retest correlations as indicators of rank-order stability, and p-values indicating significant group differences therein between grandparents and each control group. The average retest intervals in years are 3.06 ($SD = 0.89$) for the LISS parent sample, 3.05 ($SD = 0.94$) for the LISS nonparent sample, 4.15 ($SD = 0.77$) for the HRS parent sample, and 4.11 ($SD = 0.67$) for the HRS nonparent sample. Cor = correlation; GP = grandparents; con = controls.

Discussion

In an analysis of first-time grandparents compared to both parent and nonparent matched control respondents, we found pronounced stability in the Big Five and life satisfaction over the transition to grandparenthood. There were a few isolated effects in line with our hypotheses on mean-level increases in agreeableness and conscientiousness, and decreases in neuroticism (H1a). However, they were very small in size, only present in grandfathers, and not consistent over the two analyzed panel studies (LISS and HRS) or the two matched control groups (parents and nonparents). We found no robust evidence that grandparents providing grandchild care experienced more pronounced positive personality development than those who did not (H1b). Evidence for moderation of mean-level trajectories by performing paid work was inconsistent. There was no evidence that grandmothers (or grandfathers) reached higher levels of life satisfaction following the transition to grandparenthood (H1c). Although interindividual differences in change were present for all change parameters, they were only greater in the grandparents than the controls in a small minority of model comparisons (H2). Finally, rank-order stability did not differ between grandparents and either control group, or it was lower in the control group—contrary to expectations (H3).

Social Investment Principle

We conducted a preregistered, cross-study, and multi-comparison test of the social investment principle (Lodi-Smith & Roberts, 2007; Roberts & Wood, 2006) with grandparenthood as a candidate catalyst of personality change (Hutteman et al., 2014). We found more evidence of trait stability than of change.

The direction of the few effects we found generally supported the social investment principle, that is, increases to agreeableness and conscientiousness and decreases to neuroticism—in contrast to development following parenthood (Asselmann & Specht, 2021b; van Scheppingen et al., 2016). However, even though small psychological effects may be meaningful and involve real-world consequences (Götz et al., 2021), the effects we found were not only small but also inconsistent across analysis samples.

Past research—mostly in the domains of well-being and health—found more pronounced effects of the transition to grandparenthood for grandmothers (Di Gessa et al., 2016b, 2019; Sheppard & Monden, 2019; Tanskanen et al., 2019). This has been discussed in the context of grandmothers spending more time with their grandchildren than grandfathers and providing more hours of care (Condon et al., 2013; Di Gessa et al., 2020), thus making a higher social investment.[9] Our results for the Big Five were not in agreement with this line of thought. One possible explanation is that (future) grandfathers were previously more invested in their work lives than in child rearing, and at the end of their career or after retirement, found investments in grandchild care to be a more novel and meaningful transition than grandmothers (StGeorge & Fletcher, 2014; Tanskanen et al., 2021). Currently, however, empirical research specifically on the grandfather role is sparse (for a qualitative approach, see Mann & Leeson, 2010), while the demography of grandparenthood is undergoing sweeping changes, with rising proportions of grandfathers actively involved in grandchild care (see Coall et al., 2016; Mann, 2007). Thus, more research into grandfathers' experience of the transition to grandparenthood is needed.

We tested paid work and grandchild care as moderators to gain more insight into social investment mechanisms. For conscientiousness, we found that grandparents who were not employed increased in anticipation of the transition to grandparenthood compared to working grandparents (and matched nonworking controls). This could imply that working grandparents did not find as much time for social investment because of the role conflict with the employee/worker role (Goode, 1960; see also, Arpino & Bellani, 2022; Tanskanen et al., 2021). Worth noting, we expected these moderation effects after the transition, when grandparents were able to spend time with their grandchild. However,

[9] In the HRS, a higher proportion of first-time grandmothers (M = 0.45, SD = 0.50) than grandfathers (M = 0.41, SD = 0.49) reported that they provided at least 100 hours of grandchild care since the last assessment.

such post-transition differences did not surface. Results for neuroticism were even less in line with the social investment principle: Working grandparents increased in neuroticism in anticipation of the transition to grandparenthood compared to the matched controls. Regarding moderation by grandchild care, our results suggested that grandparents who provided grandchild care increased slightly more in conscientiousness than grandparents who did not. However, the strength of the evidence was weak and indicates a need for temporally more fine-grained assessments with more extensive instruments of grandchild care (e.g., Vermote et al., 2021; see also Fingerman et al., 2020).

In total, evidence in favor of the social investment principle was very thin, and our analyses do not support the view that becoming a grandparent, in and of itself, changes personality in any meaningful way. This adds to other recent empirical tests in the context of parenthood and romantic relationships (Asselmann & Specht, 2020, 2021b; Spikic et al., 2021; van Scheppingen et al., 2016) that have challenged the original core assumption of personality maturation through age-graded social role transitions. It now seems likely that distinct (or additional) theoretical assumptions and mechanisms are required to explain empirical findings of personality development in middle and older adulthood. First steps in that direction include the recent distinction between social investment and divestment (Schwaba & Bleidorn, 2019) in the context of retirement (for the related distinction between personality maturation and relaxation, see Asselmann & Specht, 2021a). Further, personality development may be more closely tied to subjective perceptions of role competency and mastery than to transitions per se (Roberts & Davis, 2016; Roberts & Nickel, 2017).

Nonetheless, the possibility remains that preconditions we have not considered have to be met for grandparents to undergo personality development. For example, grandparents might need to live near their grandchild, see them regularly, and provide care above a certain quantity and quality. To our knowledge, however, there are presently no datasets with such detailed information regarding the grandparent role in conjunction with multiple waves of Big Five personality data. Studies on well-being have provided initial evidence that more frequent contact with grandchildren is associated with higher grandparental well-being (Arpino, Bordone, et al., 2018; Danielsbacka et al., 2019; Danielsbacka & Tanskanen, 2016; Dunifon et al., 2020). However, Danielsbacka et al. (2019) noted that this effect is due to between-person differences in grandparents, thus limiting a causal interpretation of frequency of grandchild care as a mechanism of development in psychological characteristics like life satisfaction and personality.

Life Satisfaction

Similar to the Big Five personality traits, we did not find convincing evidence that life satisfaction changed due to grandparenthood. A study of the effects of the transition on first-time grandparents' life satisfaction that used fixed effects regressions also did not discover any positive within-person effects of the transition (Sheppard & Monden, 2019; see also Ates, 2019). Further, in line with this study, we did not find evidence that grandparents who provided grandchild care increased more strongly in life satisfaction than those who did not, and grandparents' life satisfaction trajectories were also not moderated by employment status (Sheppard & Monden, 2019).

Overall, evidence has accumulated that there is an association between having grandchildren and higher life satisfaction on the between-person level—especially for (maternal) non-coresiding grandmothers who provide grandchild care (Danielsbacka et al., 2011, 2022; Danielsbacka & Tanskanen, 2016)—but no within-person effect of the transition. The main reason for this divergence is the presence of *selection* effects. Specifically, through propensity score matching we controlled for confounding (Luhmann et al., 2014; Thoemmes & Kim, 2011; VanderWeele et al., 2020), but its influence was present in previous studies. We carefully deliberated the inclusion of each covariate on the basis of its assumed causal relations to treatment assignment and the outcomes and made these underlying assumptions transparent within the preregistration.

In an exploratory analysis, Black/African American grandparents—usually lower in life satisfaction compared to White HRS respondents (e.g., W. Zhang et al., 2017)—increased in life satisfaction following the transition to grandparenthood bringing them up on par with White respondents. This is in line with cross-sectional data indicating no ethnic differences in life satisfaction between African American and White grandmothers (Goodman & Silverstein, 2006). Corroboration of this tentative finding in other samples should be awaited, though.

Interindividual Differences in Change

All parameters of change exhibited considerable interindividual differences. Similar to Denissen et al. (2019), who found model fit improvements with random slopes in most models (see also Doré & Bolger, 2018), respondents—both grandparents and matched controls—deviated to a considerable extent from mean-level change trajectories.

We expected larger interindividual differences in grandparents because life events differ in their impact on daily life and in the degree to which they are perceived as meaningful or emotionally significant (Doré & Bolger, 2018; Luhmann et al., 2021). Another reason for expecting heterogeneity in the individual trajectories were the considerable differences between grandparents in the amount of grandparental investment (e.g., Danielsbacka et al., 2022) and competing role demands (e.g., Arpino & Bellani, 2022) present in our samples. Our results, however, indicated that interindividual differences were larger in the controls than the grandparents for many models, or not significantly different between groups. Only in a small minority of tests were interindividual differences significantly larger in grandparents (concerning the linear slope in anticipation of grandparenthood for openness and life satisfaction).

Importantly, most previous studies do not compare interindividual differences in personality change between an event group and a comparison group (even if they use comparison groups for the main analyses, Denissen et al., 2019; Schwaba & Bleidorn, 2019;

cf. Jackson & Beck, 2021). Interindividual differences in personality change are substantial up until around 70 years of age (Schwaba & Bleidorn, 2018). Regarding the substantive question of how the transition to grandparenthood affects interindividual differences in change, we propose that it is more informative to test grandparents' variability in change against well-matched control groups than against no groups.

Recently, Jackson and Beck (2021) presented evidence that the experience of sixteen commonly analyzed life events was mostly associated with decreases in interindividual variation in the Big Five compared to those not experiencing the respective event. They used a comparable approach to ours but in a SEM latent growth curve framework and without accounting for pre-existing group differences (i.e., without matching). Their results based on the German SOEP data suggested—contrary to their expectations—that most life events made people *more* similar to each other (Jackson & Beck, 2021). Thus, taken together with our results, it seems that the assumption that life events and transitions ostensibly produce increased heterogeneity between people needs to be scrutinized in future studies. It is possible that normative social demands of events such as grandparenthood increase homogeneity of personality development trajectories.

Rank-Order Stability

We expected lower rank-order stability over the transition to grandparenthood in grandparents compared to the matched controls based on the assumption that grandparents' personality is reorganized through the experience of the event and the addition of the new social role. Conceptually, rank-order stability represents to which extent individual differences endure over time and it can be low even in the absence of mean-level changes if traits change nonsystematically. Empirically, though, we did not find evidence supporting our hypothesis (H3): Rank-order stability was highly similar in most comparisons of grandparents and controls, and it was not significantly lower in these comparisons. In a recent study of the effects of eight different life events on the development of the Big Five personality traits and life satisfaction (Denissen et al., 2019), comparably high rank-order stability was reported in the event groups. Only particularly adverse events such as widowhood and disability significantly lowered rank-order stability (Chopik, 2018; Denissen et al., 2019).

Regarding the Big Five's general age trajectories of rank-order stability, support for inverted U-shape trajectories was recently strengthened in a study of two panel data sets (Seifert et al., 2021). This study also explored that health deterioration accounted for parts of the decline of personality stability in old age. Therefore, it is possible that in later developmental phases (see also Hutteman et al., 2014) rank-order stability of personality is largely influenced by health status and less by normative life events. In the context of grandparenthood, this relates to research into health benefits (Chung & Park, 2018; Condon et al., 2018; Di Gessa et al., 2016a, 2016b; cf. Ates, 2017) and decreases to mortality risk associated with grandparenthood or grandchild care (Choi, 2020; Christiansen, 2014; Hilbrand et al., 2017; cf. Ellwardt et al., 2021). Grandparenthood might therefore have a time-lagged effect on personality stability through protective effects on health. However, with the currently available data, such a mediating effect cannot be reliably recovered (under realistic assumptions, Rohrer et al., 2022).

Limitations and Future Directions

A number of limitations need to be addressed: First, there remains some doubt whether we were able to follow truly socially invested grandparents over time. The moderator variable on grandchild care only reflects whether a respondent (or their spouse/partner) provides a minimal level of care. More detailed information regarding a grandparent's relationship with their first and later grandchildren[10] and the level of care a grandparent provides would be a valuable source of information on social investment, as would information on constraining factors such as length and cost of travel between

[10] It is also possible that effects of grandparental role investment accumulate with successive grandchildren (as shown for parental sleep deficits, Richter et al., 2019).

grandparent and grandchild. One way to obtain comprehensive information on mechanisms of grandparental development would be a measurement burst design in a sample of grandparents with diverse social backgrounds (see Crawford et al., 2022; Springstein et al., 2022). This would allow differentiating contexts of social investment while also providing insight into daily-life social activities (e.g., Dunifon et al., 2020) and their medium- to long-term influence on personality development (Wrzus & Roberts, 2017). On a similar note, we did not examine grandparents' subjective perception of the transition to grandparenthood in terms of the emotional significance, meaningfulness, and impact on daily lives, which might be responsible for differential individual change trajectories (Haehner et al., 2022; Kritzler et al., 2023; Luhmann et al., 2021). Grandparents' perception of potential role conflicts (Goode, 1960), and whether they perceive caregiving as a burden or obligation (Xu et al., 2017), could also uncover mechanisms of personality development.

Second, a causal interpretation of our results rests on a number of assumptions that are not directly testable with the data (Li, 2013; Stuart, 2010): We assumed that we picked the right sets of covariates, that our model to estimate the propensity score was correctly specified, and that there was no substantial remaining bias due to unmeasured confounding. Importantly, we selected covariates following state-of-the-art recommendations and substantiated each covariate's selection explicitly within our preregistration. Regarding the propensity score estimation, we computed grandparents' propensity scores at a specific time point at least two years before the transition to grandparenthood, which had the advantages that (*1*) the covariates were uncontaminated by anticipation of the transition, and (*2*) the matched controls had a clear counterfactual timeline of transition (for similar approaches, see Balbo & Arpino, 2016; Krämer & Rodgers, 2020; van Scheppingen & Leopold, 2020). It also has to be emphasized that the timing of measurements might have missed more short-term effects of grandparenthood playing out over months instead of years.

Third, our results only pertain to the countries for which our data are representative on a population level: the Netherlands and the United States. Personality development has been examined cross-culturally (e.g., Bleidorn et al., 2013; Chopik & Kitayama, 2018): On the one hand, these studies showed universal average patterns of positive personality development over the life span. On the other hand, they emphasized cultural differences regarding norms and values and the temporal onset of social roles (see Arshad & Chung, 2022). For grandparenthood, there are demographic differences between countries (Leopold & Skopek, 2015), as well as differences in public child care systems that may demand different levels of grandparental involvement (Bordone et al., 2017; Hank & Buber, 2009). In the Netherlands, people become grandparents six years later on average than in the United States (Leopold & Skopek, 2015). Furthermore, although both countries have largely market-based systems for early child care, parents in the Netherlands on average have access to more extensive childcare services through (capped) governmental benefits (OECD, 2020). Despite these differences, our results from the Dutch and US samples did not indicate systematic discrepancies.

Conclusion

Do personality traits change over the transition to grandparenthood? In two nationally representative panel studies in a preregistered propensity score matching design, Big Five personality traits and life satisfaction remained predominantly stable in first-time grandparents over this transition compared to matched parents and nonparents. We found slight post-transition increases to grandparents' agreeableness and conscientiousness in line with the social investment principle. However, these effects were minuscule and inconsistent across analysis samples. In addition, our analyses revealed (*1*) a lack of consistent moderators of personality development, (*2*) interindividual differences in change that were mostly smaller in grandparents than in matched respondents, and (*3*) comparable rank-order stability in grandparents and matched respondents. Thus, we conclude that the transition to grandparenthood did not act as a straightforwardly important developmental task driving personality development (as previously proposed, see Hutteman et al., 2014). With more detailed assessment of the grandparent role, future research can investigate whether personality development occurs in grandparents with specific degrees of role investment.

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References

Aassve, A., Luppi, F., & Mencarini, L. (2021). A first glance into the black box of life satisfaction surrounding childbearing. *Journal of Population Research*. https://doi.org/10.1007/s12546-021-09267-z

Allemand, M., Zimprich, D., & Martin, M. (2008). Long-term correlated change in personality traits in old age. *Psychology and Aging*, *23*(3), 545–557. https://doi.org/10.1037/a0013239

Anglim, J., Horwood, S., Smillie, L. D., Marrero, R. J., & Wood, J. K. (2020). Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychological Bulletin*, *146*(4), 279–323. https://doi.org/10.1037/bul0000226

Anusic, I., & Schimmack, U. (2016). Stability and change of personality traits, self-esteem, and well-being: Introducing the meta-analytic stability and change model of retest correlations. *Journal of Personality and Social Psychology*, *110*(5), 766–781. https://doi.org/10.1037/pspp0000066

Ardelt, M. (2000). Still stable after all these years? Personality stability theory revisited. *Social Psychology Quarterly*, *63*(4), 392–405. https://doi.org/10.2307/2695848

Arpino, B., & Bellani, D. (2022). Juggling grandchild care and labor force participation: The effect on psychological wellbeing of older women. *Frontiers in Sociology*, *6*. https://www.frontiersin.org/article/10.3389/fsoc.2021.806099

Arpino, B., & Bordone, V. (2017). Regular provision of grandchild care and participation in social activities. *Review of Economics of the Household*, *15*(1), 135–174. https://doi.org/10.1007/s11150-016-9322-4

Arpino, B., Bordone, V., & Balbo, N. (2018). Grandparenting, education and subjective well-being of older Europeans. *European Journal of Ageing*, *15*(3), 251–263. https://doi.org/10.1007/s10433-018-0467-2

Arpino, B., & Gómez-León, M. (2020). Consequences on depression of combining grandparental childcare with other caregiving roles. *Aging & Mental Health*, *24*(8), 1263–1270. https://doi.org/10.1080/13607863.2019.1584788

Arpino, B., Gumà, J., & Julià, A. (2018). Family histories and the demography of grandparenthood. *Demographic Research*, *39*(42), 1105–1150. https://doi.org/10.4054/DemRes.2018.39.42

Arshad, M., & Chung, J. (2022). Practical recommendations for considering culture, race, and ethnicity in personality psychology. *Social and Personality Psychology Compass*, *16*. https://doi.org/10.1111/spc3.12656

Asselmann, E., & Specht, J. (2021a). Personality maturation and personality relaxation: Differences of the Big Five personality traits in the years around the beginning and ending of working life. *Journal of Personality*, *89*(6), 1126–1142. https://doi.org/10.1111/jopy.12640

Asselmann, E., & Specht, J. (2020). Taking the ups and downs at the rollercoaster of love: Associations between major life events in the domain of romantic relationships and the Big Five personality traits. *Developmental Psychology*, *56*(9), 1803–1816. https://doi.org/10.1037/dev0001047

Asselmann, E., & Specht, J. (2021b). Testing the Social Investment Principle Around Childbirth: Little Evidence for Personality Maturation Before and After Becoming a Parent. *European Journal of Personality*, *35*(1), 85–102. https://doi.org/10.1002/per.2269

Ates, M. (2017). Does grandchild care influence grandparents' self-rated health? Evidence from a fixed effects approach. *Social Science & Medicine*, *190*, 67–74. https://doi.org/10.1016/j.socscimed.2017.08.021

Ates, M. (2019). *Well-Being of Grandparents in Germany* [PhD thesis, Universität zu Köln]. http://kups.ub.uni-koeln.de/id/eprint/10604

Ates, M., Bordone, V., & Arpino, B. (2021). Does grandparental child-care provision affect number, satisfaction and with whom leisure activities are done? *Ageing and Society*, 1–23. https://doi.org/10.1017/S0144686X2100009X

Aust, F., & Barth, M. (2020). *papaja: Prepare reproducible APA journal articles with R Markdown*. https://github.com/crsh/papaja

Austin, P. C. (2017). Double propensity-score adjustment: A solution to design bias or bias due to incomplete matching. *Statistical Methods in Medical Research*, *26*(1), 201–222. https://doi.org/10.1177/0962280214543508

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, *46*(3), 399–424. https://doi.org/10.1080/00273171.2011.568786

Baird, B. M., Lucas, R. E., & Donnellan, M. B. (2010). Life satisfaction across the lifespan: Findings from two nationally representative panel studies. *Social Indicators Research*, *99*(2), 183–203. https://doi.org/10.1007/s11205-010-9584-9

Balbo, N., & Arpino, B. (2016). The role of family orientations in shaping the effect of fertility on subjective well-being: A propensity score matching approach. *Demography*, *53*(4), 955–978. https://doi.org/10.1007/s13524-016-0480-z

Baltes, P. B., Lindenberger, U., & Staudinger, U. M. (2006). Life span theory in developmental psychology. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology: Theoretical models of human development* (pp. 569–664). John Wiley & Sons Inc.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Beck, E. D., & Jackson, J. J. (2022). A mega-analysis of personality prediction: Robustness and boundary conditions. *Journal of Personality and Social Psychology*, *122*(3), 523–553. https://doi.org/10.1037/pspp0000386

Bengtson, V. L. (2001). Beyond the nuclear family: The increasing importance of multigenerational bonds. *Journal of Marriage and Family*, *63*(1), 1–16. https://doi.org/10.1111/j.1741-3737.2001.00001.x

Benjamin, D. J., Berger, J. O., Clyde, M., Wolpert, R. L., Johnson, V. E., Johannesson, M., Dreber, A., Nosek, B. A., Wagenmakers, E. J., Berk, R., & Brembs, B. (2018). Redefine statistical significance. *Nature Human Behavior*, *2*, 6–10. https://doi.org/10.1038/s41562-017-0189-z

Bleidorn, W., Hopwood, C. J., Back, M. D., Denissen, J. J. A., Hennecke, M., Hill, P. L., Jokela, M., Kandler, C., Lucas, R. E., Luhmann, M., Orth, U., Roberts, B. W., Wagner, J., Wrzus, C., & Zimmermann, J. (2021). Personality trait stability and change. *Personality Science*, *2*(1), 1–20. https://doi.org/10.5964/ps.6009

Bleidorn, W., Hopwood, C. J., & Lucas, R. E. (2018). Life events and personality trait change. *Journal of Personality*, *86*(1), 83–96. https://doi.org/10.1111/jopy.12286

Bleidorn, W., Klimstra, T. A., Denissen, J. J. A., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2013). Personality maturation around the world: A cross-cultural examination of social-investment theory. *Psychological Science*, *24*(12), 2530–2540. https://doi.org/10.1177/0956797613498396

Bleidorn, W., & Schwaba, T. (2017). Personality development in emerging adulthood. In J. Specht (Ed.), *Personality Development Across the Lifespan* (pp. 39–51). Academic Press. https://doi.org/10.1016/B978-0-12-804674-6.00004-1

Bleidorn, W., & Schwaba, T. (2018). Retirement is associated with change in self-esteem. *Psychology and Aging*, *33*(4), 586–594. https://doi.org/10.1037/pag0000253

Bordone, V., Arpino, B., & Aassve, A. (2017). Patterns of grandparental child care across Europe: The role of the policy context and working mothers' need. *Ageing and Society*, *37*(4), 845–873. https://doi.org/10.1017/S0144686X1600009X

Brüderl, J., & Ludwig, V. (2015). *Fixed-Effects Panel Regression*. SAGE.

Burgette, L. F., & Reiter, J. P. (2010). Multiple Imputation for Missing Data via Sequential Regression Trees. *American Journal of Epidemiology*, *172*(9), 1070–1076. https://doi.org/10.1093/aje/kwq260

Choi, S. E. (2020). Grandparenting and Mortality: How Does Race-Ethnicity Matter?

Journal of Health and Social Behavior, *61*(1), 96–112. https://doi.org/10.1177/0022146520903282

Chopik, W. J. (2018). Does personality change following spousal bereavement? *Journal of Research in Personality*, *72*, 10–21. https://doi.org/10.1016/j.jrp.2016.08.010

Chopik, W. J., & Kitayama, S. (2018). Personality change across the life span: Insights from a cross-cultural, longitudinal study. *Journal of Personality*, *86*(3), 508–521. https://doi.org/10.1111/jopy.12332

Christiansen, S. G. (2014). The association between grandparenthood and mortality. *Social Science & Medicine*, *118*, 89–96. https://doi.org/10.1016/j.socscimed.2014.07.061

Chung, S., & Park, A. (2018). The longitudinal effects of grandchild care on depressive symptoms and physical health of grandmothers in South Korea: A latent growth approach. *Aging & Mental Health*, *22*(12), 1556–1563. https://doi.org/10.1080/13607863.2017.1376312

Coall, D. A., & Hertwig, R. (2011). Grandparental investment: A relic of the past or a resource for the future? *Current Directions in Psychological Science*, *20*(2), 93–98. https://doi.org/10.1177/0963721411403269

Coall, D. A., Hilbrand, S., Sear, R., & Hertwig, R. (2018). Interdisciplinary perspectives on grandparental investment: A journey towards causality. *Contemporary Social Science*, *13*(2), 159–174. https://doi.org/10.1080/21582041.2018.1433317

Coall, D. A., Hilbrand, S., Sear, R., & Hertwig, R. (2016). A new niche? The theory of grandfather involvement. In A. Buchanan & A. Rotkirch (Eds.), *Grandfathers: Global Perspectives* (pp. 21–44). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-56338-5_2

Condon, J., Corkindale, C., Luszcz, M., & Gamble, E. (2013). The Australian first-time grandparents study: Time spent with the grandchild and its predictors. *Australasian Journal on Ageing*, *32*(1), 21–27. https://doi.org/10.1111/j.1741-6612.2011.00588.x

Condon, J., Luszcz, M., & McKee, I. (2018). The transition to grandparenthood: A prospective study of mental health implications. *Aging & Mental Health*, *22*(3), 336–343. https://doi.org/10.1080/13607863.2016.1248897

Cook, T. D., Zhu, N., Klein, A., Starkey, P., & Thomas, J. (2020). How much bias results if a quasi-experimental design combines local comparison groups, a pretest outcome measure and other covariates?: A within study comparison of preschool effects. *Psychological Methods*, Advance Online Publication. https://doi.org/10.1037/met0000260

Costa, P. T., McCrae, R. R., & Löckenhoff, C. E. (2019). Personality across the life span. *Annual Review of Psychology*, *70*(1), 423–448. https://doi.org/10.1146/annurev-psych-010418-103244

Crawford, J. L., English, T., & Braver, T. S. (2022). Incorporating ecological momentary assessment into multimethod investigations of cognitive aging: Promise and practical considerations. *Psychology and Aging*, *37*(1), 84–96. https://doi.org/10.1037/pag0000646

Damian, R. I., Spengler, M., Sutu, A., & Roberts, B. W. (2019). Sixteen going on sixty-six: A longitudinal study of personality stability and change across 50 years. *Journal of Personality and Social Psychology*, *117*(3), 674–695. https://doi.org/10.1037/pspp0000210

Danielsbacka, M., Křenková, L., & Tanskanen, A. O. (2022). Grandparenting, health, and well-being: A systematic literature review. *European Journal of Ageing*. https://doi.org/10.1007/s10433-021-00674-y

Danielsbacka, M., & Tanskanen, A. O. (2016). The association between grandparental investment and grandparents' happiness in Finland. *Personal Relationships*, *23*(4), 787–800. https://doi.org/10.1111/pere.12160

Danielsbacka, M., Tanskanen, A. O., Coall, D. A., & Jokela, M. (2019). Grandparental childcare, health and well-being in Europe: A within-individual investigation of longitudinal data. *Social Science & Medicine*, *230*, 194–203.

https://doi.org/10.1016/j.socscimed.2019.03.031

Danielsbacka, M., Tanskanen, A. O., Jokela, M., & Rotkirch, A. (2011). Grandparental child care in Europe: Evidence for preferential investment in more certain kin. *Evolutionary Psychology*, *9*(1), 147470491100900102. https://doi.org/10.1177/147470491100900102

Denissen, J. J. A., Geenen, R., Soto, C. J., John, O. P., & van Aken, M. A. G. (2020). The Big Five Inventory–2: Replication of Psychometric Properties in a Dutch Adaptation and First Evidence for the Discriminant Predictive Validity of the Facet Scales. *Journal of Personality Assessment*, *102*(3), 309–324. https://doi.org/10.1080/00223891.2018.1539004

Denissen, J. J. A., Luhmann, M., Chung, J. M., & Bleidorn, W. (2019). Transactions between life events and personality traits across the adult lifespan. *Journal of Personality and Social Psychology*, *116*(4), 612–633. https://doi.org/10.1037/pspp0000196

Di Gessa, G., Bordone, V., & Arpino, B. (2019). Becoming a Grandparent and Its Effect on Well-Being: The Role of Order of Transitions, Time, and Gender. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, Advance Online Publication. https://doi.org/10.1093/geronb/gbz135

Di Gessa, G., Glaser, K., & Tinker, A. (2016a). The Health Impact of Intensive and Nonintensive Grandchild Care in Europe: New Evidence From SHARE. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *71*(5), 867–879. https://doi.org/10.1093/geronb/gbv055

Di Gessa, G., Glaser, K., & Tinker, A. (2016b). The impact of caring for grandchildren on the health of grandparents in Europe: A lifecourse approach. *Social Science & Medicine*, *152*, 166–175. https://doi.org/10.1016/j.socscimed.2016.01.041

Di Gessa, G., Zaninotto, P., & Glaser, K. (2020). Looking after grandchildren: Gender differences in “when,” “what,” and “why”: Evidence from the English Longitudinal

Study of Ageing. *Demographic Research*, *43*(53), 1545–1562. https://doi.org/10.4054/DemRes.2020.43.53

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment*, *49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Diener, E., Oishi, S., & Tay, L. (2018). Advances in subjective well-being research. *Nature Human Behaviour*, *2*(4), 253–260. https://doi.org/10.1038/s41562-018-0307-6

Doré, B., & Bolger, N. (2018). Population- and individual-level changes in life satisfaction surrounding major life stressors. *Social Psychological and Personality Science*, *9*(7), 875–884. https://doi.org/10.1177/1948550617727589

Dunifon, R. E., Musick, K. A., & Near, C. E. (2020). Time with Grandchildren: Subjective Well-Being Among Grandparents Living with Their Grandchildren. *Social Indicators Research*, *148*(2), 681–702. https://doi.org/10.1007/s11205-019-02206-9

Eid, M., & Larsen, R. J. (2008). *The science of subjective well-being*. Guilford Press.

Ellwardt, L., Hank, K., & Mendes de Leon, C. F. (2021). Grandparenthood and risk of mortality: Findings from the Health and Retirement Study. *Social Science & Medicine*, *268*, 113371. https://doi.org/10.1016/j.socscimed.2020.113371

Elwert, F., & Winship, C. (2014). Endogenous selection bias: The problem of conditioning on a collider variable. *Annual Review of Sociology*, *40*(1), 31–53. https://doi.org/10.1146/annurev-soc-071913-043455

Fingerman, K. L., Huo, M., & Birditt, K. S. (2020). A decade of research on intergenerational ties: Technological, economic, political, and demographic changes. *Journal of Marriage and Family*, *82*(1), 383–403. https://doi.org/10.1111/jomf.12604

Fox, J., & Weisberg, S. (2019). *An R companion to applied regression* (3rd ed.). Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Gebauer, J. E., Bleidorn, W., Gosling, S. D., Rentfrow, P. J., Lamb, M. E., & Potter, J. (2014). Cross-cultural variations in Big Five relationships with religiosity: A sociocultural motives perspective. *Journal of Personality and Social Psychology*, *107*(6), 1064–1091. https://doi.org/10.1037/a0037683

Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment*, *4*(1), 26–42. https://doi.org/10.1037/1040-3590.4.1.26

Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. *Personality Psychology in Europe*, *7*(1), 7–28.

Golle, J., Rose, N., Göllner, R., Spengler, M., Stoll, G., Hübner, N., Rieger, S., Trautwein, U., Lüdtke, O., Roberts, B. W., & Nagengast, B. (2019). School or work? The choice may change your personality. *Psychological Science*, *30*(1), 32–42. https://doi.org/10.1177/0956797618806298

Goode, W. J. (1960). A theory of role strain. *American Sociological Review*, *25*, 483–496. https://doi.org/10.2307/2092933

Goodman, C. C., & Silverstein, M. (2006). Grandmothers Raising Grandchildren: Ethnic and Racial Differences in Well-Being Among Custodial and Coparenting Families. *Journal of Family Issues*, *27*(11), 1605–1626. https://doi.org/10.1177/0192513X06291435

Götmark, F., & Andersson, M. (2020). Human fertility in relation to education, economy, religion, contraception, and family planning programs. *BMC Public Health*, *20*(1), 265. https://doi.org/10.1186/s12889-020-8331-7

Götz, F. M., Gosling, S. D., & Rentfrow, P. J. (2021). Small Effects: The Indispensable Foundation for a Cumulative Psychological Science. *Perspectives on Psychological Science*, Advance Online Publication. https://doi.org/10.1177/1745691620984483

Graham, E. K., Weston, S. J., Gerstorf, D., Yoneda, T. B., Booth, T., Beam, C. R., Petkus, A. J., Drewelies, J., Hall, A. N., Bastarache, E. D., Estabrook, R., Katz, M. J., Turiano, N. A., Lindenberger, U., Smith, J., Wagner, G. G., Pedersen, N. L., Allemand, M., Spiro Iii, A., . . . Mroczek, D. K. (2020). Trajectories of Big Five Personality Traits:

A Coordinated Analysis of 16 Longitudinal Samples. *European Journal of Personality*, Advance Online Publication. https://doi.org/10.1002/per.2259

Greenland, S. (2003). Quantifying biases in causal models: Classical confounding vs collider-stratification bias. *Epidemiology*, *14*(3), 300–306. https://doi.org/10.1097/01.EDE.0000042804.12056.6C

Greenland, S., & Finkle, W. D. (1995). A Critical Look at Methods for Handling Missing Covariates in Epidemiologic Regression Analyses. *American Journal of Epidemiology*, *142*(12), 1255–1264. https://doi.org/10.1093/oxfordjournals.aje.a117592

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

Hagestad, G. O., & Neugarten, B. L. (1985). Age and the life course. In E. Shanas & R. Binstock (Eds.), *Handbook of aging and the social sciences*. Van Nostrand and Reinhold.

Hallberg, K., Cook, T. D., Steiner, P. M., & Clark, M. H. (2018). Pretest Measures of the Study Outcome and the Elimination of Selection Bias: Evidence from Three Within Study Comparisons. *Prevention Science*, *19*(3), 274–283. https://doi.org/10.1007/s11121-016-0732-6

Hank, K., & Buber, I. (2009). Grandparents Caring for their Grandchildren: Findings From the 2004 Survey of Health, Ageing, and Retirement in Europe. *Journal of Family Issues*, *30*(1), 53–73. https://doi.org/10.1177/0192513X08322627

Hayford, S. R., & Morgan, S. P. (2008). Religiosity and Fertility in the United States: The Role of Fertility Intentions. *Social Forces*, *86*(3), 1163–1188. https://doi.org/10.1353/sof.0.0000

Hayslip, B., Fruhauf, C. A., & Dolbin-MacNab, M. L. (2019). Grandparents raising grandchildren: What have we learned over the past decade? *The Gerontologist*, *59*(3), e152–e163. https://doi.org/10.1093/geront/gnx106

Hentschel, S., Eid, M., & Kutscher, T. (2017). The Influence of Major Life Events and Personality Traits on the Stability of Affective Well-Being. *Journal of Happiness Studies*, *18*(3), 719–741. https://doi.org/10.1007/s10902-016-9744-y

Hilbrand, S., Coall, D. A., Gerstorf, D., & Hertwig, R. (2017). Caregiving within and beyond the family is associated with lower mortality for the caregiver: A prospective study. *Evolution and Human Behavior*, *38*(3), 397–403. https://doi.org/10.1016/j.evolhumbehav.2016.11.010

Ho, D. E., Imai, K., King, G., & Stuart, E. A. (2011). MatchIt: Nonparametric preprocessing for parametric causal inference. *Journal of Statistical Software*, *42*(8), 1–28. https://www.jstatsoft.org/v42/i08/

Hoffman, L. (2015). *Longitudinal analysis: Modeling within-person fluctuation and change.* Routledge/Taylor & Francis Group.

Hoffman, L., & Walters, R. W. (2022). Catching up on multilevel modeling. *Annual Review of Psychology*, *73*(1), 659–689. https://doi.org/10.1146/annurev-psych-020821-103525

Hutteman, R., Hennecke, M., Orth, U., Reitz, A. K., & Specht, J. (2014). Developmental tasks as a framework to study personality development in adulthood and old age. *European Journal of Personality*, *28*(3), 267–278. https://doi.org/10.1002/per.1959

Infurna, F. J., Gerstorf, D., & Lachman, M. E. (2020). Midlife in the 2020s: Opportunities and challenges. *American Psychologist*, *75*(4), 470–485. https://doi.org/10.1037/amp0000591

Jackson, J. J., & Beck, E. D. (2021). Personality development beyond the mean: Do life events shape personality variability, structure, and ipsative continuity? *The Journals of Gerontology: Series B*, *76*(1), 20–30. https://doi.org/10.1093/geronb/gbaa093

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (pp. 114–158). The Guilford Press.

John, O. P., & Srivastava, S. (1999). The Big Five Trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research, 2nd ed.* (pp. 102–138). Guilford Press.

Johnson, A. B., & Rodgers, J. L. (2006). The impact of having children on the lives of women: The Effects of Children Questionnaire. *Journal of Applied Social Psychology*, *36*(11), 2685–2714. https://doi.org/10.1111/j.0021-9029.2006.00123.x

Kandler, C., Kornadt, A. E., Hagemeyer, B., & Neyer, F. J. (2015). Patterns and sources of personality development in old age. *Journal of Personality and Social Psychology*, *109*(1), 175–191. https://doi.org/10.1037/pspp0000028

Kandler, C., Zimmermann, J., & Mcadams, D. (2014). Core and Surface Characteristics for the Description and Theory of Personality Differences and Development. *European Journal of Personality*, *28*(3), 231–243. https://doi.org/10.1002/per.1952

Kim, H.-J., Kang, H., & Johnson-Motoyama, M. (2017). The psychological well-being of grandparents who provide supplementary grandchild care: A systematic review. *Journal of Family Studies*, *23*(1), 118–141. https://doi.org/10.1080/13229400.2016.1194306

Krämer, M. D., & Rodgers, J. L. (2020). The impact of having children on domain-specific life satisfaction: A quasi-experimental longitudinal investigation using the Socio-Economic Panel (SOEP) data. *Journal of Personality and Social Psychology*, *119*(6), 1497–1514. https://doi.org/10.1037/pspp0000279

Kritzler, S., Rakhshani, A., Terwiel, S., Fassbender, I., Donnellan, M. B., Lucas, R. E., & Luhmann, M. (2023). How are common major live events perceived? Exploring differences between and variability of different typical event profiles and raters. *European Journal of Personality*, *37*(2), 171–186. https://doi.org/10.1177/08902070221076586

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Lachman, M. E., & Weaver, S. L. (1997). *The Midlife Development Inventory (MIDI) personality scales: Scale construction and scoring*. Brandeis University. https://www.brandeis.edu/psychology/lachman/pdfs/midi-personality-scales.pdfAOvVaw1Hh7MFTM51uU7UScd1LT3o

Leopold, T., & Skopek, J. (2015). The Demography of Grandparenthood: An International Profile. *Social Forces*, *94*(2), 801–832. https://doi.org/10.1093/sf/sov066

Li, M. (2013). Using the Propensity Score Method to Estimate Causal Effects: A Review and Practical Guide. *Organizational Research Methods*, *16*(2), 188–226. https://doi.org/10.1177/1094428112447816

Lodi-Smith, J., & Roberts, B. W. (2007). Social investment and personality: A meta-analysis of the relationship of personality traits to investment in work, family, religion, and volunteerism. *Personality and Social Psychology Review*, *11*(1), 68–86. https://doi.org/10.1177/1088868306294590

Lucas, R. E., & Donnellan, M. B. (2011). Personality development across the life span: Longitudinal analyses with a national sample from Germany. *Journal of Personality and Social Psychology*, *101*(4), 847–861. https://doi.org/10.1037/a0024298

Lüdtke, O., Roberts, B. W., Trautwein, U., & Nagy, G. (2011). A random walk down university avenue: Life paths, life events, and personality trait change at the transition to university life. *Journal of Personality and Social Psychology*, *101*(3), 620–637. https://doi.org/10.1037/a0023743

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

Luhmann, M., Hofmann, W., Eid, M., & Lucas, R. E. (2012). Subjective well-being and adaptation to life events: A meta-analysis. *Journal of Personality and Social Psychology*, *102*(3), 592–615. https://doi.org/10.1037/a0025948

Luhmann, M., Orth, U., Specht, J., Kandler, C., & Lucas, R. E. (2014). Studying changes in life circumstances and personality: It's about time. *European Journal of Personality*, *28*(3), 256–266. https://doi.org/10.1002/per.1951

Lumsdaine, R. L., & Vermeer, S. J. C. (2015). Retirement timing of women and the role of care responsibilities for grandchildren. *Demography*, *52*(2), 433–454. https://doi.org/10.1007/s13524-015-0382-5

MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods*, *7*(1), 19–40. https://doi.org/10.1037/1082-989X.7.1.19

Mahne, K., & Motel-Klingebiel, A. (2012). The importance of the grandparent role: A class specific phenomenon? Evidence from Germany. *Advances in Life Course Research*, *17*(3), 145–155. https://doi.org/10.1016/j.alcr.2012.06.001

Mann, R. (2007). Out of the shadows?: Grandfatherhood, age and masculinities. *Masculinity and Aging*, *21*(4), 281–291. https://doi.org/10.1016/j.jaging.2007.05.008

Mann, R., & Leeson, G. (2010). Grandfathers in Contemporary Families in Britain: Evidence from Qualitative Research. *Journal of Intergenerational Relationships*, *8*(3), 234–248. https://doi.org/10.1080/15350770.2010.498774

Margolis, R., & Verdery, A. M. (2019). A cohort perspective on the demography of grandparenthood: Past, present, and future changes in race and sex disparities in the United States. *Demography*, *56*(4), 1495–1518. https://doi.org/10.1007/s13524-019-00795-1

Margolis, R., & Wright, L. (2017). Healthy Grandparenthood: How Long Is It, and How Has It Changed? *Demography*, *54*(6), 2073–2099. https://doi.org/10.1007/s13524-017-0620-0

Marsh, H. W., Nagengast, B., & Morin, A. J. S. (2013). Measurement invariance of big-five factors over the life span: ESEM tests of gender, age, plasticity, maturity, and la dolce vita effects. *Developmental Psychology*, *49*(6), 1194–1218. https://doi.org/10.1037/a0026913

McCrae, R. R. (1993). Moderated analyses of longitudinal personality stability. *Journal of Personality and Social Psychology*, *65*(3), 577–585. https://doi.org/10.1037/0022-3514.65.3.577

McNeish, D. (2018). Thanks coefficient alpha, we'll take it from here. *Psychological Methods*, *23*(3), 412–433. https://doi.org/10.1037/met0000144

McNeish, D., & Kelley, K. (2019). Fixed effects models versus mixed effects models for clustered data: Reviewing the approaches, disentangling the differences, and making recommendations. *Psychological Methods*, *24*(1), 20–35. https://doi.org/10.1037/met0000182

Meyer, M. H., & Kandic, A. (2017). Grandparenting in the United States. *Innovation in Aging*, *1*(2), 1–10. https://doi.org/10.1093/geroni/igx023

Mitra, R., & Reiter, J. P. (2016). A comparison of two methods of estimating propensity scores after multiple imputation. *Statistical Methods in Medical Research*, *25*(1), 188–204. https://doi.org/10.1177/0962280212445945

Mõttus, R., Johnson, W., & Deary, I. J. (2012). Personality traits in old age: Measurement and rank-order stability and some mean-level change. *Psychology and Aging*, *27*(1), 243–249. https://doi.org/10.1037/a0023690

Mueller, M., & Elder, G. (2003). Family Contingencies Across the Generations: Grandparent-Grandchild Relationships in Holistic Perspective. *Journal of Marriage and Family*, *65*, 404–417. https://doi.org/10.1111/j.1741-3737.2003.00404.x

Mueller, S., Wagner, J., Drewelies, J., Duezel, S., Eibich, P., Specht, J., Demuth, I., Steinhagen-Thiessen, E., Wagner, G. G., & Gerstorf, D. (2016). Personality development in old age relates to physical health and cognitive performance: Evidence from the Berlin Aging Study II. *Journal of Research in Personality*, *65*, 94–108. https://doi.org/10.1016/j.jrp.2016.08.007

Notter, I. R. (2022). Grandchild Care and Well-Being: Gender Differences in Mental Health Effects of Caregiving Grandparents. *The Journals of Gerontology: Series B*, *77*(7), 1294–1304. https://doi.org/10.1093/geronb/gbab164

OECD. (2020). *Is Childcare Affordable? Policy Brief On Employment, Labour And Social Affairs*. https://www.oecd.org/els/family/OECD-Is-Childcare-Affordable.pdf

Pearl, J. (2009). Causal inference in statistics: An overview. *Statistics Surveys*, *3*, 96–146. https://doi.org/10.1214/09-SS057

Pilkauskas, N. V., Amorim, M., & Dunifon, R. E. (2020). Historical Trends in Children Living in Multigenerational Households in the United States: 1870–2018. *Demography*, *57*(6), 2269–2296. https://doi.org/10.1007/s13524-020-00920-5

Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D., & R Core Team. (2021). *nlme: Linear and nonlinear mixed effects models*. https://CRAN.R-project.org/package=nlme

Pusch, S., Mund, M., Hagemeyer, B., & Finn, C. (2019). Personality development in emerging and young adulthood: A study of age differences. *European Journal of Personality*, *33*(3), 245–263. https://doi.org/10.1002/per.2181

Quirke, E., König, H.-H., & Hajek, A. (2021). What are the social consequences of beginning or ceasing to care for grandchildren? Evidence from an asymmetric fixed effects analysis of community dwelling adults in Germany. *Aging & Mental Health*, *25*(5), 969–975. https://doi.org/10.1080/13607863.2020.1727846

R Core Team. (2021). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

Revelle, W. (2021). *Psych: Procedures for psychological, psychometric, and personality research*. Northwestern University. https://CRAN.R-project.org/package=psych

Richter, D., Krämer, M. D., Tang, N. K. Y., Montgomery-Downs, H. E., & Lemola, S. (2019). Long-term effects of pregnancy and childbirth on sleep satisfaction and duration of first-time and experienced mothers and fathers. *Sleep*, *42*(4), 1–10. https://doi.org/10.1093/sleep/zsz015

Roberts, B. W., & Davis, J. P. (2016). Young adulthood is the crucible of personality development. *Emerging Adulthood*, *4*(5), 318–326.

https://doi.org/10.1177/2167696816653052

Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin*, *126*(1), 3–25. https://doi.org/10.1037/0033-2909.126.1.3

Roberts, B. W., & Nickel, L. B. (2017). A critical evaluation of the Neo-Socioanalytic Model of personality. In J. Specht (Ed.), *Personality Development Across the Lifespan* (pp. 157–177). Academic Press. https://doi.org/10.1016/B978-0-12-804674-6.00011-9

Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin*, *132*, 1–25. https://doi.org/10.1037/0033-2909.132.1.1

Roberts, B. W., & Wood, D. (2006). Personality development in the context of the neo-socioanalytic model of personality. In D. K. Mroczek & T. D. Little (Eds.), *Handbook of Personality Development*. Routledge.

Roberts, B. W., Wood, D., & Smith, J. L. (2005). Evaluating Five Factor Theory and social investment perspectives on personality trait development. *Journal of Research in Personality*, *39*(1), 166–184. https://doi.org/10.1016/j.jrp.2004.08.002

Roberts, B. W., & Yoon, H. J. (2022). Personality psychology. *Annual Review of Psychology*, *73*(1), 489–516. https://doi.org/10.1146/annurev-psych-020821-114927

Rohrer, J. M. (2018). Thinking Clearly About Correlations and Causation: Graphical Causal Models for Observational Data. *Advances in Methods and Practices in Psychological Science*, *1*(1), 27–42. https://doi.org/10.1177/2515245917745629

Rohrer, J. M., Hünermund, P., Arslan, R. C., & Elson, M. (2022). That's a lot to process! Pitfalls of popular path models. *Advances in Methods and Practices in Psychological Science*, *5*(2). https://doi.org/10.1177/25152459221095827

Rosenbaum, P. (1984). The consquences of adjustment for a concomitant variable that has been affected by the treatment. *Journal of the Royal Statistical Society. Series A (General)*, *147*(5), 656–666. https://doi.org/10.2307/2981697

Scherpenzeel, A. C. (2011). Data Collection in a Probability-Based Internet Panel: How the LISS Panel Was Built and How It Can Be Used. *Bulletin of Sociological Methodology/Bulletin de Méthodologie Sociologique*, *109*(1), 56–61. https://doi.org/10.1177/0759106310387713

Scherpenzeel, A. C., & Das, M. (2010). True" longitudinal and probability-based internet panels: Evidence from the Netherlands. In M. Das, P. Ester, & L. Kaczmirek (Eds.), *Social and behavioral research and the internet: Advances in applied methods and research strategies* (pp. 77–104). Taylor & Francis.

Schwaba, T., & Bleidorn, W. (2018). Individual differences in personality change across the adult life span. *Journal of Personality*, *86*(3), 450–464. https://doi.org/10.1111/jopy.12327

Schwaba, T., & Bleidorn, W. (2019). Personality trait development across the transition to retirement. *Journal of Personality and Social Psychology*, *116*(4), 651–665. https://doi.org/10.1037/pspp0000179

Seifert, I. S., Rohrer, J. M., Egloff, B., & Schmukle, S. C. (2021). The development of the rank-order stability of the big five across the life span. *Journal of Personality and Social Psychology*. https://doi.org/10.1037/pspp0000398

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton, Mifflin and Company.

Sheppard, P., & Monden, C. (2019). Becoming a first-time grandparent and subjective well-being: A fixed effects approach. *Journal of Marriage and Family*, *81*(4), 1016–1026. https://doi.org/10.1111/jomf.12584

Sieber, S. D. (1974). Toward a theory of role accumulation. *American Sociological Review*, *39*(4), 567–578. https://doi.org/10.2307/2094422

Silverstein, M., & Marenco, A. (2001). How Americans enact the grandparent role across the family life course. *Journal of Family Issues*, *22*(4), 493–522.

https://doi.org/10.1177/019251301022004006

Skopek, J., & Leopold, T. (2017). Who becomes a grandparent – and when? Educational differences in the chances and timing of grandparenthood. *Demographic Research*, *37*(29), 917–928. https://doi.org/10.4054/DemRes.2017.37.29

Sonnega, A., Faul, J. D., Ofstedal, M. B., Langa, K. M., Phillips, J. W., & Weir, D. R. (2014). Cohort Profile: The Health and Retirement Study (HRS). *International Journal of Epidemiology*, *43*(2), 576–585. https://doi.org/10.1093/ije/dyu067

Specht, J. (2017). Personality development in adulthood and old age. In J. Specht (Ed.), *Personality Development Across the Lifespan* (pp. 53–67). Academic Press. https://doi.org/10.1016/B978-0-12-804674-6.00005-3

Specht, J., Bleidorn, W., Denissen, J. J. A., Hennecke, M., Hutteman, R., Kandler, C., Luhmann, M., Orth, U., Reitz, A. K., & Zimmermann, J. (2014). What drives adult personality development? A comparison of theoretical perspectives and empirical evidence. *European Journal of Personality*, *28*(3), 216–230. https://doi.org/10.1002/per.1966

Specht, J., Egloff, B., & Schmukle, S. C. (2011). Stability and change of personality across the life course: The impact of age and major life events on mean-level and rank-order stability of the Big Five. *Journal of Personality and Social Psychology*, *101*(4), 862–882. https://doi.org/10.1037/a0024950

Spikic, S., Mortelmans, D., & Pasteels, I. (2021). Does divorce change your personality? Examining the effect of divorce occurrence on the Big Five personality traits using panel surveys from three countries. *Personality and Individual Differences*, *171*, 110428. https://doi.org/10.1016/j.paid.2020.110428

Springstein, T., Growney, C. M., & English, T. (2022). Supporting robust research on adult emotional development by considering context. *Psychology and Aging*, *37*(1), 97–110. https://doi.org/10.1037/pag0000669

Steiner, P., Cook, T., Shadish, W., & Clark, M. (2010). The Importance of Covariate

Selection in Controlling for Selection Bias in Observational Studies. *Psychological Methods*, *15*, 250–267. https://doi.org/10.1037/a0018719

Stephan, Y., Sutin, A. R., & Terracciano, A. (2014). Physical activity and personality development across adulthood and old age: Evidence from two longitudinal studies. *Journal of Research in Personality*, *49*, 1–7. https://doi.org/10.1016/j.jrp.2013.12.003

StGeorge, J. M., & Fletcher, R. J. (2014). Men's experiences of grandfatherhood: A welcome surprise. *The International Journal of Aging & Human Development*, *78*(4), 351–378. https://doi.org/10.2190/AG.78.4.c

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science: A Review Journal Of The Institute Of Mathematical Statistics*, *25*(1), 1–21. https://doi.org/10.1214/09-STS313

Tanskanen, A. O. (2017). Intergenerational relations before and after offspring arrive: A within-person investigation. *Social Science Research*, *67*, 138–146. https://doi.org/10.1016/j.ssresearch.2017.08.001

Tanskanen, A. O., Danielsbacka, M., Coall, D. A., & Jokela, M. (2019). Transition to grandparenthood and subjective well-being in older Europeans: A within-person investigation using longitudinal data. *Evolutionary Psychology*, *17*(3), 1474704919875948. https://doi.org/10.1177/1474704919875948

Tanskanen, A. O., Danielsbacka, M., Hämäläinen, H., & Solé-Auró, A. (2021). Does transition to retirement promote grandchild care? Evidence from Europe. *Frontiers in Psychology*, *12*. https://www.frontiersin.org/article/10.3389/fpsyg.2021.738117

Thiele, D. M., & Whelan, T. A. (2006). The nature and dimensions of the grandparent role. *Marriage & Family Review*, *40*(1), 93–108. https://doi.org/10.1300/J002v40n01_06

Thoemmes, F. J., & Kim, E. S. (2011). A Systematic Review of Propensity Score Methods in the Social Sciences. *Multivariate Behavioral Research*, *46*(1), 90–118. https://doi.org/10.1080/00273171.2011.540475

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in r. *Journal of Statistical Software*, *45*(3), 1–67. https://www.jstatsoft.org/v45/i03/

van der Laan, J. (2009). *Representativity of the LISS panel (Discussion Paper 09041).* Statistics Netherlands. https://www.cbs.nl/-/media/imported/documents/2009/40/2009-41-x10-pub.pdf

van Scheppingen, M. A., Jackson, J. J., Specht, J., Hutteman, R., Denissen, J. J. A., & Bleidorn, W. (2016). Personality trait development during the transition to parenthood: A test of social investment theory. *Social Psychological and Personality Science*, *7*(5), 452–462. https://doi.org/10.1177/1948550616630032

van Scheppingen, M. A., & Leopold, T. (2020). Trajectories of life satisfaction before, upon, and after divorce: Evidence from a new matching approach. *Journal of Personality and Social Psychology*, *119*(6), 1444–1458. https://doi.org/10.1037/pspp0000270

VanderWeele, T. J. (2019). Principles of confounder selection. *European Journal of Epidemiology*, *34*(3), 211–219. https://doi.org/10.1007/s10654-019-00494-6

VanderWeele, T. J., Mathur, M. B., & Chen, Y. (2020). Outcome-wide longitudinal designs for causal inference: A new template for empirical studies. *Statistical Science*, *35*(3), 437–466. https://doi.org/10.1214/19-STS728

Vermote, M., Deliens, T., Deforche, B., & D'Hondt, E. (2021). The impact of non-residential grandchild care on physical activity and sedentary behavior in people aged 50 years and over: Study protocol of the Healthy Grandparenting Project. *BMC Public Health*, *21*. https://doi.org/10.1186/s12889-020-10024-9

Wagner, J., Becker, M., Lüdtke, O., & Trautwein, U. (2015). The first partnership experience and personality development: A propensity score matching study in young adulthood. *Social Psychological and Personality Science*, *6*(4), 455–463. https://doi.org/10.1177/1948550614566092

Wagner, J., Lüdtke, O., & Robitzsch, A. (2019). Does personality become more stable with age? Disentangling state and trait effects for the big five across the life span using local structural equation modeling. *Journal of Personality and Social Psychology*, *116*(4), 666–680. https://doi.org/10.1037/pspp0000203

Wagner, J., Orth, U., Bleidorn, W., Hopwood, C. J., & Kandler, C. (2020). Toward an integrative model of sources of personality stability and change. *Current Directions in Psychological Science*, *29*(5), 438–444. https://doi.org/10.1177/0963721420924751

Wagner, J., Ram, N., Smith, J., & Gerstorf, D. (2016). Personality trait development at the end of life: Antecedents and correlates of mean-level trajectories. *Journal of Personality and Social Psychology*, *111*(3), 411–429. https://doi.org/10.1037/pspp0000071

Wang, S., & Mutchler, J. E. (2020). The Implications of Providing Grandchild Care for Grandparents' Marital Quality. *Journal of Family Issues*, *41*(12), 2476–2501. https://doi.org/10.1177/0192513X20934845

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T. L., Miller, E., Bache, S. M., Müller, K., Ooms, J., Robinson, D., Seidel, D. P., Spinu, V., … Yutani, H. (2019). Welcome to the tidyverse. *Journal of Open Source Software*, *4*(43), 1686. https://doi.org/10.21105/joss.01686

Wortman, J., Lucas, R. E., & Donnellan, M. B. (2012). Stability and change in the Big Five personality domains: Evidence from a longitudinal study of Australians. *Psychology and Aging*, *27*(4), 867–874. https://doi.org/10.1037/a0029322

Wrzus, C., & Roberts, B. W. (2017). Processes of personality development in adulthood: The TESSERA framework. *Personality and Social Psychology Review*, *21*(3), 253–277. https://doi.org/10.1177/1088868316652279

Xu, L., Tang, F., Li, L. W., & Dong, X. Q. (2017). Grandparent Caregiving and Psychological Well-Being Among Chinese American Older Adults—The Roles of Caregiving Burden and Pressure. *The Journals of Gerontology: Series A*, *72*, S56–S62. https://doi.org/10.1093/gerona/glw186

Zhang, L. (2008). Religious affiliation, religiosity, and male and female fertility.

Demographic Research, *18*, 233–262. https://doi.org/10.4054/DemRes.2008.18.8

Zhang, W., Braun, K. L., & Wu, Y. Y. (2017). The educational, racial and gender crossovers in life satisfaction: Findings from the longitudinal Health and Retirement Study. *Archives of Gerontology and Geriatrics*, *73*, 60–68. https://doi.org/10.1016/j.archger.2017.07.014

Chapter 3

Resuming Social Contact After Months of Contact Restrictions: Social Traits Moderate Associations Between Changes in Social Contact and Well-Being (Study II)

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Chapter 4

Social Dynamics and Affect: Investigating Within-Person Associations in Daily Life Using Experience Sampling and Mobile Sensing (Study III)

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Social dynamics and affect: Investigating within-person associations in daily life using experience sampling and mobile sensing

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Abstract

Social interactions are crucial to affective well-being. Still, people vary interindividually and intraindividually in their social needs. Social need regulation theories state that mismatches between momentary social desire and actual social contact result in lowered affect, yet empirical knowledge about this dynamic regulation is limited. 306 participants in a sample stratified by age and gender (51% women, $M_{age} = 39.41$, range 18-80 years) answered up to 20 questionnaires about social interactions and affect while mobile sensing tracked their conversations, calls, and app usage over two days. Combining preregistered and exploratory analyses, we investigated how momentary affect relates to social dynamics, focusing on two states of mismatch between social desire and social contact: social deprivation (i.e., being alone but desiring social contact) and social oversatiation (i.e., being in contact but desiring to be alone). We used specification curve analyses to scrutinize the operationalization of these constructs. Social oversatiation was associated with decreased positive affect (PA) and increased negative affect (NA). Social deprivation, however, was unrelated to affect. Exploratory multilevel models showed that a higher desire to be alone was consistently associated with decreased affect, whereas a higher desire for social contact was related to increased affect. Mobile sensing data revealed that having more conversations was related to higher PA even when controlling for the desire to be alone. Using communication apps more frequently when alone was related to higher NA. We discuss implications for social need regulation, related studies on voluntary solitude, and the advantages of combining experience sampling and mobile sensing assessments.

Keywords: affect, social contact, social dynamics, experience sampling method, mobile sensing

Social dynamics and affect: Investigating within-person associations in daily life using experience sampling and mobile sensing

Social relationships and contact are crucial to well-being across the life span (Baumeister & Leary, 1995; Buijs et al., 2021). In daily life, however, the relationship between social contact and momentary affect is complex, because the beneficial effects of social interactions depend on a multitude of factors such as their perceived quality (Liu et al., 2019; Sun et al., 2020), situational factors (daSilva et al., 2021; Kroencke et al., 2022), and the quantity and quality of previous interactions (Liu et al., 2021; Luo, Macdonald, et al., 2022; Ren et al., 2021). One often overlooked aspect of this complexity is that social needs differ, both interindividually and intraindividually (i.e., the desire for social contact or to be alone, Hofer & Hagemeyer, 2018; Lay, Pauly, et al., 2020; Lay et al., 2019; Schönbrodt & Gerstenberg, 2012). As a result, the question how affect is influenced by the dynamic interplay between social contact and momentary social desire remains largely unexplored (cf. Zygar et al., 2018).

In this study, we investigate two states of mismatch between social contact and social desire in daily life: *social deprivation*, which we define as the absence of social interactions accompanied by a desire for social contact, and *social oversatiation*, that is, the presence of social interactions accompanied by a desire to be alone. We test whether social deprivation and oversatiation are followed by short-term decreases in momentary affect, and whether this experience varies depending on people's social traits. In addition, we explore how deviations from individuals' usual levels of social contact and social desire relate to affect, comparing indicators of social contact assessed with experience sampling and mobile sensing methods (i.e., observation through mobile phone sensors, Harari et al., 2016). Understanding how social dynamics relate to affect is important because accumulated states of mismatch between social desire and actual social interactions may lead to long-term deterioration in mental and physical health, as demonstrated for social deprivation (Holt-Lunstad et al., 2015; Teo et al., 2013) and suggested for some forms of excessive or unwanted social interactions (Jacques-Hamilton et al., 2019; Stavrova & Ren, 2021).

Momentary Affect and Social Contact

The quantity and quality of everyday social contact differ between and within individuals (Weber et al., 2020; Wrzus et al., 2016). Both a higher quantity (e.g., Lucas et al., 2008; Sandstrom & Dunn, 2014) and quality of social contact (e.g., Kashdan et al., 2014; Smillie et al., 2015) correlate with higher affective well-being (for a review, see Liu et al., 2019). Yet recent studies have provided initial evidence that for the quantity of social contact, this relationship exists only up to a certain point, beyond which social oversatiation occurs, and further social interactions may be detrimental to well-being (Kushlev et al., 2018; Luo, Macdonald, et al., 2022; Ren et al., 2021; Stavrova & Ren, 2021). For example, fatigue increases after roughly three hours of extraverted behavior (Leikas & Ilmarinen, 2017; see also Nguyen et al., 2018).

In terms of quality, involuntary social contact and low autonomy are associated with worse affect (Tse et al., 2022). In this context, personal (i.e., face-to-face) interactions on average surpass indirect (i.e., technology-mediated) interactions in their affective benefits (Kroencke et al., 2022; Lin & Lachman, 2021). Whereas much of this research has relied on self-reported social contact, unobtrusive behavioral assessments using mobile sensing can provide additional insights and allow (almost) continuous collection of data that are not affected by response styles or recall biases (Roos et al., 2023).

There exists solid evidence of how general patterns of social contact relate to affect, yet prior findings on the relationship between dynamically changing social contact and affect in daily life are mixed and incomplete. In particular, the role of momentary affect as the result of a mismatch between social desire and actual social contact has not been explicitly tested.

Social Dynamics of Seeking Contact or Solitude

Theoretical approaches conceptualize social need regulation as ongoing internal comparisons of the person-specific ideal level of contact and closeness in social relationships with the characteristics of actual social contact (Hall & Davis, 2017; Nezlek, 2001; O'Connor & Rosenblood, 1996; Sheldon, 2011). Deviations in both directions from the ideal level are followed by changes in momentary social desire that in turn motivate individuals to realign their social behavior (Hall & Davis, 2017; Sheldon, 2011). When this behavioral regulation fails, people find themselves in states of mismatch between social desire and actual social contact which we refer to as either *social deprivation episodes* (SDE) or *social oversatiation episodes* (SOE). It is theorized that when individuals endure SDE or SOE over extended periods of time, affect decreases and individuals become more motivated to readjust the level of social contact up- or downwards (Quoidbach, Taquet, et al., 2019; cf. Elmer, 2021). The temporal makeup of these processes is still the subject of research. They can presumably occur over hours within a day (Hall, 2017), but also over several days (Neubauer et al., 2018). We therefore assume a dynamic system of fluctuating states of social need regulation in which an individual's prior state influences the next state (Carver & Scheier, 1998; Read et al., 2010), possibly resulting in within-person changes to momentary affect.

There is a lack of empirical research on the relationship between social dynamics over time and affect. In couples, states of higher communal motivation increased the likelihood of subsequent behavior instrumental in satisfying social needs (e.g., showing affection towards their partner, Zygar et al., 2018). This behavior was beneficial to momentary relationship satisfaction but not to affect. Another study investigated temporal dynamics of need regulation for three basic needs (Neubauer et al., 2018). Participants with a higher relatedness motivation on one day satisfied their social needs more successfully through social contact the following day. However, social need dissatisfaction was not associated with subsequent relatedness motivation on the within-person level.

Individual Differences due to Social Traits

Importantly, people also differ in how much social contact they usually desire. Theoretical frameworks incorporate individual differences in setting the ideal level of social contact toward which people strive and to which they compare their current experience (Sheldon, 2011). These individual differences can be measured with several (somewhat overlapping) social traits such as extraversion (DeYoung et al., 2013; Smillie et al., 2015) or affiliation motive (Hofer & Hagemeyer, 2018; Kersten et al., 2022). Furthermore, people with a stronger affiliation motive or higher extraversion benefit more from increased social contact affectively (Dufner et al., 2015; Hofer & Busch, 2011; Kersten et al., 2022; Krämer et al., 2022). Other studies, however, found no evidence of differential reactivity to social interactions depending on social traits (Lucas et al., 2008; Milek et al., 2018; Ren et al., 2021; Sun et al., 2020). First evidence also linked individual differences in neuroticism to how people react to social contact (Kroencke et al., 2022; Suls & Martin, 2005).

Thus, initial evidence is mixed on whether individual differences in social traits explain how discrepancies between the ideal level of social contact and actual social experiences relate to affect. We address this gap by extending prior research to affective responses during SDE and SOE. We assume that SDE leads to greater losses in positive affect in individuals with above-average extraversion, and that SOE is followed by greater increases in negative affect in individuals high in neuroticism.

Current Study

Using data collected with the experience sampling method (ESM) from an adult lifespan sample stratified by gender and age, we tested hypotheses in confirmatory analyses and evaluated different operationalizations of SDE and SOE in preregistered specification curve analyses (Simonsohn et al., 2020). We further explored how social contact and social desire relate to affect and compared different types of social contact including measures assessed continuously with mobile sensing. Thus, based on multi-method intensive longitudinal data with high temporal resolution, we investigated the following research questions to provide insight into social dynamics and affect in daily life:

1. How do social contact dynamics, specifically SDE and SOE, relate to momentary affect?
2. Do the effects of SDE and SOE on momentary affect depend on individual differences in social traits?

Informed by theory and empirical research we preregistered the following hypotheses to be tested in confirmatory analyses (https://osf.io/4syhg)[1]:

- H1a: SDE are associated with lowered positive affect and increased negative affect (within-person; as compared to the state before the SDE).
- H2a: SOE are associated with lowered positive affect and increased negative affect (within-person; as compared to the state before the SOE).
- H3a: Higher trait extraversion and higher affiliation motive are associated with more pronounced decreases in positive affect during SDE.
- H3b: Lower trait extraversion and lower affiliation motive are associated with more pronounced increases in negative affect during SOE.
- H3c: Higher trait neuroticism is associated with more pronounced increases in negative affect during SDE and SOE.

We distinguished positive affect (PA) and negative affect (NA) as two central dimensions of subjective well-being that vary both within and between individuals (Luhmann et al., 2021; Schimmack, 2008). We analyzed PA and NA separately to either detect distinct associations with social contact or replicate patterns across both affect facets.

[1] We also preregistered hypotheses on the effects of recovery from deprivation and oversatiation on affect but were unable to test them appropriately due to the low occurrence of the recovery episodes in the current sample. A full list of deviations from our preregistration can be found on https://osf.io/mdegx/ (*deviations_prereg.pdf*).

Method

Sample

Based on power analyses for between-person associations with $\alpha = .05$, $(1 - \beta) = .90$, and $r = .20$ / $.15$ (considering effect sizes reported in Stachl, Au, et al., 2020), 207 to 374 participants were needed. Simulation-based power estimation was not possible at the time of preregistration because of insufficient information on within-person effect sizes (across different time scales) and exact model specifications to be employed in different parts of the project. Data collection began in September 2021, stopped from mid-December 2021 to mid-March 2022 due to a surge in COVID-19 infections alongside renewed contact restrictions, and then resumed from March to April 2022. An overview of governmental contact restrictions in place during the study period can be found on https://osf.io/mdegx/. Overall, no broad restrictions to everyday social contact were present and 94% of participants were already vaccinated against COVID-19.

We recruited 320 German-speaking participants balanced by gender and four age groups (18-29 years, 30-39 years, 40-49 years, >50 years) via Facebook advertisements, institutional mailing lists, and community-based outreach (e.g., flyers, presentations). We excluded one participant based on a screening of non-compliant responses in the baseline survey and, for analyses presented in this paper, included $N = 306$ participants who answered ESM assessments (157 women; $M_{age} = 39.41$, $SD_{age} = 14.13$, $min_{age} = 18$, $max_{age} = 80$). Of those participants, 29% were married, 31% partnered, 7% divorced or separated, and the rest single, and 33% had at least one child. Slightly less than half held a university degree (44%), 28% a high school degree, and 24% another school-leaving certificate. Regarding their occupational status, 33% worked full-time, 12% part-time, 32% were students, 10% were retired and the remaining were unemployed (6%) or did not indicate their status.

Procedure

We invited participants to attend video call group sessions on Thursdays where they received information about the study and were instructed in the use of the PhoneStudy app for Android OS (https://phonestudy.org/en/) which we relied on for ESM assessments and mobile sensing. Participants gave informed consent, installed the app, and filled out the initial survey on the same day. Over the next two days (Friday and Saturday), participants were prompted by a notification sound to complete 10 ESM assessments per day (roughly every 80 minutes between 9 a.m. and 9 p.m. in slightly irregular intervals). Participants received a reminder notification if they skipped several ESM assessments. Compliance with the protocol was high, with a median of 16 validly answered ESM assessments, resulting in a total of 4524 assessments. Mobile sensing ran continuously over the study period tracking participants' calling, messaging, and app usage behavior (among other parameters of smartphone use). Participants were instructed to uninstall the research app on Sunday to end study participation. They received 40 or 50 euros as compensation (50 euros if more than 16 ESM questionnaires were completed). The study adhered to the principles of the Declaration of Helsinki for research involving human subjects and was given IRB approval by Johannes Gutenberg University Mainz (# 2018-JGU-psychEK-002).

Measures

Momentary Affect

Affect as outcome variable was assessed at the beginning of each ESM assessment with the question "How do you feel at the moment?" followed by eight items answered on a 7-point scale (1 = *not at all*, 7 = *very much*). We formed sum scores for PA based on the items "happy", "relaxed", "energetic", and "content" and for NA based on the items "angry", "downcast", "disappointed", and "nervous". These items were adapted from adjective scales (Matthews et al., 1990; Watson & Clark, 1999) and have been used in ESM studies of within-person affect variability (Luong et al., 2016; Wrzus et al., 2015).

Social Contact

Each ESM questionnaire assessed momentary and retrospective social contact. For momentary social contact, we asked "Are you currently in personal contact with someone or with several people?" (answer options: *Yes, with one person*; *Yes, with several people*; *No*) and "How long has this interaction been up to now?" (scroll-wheel with the options: 5 min., 10 min., 15 min., 30 min., followed by steps of 30 min.). For the retrospective assessment, participants were instructed to report their social interactions since the last assessment (or the last hour if they missed the last assessment or if it was the first assessment of the day) by answering the questions "Did you have any other interactions with someone or with several people since the last assessment (about an hour ago)?" (answer options: *Yes, with one person*; *Yes, with several people*; *No*), "How did you have contact with this person / these persons?" (answer options: *personal*; *call/video call*), and "How long was this interaction in total?" (scroll-wheel). Retrospective contact was assessed in a loop until participants reported no further social interactions. We instructed participants beforehand that personal contact meant speaking with others or engaging in an activity together and not merely being in the same location (e.g., in public transport).

Momentary Social Desire

Participants reporting momentary personal contact were asked "Would you like to be alone right now?". Participants reporting no momentary personal contact were asked instead "Would you like to be in the company of others right now?" and "Would you like to be in personal contact with someone right now?". These items were rated on a 7-point scale (1 = *not at all*, 7 = *very much*). Thus, for a given ESM assessment, respondents expressed either the desire to be alone or the desire for social contact. We formed an average score from the two items on the desire for social contact.

Social Deprivation Episodes and Social Oversatiation Episodes

We coded instances of SDE and SOE if a mismatch between momentary social desire and social contact occurred. SDE and SOE were made up of multiple ESM episodes within the same day but not over two days and had to be preceded by a baseline episode as reference value (either momentary desire measure below 5). The condition of mismatch applied for SDE (dummy coded as 0 = *baseline episode*, 1 = *SDE*) when participants reported no personal interactions longer than five minutes for at least two consecutive ESM episodes while at the same time reporting a high desire for social contact (at least 5). For SOE, the condition of mismatch applied (dummy coded as 0 = *baseline episode*, 1 = *SOE*) if participants reported personal interactions longer than five minutes for at least two consecutive ESM episodes while at the same time reporting a high desire to be alone (at least 5). We scrutinized this operationalization in preregistered specification curve analyses that examined how results changed when, for instance, using different cutoff values for social desire or different inclusion criteria for social contact (see *Supplemental Material* for more details).

Mobile Sensing Indicators of Social Contact

For each mobile sensing indicator, we aggregated the mobile sensing data based on ESM episodes, which we defined as the time since the previous assessment if answered within 100 minutes. For the first assessment of each day, or if the previous assessment was skipped, we set it to the previous 80 minutes instead.

To obtain a proxy for personal interactions, we used the AWARE Conversations Plugin (Ferreira & Mulukutla, 2020). This on-device integrated software sampled the ambient audio signal following a cycle of one-minute sampling and three-minutes break and used a privacy-protective algorithm to infer whether conversations prevailed in ambient sound around the device (a similar algorithm was utilized in daSilva et al., 2021). We used this information to compute the proportion of detected conversation samplings per ESM episode. The algorithm achieved high accuracy of more than 85% using hip-worn audio sampling devices (Lane et al., 2011; Rabbi et al., 2011), but accuracy in the field using participants' smartphones is likely lower. In practice, we found that the software sampled at lower rates on several devices, most likely because the operating system aborted the background process to conserve battery life. We restricted any analyses including detected conversation indicators to episodes with at least five samplings (for the distribution of samplings, see Figure S1).

From the timestamped call logs, we extracted the number and length of incoming and outgoing calls per ESM episode. In addition, we categorized all apps that were used by more than two participants using the categorization dataset by Schoedel, Oldemeier, et al. (2022) together with an updated coding of apps not included therein by two independent raters. This enabled us to categorize 94.48% of all app usage events and 45.43% of all apps ever used in our sample. We formed indicators for the number of app usage sessions and app usage duration (in minutes) per ESM episode in the categories of *communication* (e.g., WhatsApp, email) and *social media* (e.g., Instagram, Twitter). For more details of this procedure, see Schoedel, Kunz, et al. (2022).

Extraversion and Neuroticism

Extraversion and neuroticism were assessed in the initial survey as part of the Big Five Inventory-2 (BFI-2, Soto & John, 2017; German version: Danner et al., 2016) consisting of 12 items per trait, which demonstrated good reliability (extraversion: $\omega_t = 0.90$, $\omega_h = 0.68$; neuroticism: $\omega_t = 0.93$, $\omega_h = 0.69$). Items were answered on a five-point Likert scale (1 = *disagree strongly* to 5 = *agree strongly*).

Affiliation Motive

To measure affiliation motive, we used the six-item version of the affiliation subscale of the Unified Motive Scales ($\alpha = 0.86$, Schönbrodt & Gerstenberg, 2012). The Unified Motive Scales featured five items formulated as statements (sample item: "I try to be in company of friends as much as possible”), which required an agreement rating (1 = *strongly disagree* to 6 = *strongly agree*), and one item formulated as a goal (“Engage in a lot of activities with other people”), which required an importance rating (1 = *not important to me* to 6 = *extremely important to me*).

Analytical Strategy

As preregistered, we Winsorized outliers with scores outside $M \pm 3 \times SD$ to the respective lower or upper bound. This procedure was used for 15 observations of PA and 58 observations of NA. We repeated the analyses without outlier correction and found almost identical results.

We used multilevel modeling (Hoffman, 2015) with observations (level 1) nested in participants (level 2). Confirmatory models were estimated using maximum likelihood, with random intercepts and random slopes of SDE or SOE. Throughout, we modeled an autoregressive residual error structure to account for the temporal inertia of affect (lag-1 autoregression).

For confirmatory analyses, we first predicted momentary affect (either PA or NA) by either SDE or SOE while including age, gender, and weekend as control variables. As level-2 variables, age_i and all traits were grand-mean-centered and therefore represented the between-person effect of deviations from the sample average. $female_i$ was coded as 0 = *male/diverse*, 1 = *female*. $weekend_{ti}$ was coded as 0 = *weekday*, 1 = *weekend*. As we proceeded, we omitted the preregistered cross-level interactions of age and gender with SDE or SOE because they were nonsignificant and our aim was to estimate parsimonious models. Second, we included cross-level interactions with social traits to test whether effects differed depending on someone’s trait levels. We estimated separate models for the two dependent variables (PA and NA), the two types of social dynamics (SDE and SOE), and each of the social traits (extraversion, neuroticism, and affiliation motive). The exemplary model formula for PA, SDE, and extraversion is given below:

$$
\begin{aligned}
PA_{ti} = &\beta_{0i} + \beta_{1i} SDE_{ti} + \beta_{2i} weekend_{ti} + e_{ti} \\
&\beta_{0i} = \gamma_{00} + \gamma_{01} female_i + \gamma_{02} age_i + \gamma_{03} extraversion_i + \upsilon_{0i} \\
&\beta_{1i} = \gamma_{10} + \gamma_{11} extraversion_i + \upsilon_{1i} \\
&\beta_{2i} = \gamma_{20}
\end{aligned} \tag{1}
$$

where at time t for participant i $e_{ti} \sim N(0, \sigma_e^2)$ and $\begin{bmatrix} \upsilon_{0i} \\ \upsilon_{1i} \end{bmatrix} \sim MVN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \tau_{00} & \\ \tau_{10} & \tau_{11} \end{bmatrix}\right)$.

In addition, we ran exploratory multilevel models where we entered personal contact duration and momentary social desire into models predicting affect. We formed an index of personal contact duration by summing up all personal interactions reported in an ESM episode (up to the actual length of the episode). Level-1 variables (contact duration, social desire) were each split into between-person (grand-mean-centered) and within-person components (person-mean-centered, Hoffman, 2015; Hoffman & Walters, 2022). This served the purpose of separating variance between and within participants and exploring how within-person variation in these variables related to momentary affect. We included random slopes of contact, social desire, and their interaction (see *Supplemental Material* for model equation). In the same fashion, we used multilevel models with separate between-person and within-person components of the different mobile sensing indicators of contact. Predictors in exploratory analyses (except for age, gender, and weekend) were standardized for better comparability.

Transparency and Openness

We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study. The preregistration (and deviations from it), aggregated data[2], documentation of assessed variables, and R scripts to reproduce this

[2] Raw mobile sensing data are too privacy-sensitive to share publicly.

manuscript are available at https://osf.io/mdegx/. Confirmatory analyses relate to variables from the ESM because at the time of preregistration, the variable extraction procedure for mobile sensing was not established yet. Therefore, analyses including mobile sensing variables are considered exploratory. We used R (Version 4.2.1; R Core Team, 2022) and the R-package *nlme* (Version 3.1.157; Pinheiro & Bates, 2000) for multilevel modeling, as well as *tidyverse* (Wickham et al., 2019) for data wrangling, *specr* (Masur & Scharkow, 2019) for specification curve analyses (SCA), and *papaja* (Aust & Barth, 2022) for reproducible manuscript production (see *Supplemental Material* for all packages used).

Results

Descriptive statistics and intra-class correlations for the time-varying variables used in confirmatory and exploratory analyses can be found in Table S1.

Confirmatory Results

In contrast to our assumptions in hypothesis H1a, we did not find significant effects of SDE on either PA, $\hat{\gamma}_{10} = 0.10$, 95% CI $[-0.11, 0.31]$, $p = .365$, or NA, $\hat{\gamma}_{10} = -0.08$, 95% CI $[-0.27, 0.10]$, $p = .396$ (see Table 1). In our preregistered SCA[3], this finding proved robust to all included specifications (see Figures S2 & S3).

In line with hypothesis H1b, we found a significant decrease in PA during SOE, $\hat{\gamma}_{10} = -0.30$, 95% CI $[-0.47, -0.13]$, $p < .001$, and a significant increase in NA, $\hat{\gamma}_{10} = 0.42$, 95% CI $[0.25, 0.60]$, $p < .001$ (see Table 1). Looking at the distribution of coefficients across participants, we found that the random slope variance was considerably large for the effect of SOE on NA, $\tau_{11} = 0.11$, but negligible for the other main effects (SOE and PA, SDE and PA/NA, $\tau_{11} < 0.001$). Thus, how people reacted to social oversatiation varied more strongly between people in terms of their NA than their PA.

The findings for SOE proved robust to the vast majority of alternative

[3] We deviated slightly from the preregistered plan due to nonconvergence issues of random slope models, and we added another set of specifications for *consec* (see *Supplemental Material*).

specifications, with a median effect size for PA of $\hat{\gamma}_{11}$ = -0.50 and a median effect size for NA of $\hat{\gamma}_{11}$ = 0.45 (see Figures 1a & 2a)[4]. The SCA also shed light on the conditions under which effects of SOE were nonsignificant (18% of specifications): SOE effects tended to shift towards zero and become nonsignificant in coding specifications that a) had a more lenient cutoff for social desire, b) spanned at least three consecutive assessments, and c) did not exclude social contact by valence (see Figures 1c & 2c).

With the main specification we preregistered for confirmatory analyses, SDE occurred relatively infrequently, with 36 individual SDE that were made up of 80 ESM

Table 1

Fixed Effects of Social Dynamics on Momentary Affect.

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Social Deprivation Episode								
Intercept, $\hat{\gamma}_{00}$	4.71	[4.57, 4.84]	68.13	< .001	2.04	[1.91, 2.16]	31.26	< .001
SDE, $\hat{\gamma}_{10}$	0.10	[-0.11, 0.31]	0.91	.365	-0.08	[-0.27, 0.10]	-0.85	.396
Weekend, $\hat{\gamma}_{20}$	-0.04	[-0.10, 0.03]	-1.02	.309	-0.09	[-0.15, -0.03]	-3.12	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.14]	-0.51	.613	-0.16	[-0.34, 0.01]	-1.85	.065
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.18	.002	-0.01	[-0.01, 0.00]	-1.65	.099
Social Oversatiation Episode								
Intercept, $\hat{\gamma}_{00}$	4.71	[4.58, 4.85]	69.23	< .001	2.04	[1.91, 2.16]	31.33	< .001
SOE, $\hat{\gamma}_{10}$	-0.30	[-0.47, -0.13]	-3.50	< .001	0.42	[0.25, 0.60]	4.71	< .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.04]	-0.89	.372	-0.09	[-0.15, -0.04]	-3.17	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.24, 0.13]	-0.59	.554	-0.17	[-0.34, 0.01]	-1.88	.061
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.25	.001	-0.01	[-0.01, 0.00]	-1.69	.091

Note. Separate models were computed for each of the two types of episodes (SDE, SOE) and two affect outcomes (PA, NA). SDE = social deprivation episode, SOE = social oversatiation episode, CI = confidence interval. Weekend, Female, SDE, and SOE are dummy-coded. Age is grand-mean-centered.

[4] Results reported were also robust to alternative centering of binary predictors as put forward in Yaremych et al. (2021): Person-mean-centering the SDE/SOE predictor dummies and adding the person-mean as a level-2 predictor to separate within- and between-person effects produced highly similar results (see Table S2).

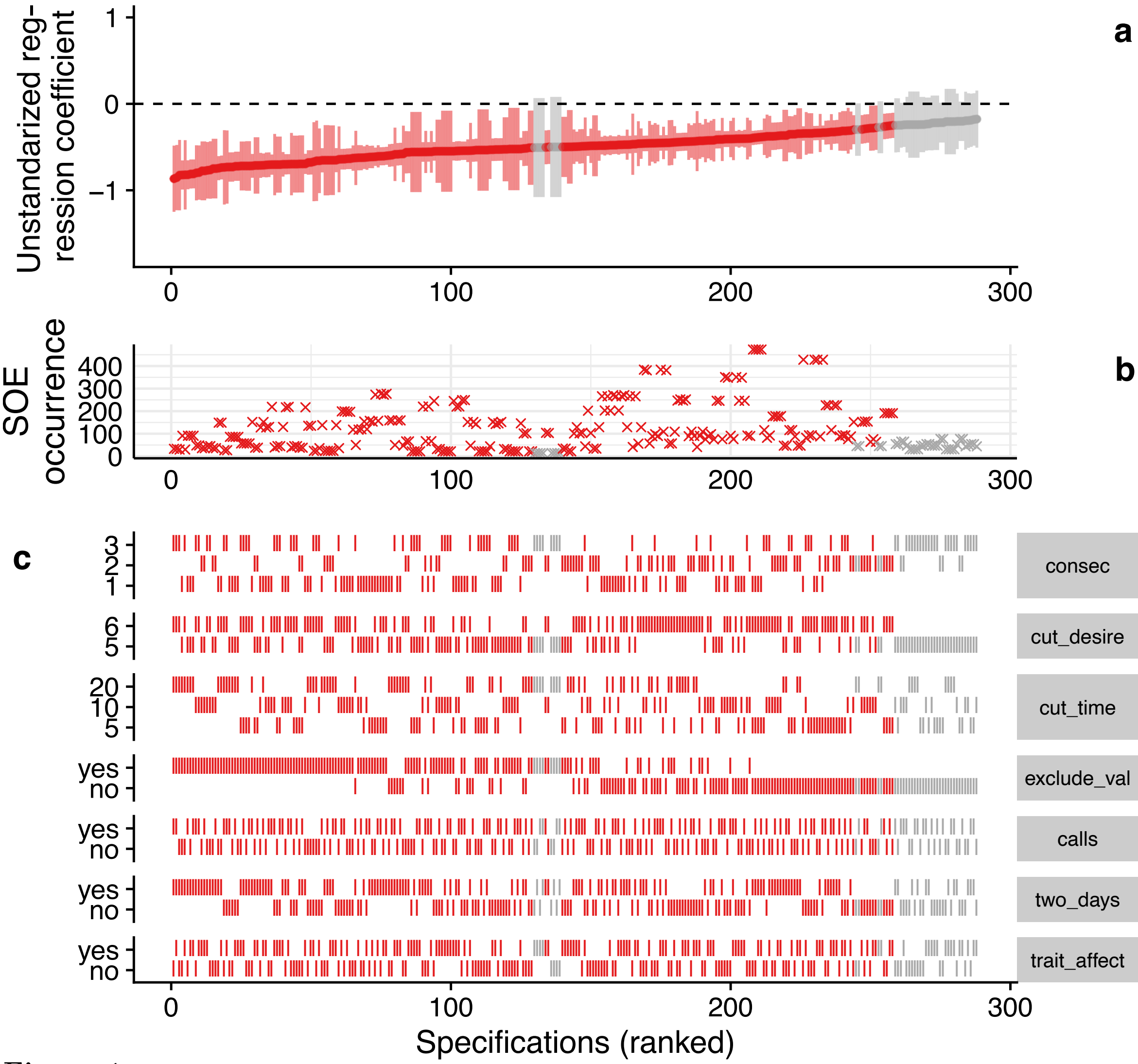

Figure 1

Specification Curve Analysis for the Effect of Social Oversatiation Episodes on Positive Affect. consec *(Options: 1, 2, 3) = minimum number of consecutive ESM assessments necessary for coding SOE;* cut_desire *(Options: 5, 6) = momentary social desire cutoff values of 5 vs. 6;* cut_time *(Options: 5, 10, 20) = minimum duration of contact that is included in the coding (in min);* exclude_val *(Options: no, yes) = exclude contact from coding of episodes based on pleasantness (above 5 for SOE);* calls *(Options: no, yes) = include calls and video calls as social contact;* two_days *(Options: no, yes) = allow episodes to span two days;* trait_affect *(Options: no, yes) = include trait-level affect as a level-2 variable. See the description in the* Supplemental Material *for details of the specifications coding.*

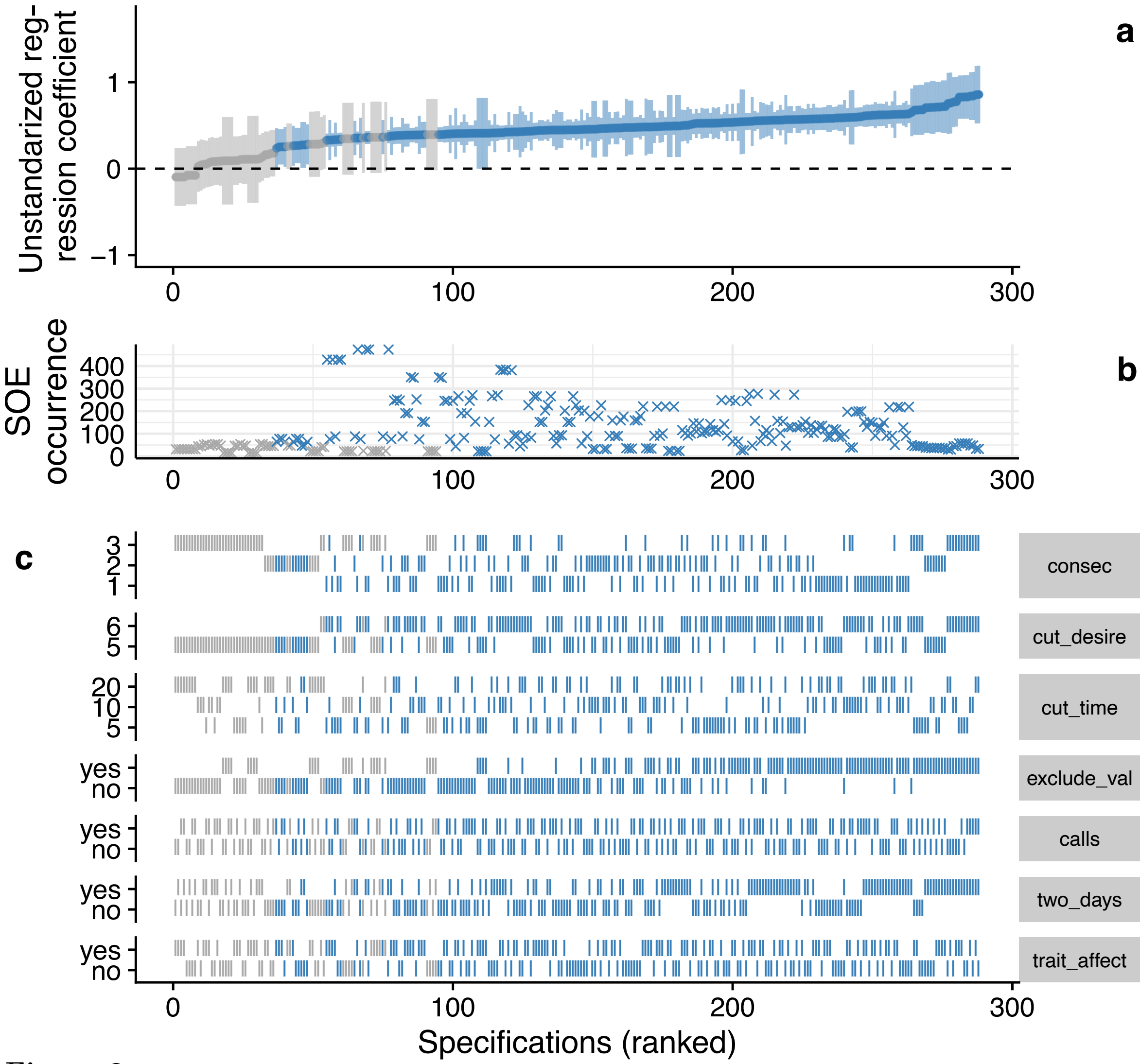

Figure 2

Specification Curve Analysis for the Effect of Social Oversatiation Episodes on Negative Affect. See Figure 1 and the description in the Supplemental Material *for details of the specifications coding.*

episodes distributed among 32 participants. SOE occurred more frequently, with 58 individual SOE that were made up of 152 ESM episodes distributed among 47 participants. Comparing both types of social dynamics in the SCA (see Figures S2b, S3b, 1b & 2b), it becomes clear that frequency of occurrence was related to the precision of the effects but that frequency alone could not explain why we found nonsignificant effects for SDE and predominantly significant effects for SOE.

Next, we investigated how effects of SDE and SOE differed depending on social traits (H3a, H3b, H3c). We found that the effects of neither SDE nor SOE were significantly moderated by participants' trait levels of extraversion, affiliation motive, or neuroticism (see Tables S3, S4, & S5). Cross-level interactions of SDE or SOE with age and gender were nonsignificant throughout (see Table S6). Therefore, we omitted these two interaction terms in the models examining moderation by social traits. The lack of moderation effects by social traits was generally supported in SCA (see Figures S4-S15)[5]. Around 33% of specifications for affiliation motive indicated that participants with a stronger affiliation motive experienced lower PA and higher NA during social oversatiation episodes. Although our results did not provide clear evidence that social traits moderated affective outcomes, there was a clear relationship between social traits and occurrence of SDE and SOE: Participants with a stronger affiliation motive experienced SDE more frequently and SOE less frequently (see Figure S24).

Exploratory Results

Exploratory analyses investigated how actual social contact as well as experiences of desiring more contact or solitude relate to momentary affect (i.e., linear within-person associations between social desire, different indicators of social contact, and affect). There was some evidence of quadratic trends in these associations, especially for desire for social contact (see Table S7, and Figures S25 & S26 for smoothed regression lines). However, linear models fit the data reasonably well and allowed us to model interaction effects parsimoniously.

For the following analyses, it is important to keep in mind that the desire to be alone was only administered in the ESM questionnaire when people were in personal

[5] In addition to the preregistered traits, we explored extraversion's sociability facet and the need to be alone (Hagemeyer et al., 2013). We found predominantly nonsignificant effects in the SCA (see Figures S16-S23). Significant effects emerged for some specifications of the moderation of the effects of SDE on PA and of SOE on NA by sociability, although in a rather unsystematic way that warrants further inquiry.

contact with someone just before answering, and the desire for social contact only when people were not in personal contact.

Self-Reported Personal Contact

We found consistent within-person effects of both types of social desire on affect (see Table 2): With a higher than usual desire to be alone, participants experienced decreased PA, $\hat{\gamma}_{20} = -0.26$, 95% CI $[-0.30, -0.21]$, $p < .001$, and increased NA, $\hat{\gamma}_{20} = 0.20$, 95% CI $[0.16, 0.25]$, $p < .001$. Conversely, with a higher than usual desire for social contact, participants experienced higher PA, $\hat{\gamma}_{20} = 0.17$, 95% CI $[0.08, 0.26]$, $p < .001$, and lower NA, $\hat{\gamma}_{20} = -0.11$, 95% CI $[-0.19, -0.04]$, $p = .002$.

Longer than usual personal contact per ESM episode was not significantly associated with affect in combined models. A main effect of more personal contact predicting improved affect only surfaced in models without the social desire variables (PA: $\hat{\gamma}_{10} = 0.09$, 95% CI $[0.06, 0.12]$, $p < .001$; NA: $\hat{\gamma}_{10} = -0.02$, 95% CI $[-0.05, 0.00]$, $p = .048$; see Table S8). Thus, controlling for momentary social desire erased the effect of personal contact.

For NA but not for PA, we found within-person interaction effects of personal contact and social desire (see Table 2): When participants experienced higher than usual desire for social contact, NA decreased with longer personal contact, $\hat{\gamma}_{30} = -0.08$, 95% CI $[-0.15, 0.00]$, $p = .045$ (see Figure 3a,b). Contrary to our expectations, when participants experienced higher desire to be alone, NA also decreased with longer personal contact, although this effect was smaller in size, $\hat{\gamma}_{30} = -0.04$, 95% CI $[-0.07, 0.00]$, $p = .037$ (see Figure 3c,d). However, because of the comparatively large main effect of desire to be alone, $\hat{\gamma}_{20}$, and small main effect of personal contact, $\hat{\gamma}_{10}$, participants with a higher than usual desire to be alone experienced elevated NA regardless of how much personal contact they had in that ESM episode (compared to a state when their desire to be alone was lower).[6]

[6] We also conducted analyses with a composite indicator of social desire, which are presented in the *Supplemental Material*.

Table 2

Fixed Effects of Personal Contact Duration, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.73	[4.60, 4.87]	< .001	2.02	[1.89, 2.15]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.02	[-0.09, 0.06]	.673	-0.10	[-0.17, -0.04]	.003
Female, $\hat{\gamma}_{01}$	-0.07	[-0.25, 0.11]	.447	-0.11	[-0.28, 0.06]	.199
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.001	-0.01	[-0.01, 0.00]	.097
PersCon. (BP), $\hat{\gamma}_{03}$	0.09	[-0.01, 0.18]	.066	-0.03	[-0.12, 0.06]	.474
PersCon. (WP), $\hat{\gamma}_{10}$	0.02	[-0.01, 0.06]	.205	0.00	[-0.03, 0.04]	.825
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.13	[-0.22, -0.04]	.006	0.10	[0.01, 0.19]	.038
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.21]	< .001	0.20	[0.16, 0.25]	< .001
PersCon. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	0.00	[-0.09, 0.09]	.999	0.00	[-0.09, 0.09]	.934
PersCon. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	-0.03	[-0.06, 0.01]	.206	0.02	[-0.02, 0.06]	.449
PersCon. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	-0.03	[-0.06, 0.01]	.131	0.01	[-0.03, 0.04]	.711
PersCon. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.02	[-0.02, 0.05]	.274	-0.04	[-0.07, 0.00]	.037
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.60	[4.43, 4.76]	< .001	2.13	[1.97, 2.29]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	.488	-0.08	[-0.16, 0.00]	.044
Female, $\hat{\gamma}_{01}$	-0.10	[-0.31, 0.10]	.324	-0.14	[-0.34, 0.06]	.177
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	< .001	-0.01	[-0.01, 0.00]	.056
PersCon. (BP), $\hat{\gamma}_{03}$	0.10	[-0.02, 0.21]	.091	-0.05	[-0.15, 0.06]	.405
PersCon. (WP), $\hat{\gamma}_{10}$	0.04	[-0.04, 0.12]	.309	0.05	[-0.03, 0.12]	.231
Desire Contact (BP), $\hat{\gamma}_{04}$	0.13	[0.01, 0.25]	.038	-0.10	[-0.22, 0.02]	.103
Desire Contact (WP), $\hat{\gamma}_{20}$	0.17	[0.08, 0.26]	< .001	-0.11	[-0.19, -0.04]	.002
PersCon. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.02	[-0.09, 0.14]	.688	-0.01	[-0.12, 0.10]	.813
PersCon. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.02	[-0.05, 0.09]	.559	-0.05	[-0.10, 0.01]	.098
PersCon. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	-0.03	[-0.11, 0.05]	.430	-0.04	[-0.11, 0.03]	.285
PersCon. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.04	[-0.05, 0.13]	.343	-0.08	[-0.15, 0.00]	.045

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S8 and S9. CI = confidence interval, PersCon. = personal contact duration, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Mobile Sensing Indicators of Social Contact

We included 3198 episodes with at least five conversation detection samplings (from 279 participants) for the analyses of detected conversations. 1484 of these episodes contained at least one AWARE sampling indicating conversation (proportion of

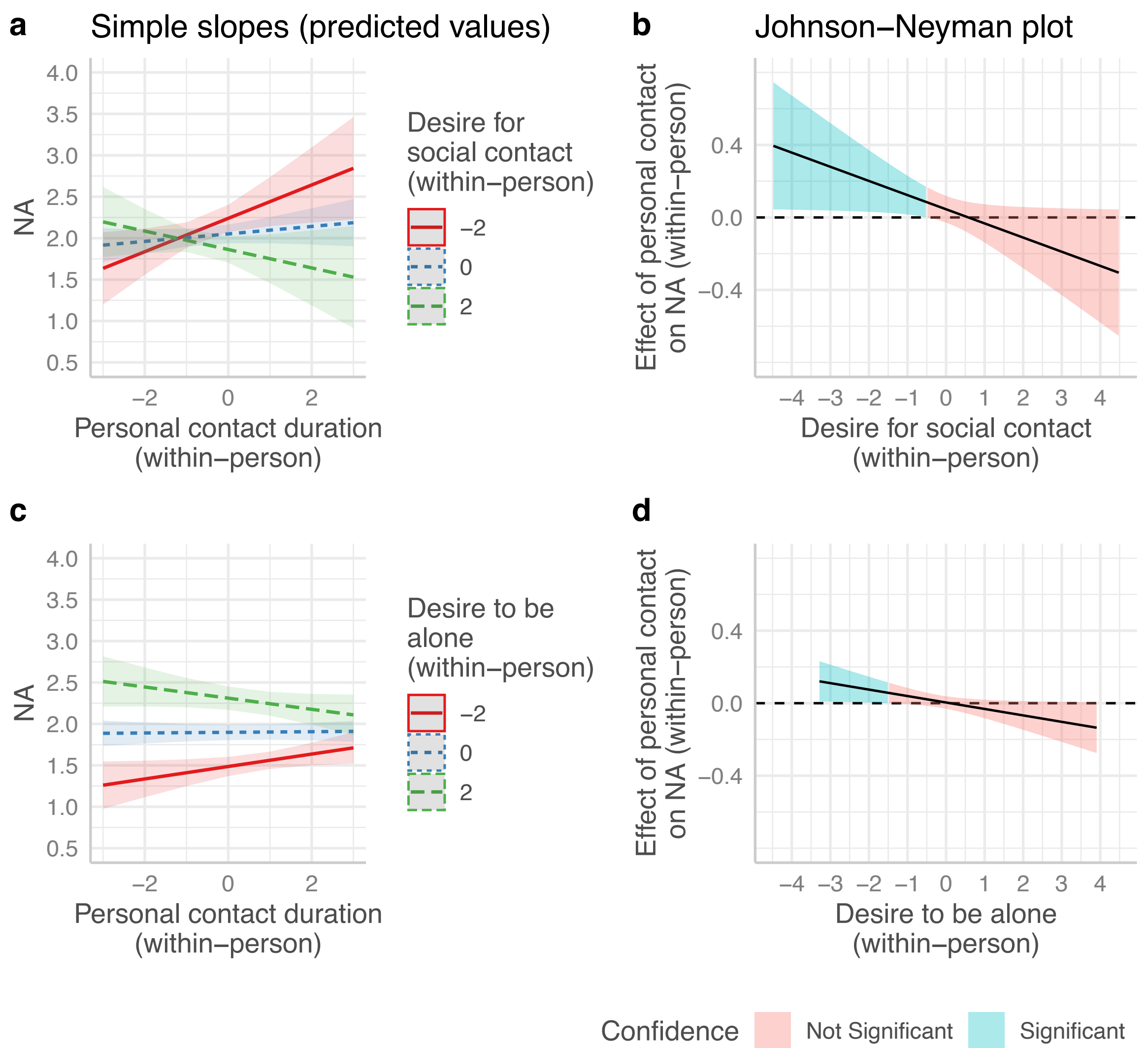

Figure 3

Simple-slopes plots (a, c) and Neyman-Johnson regions-of-significance plots (b, d) for significant within-person interaction effects predicting negative affect (NA). Confidence bands represent 95% confidence intervals. Variables presented on the X-axis are person-mean-centered and standardized.

conversations: $M = 0.23$, $SD = 0.18$). A higher than usual proportion of detected conversations was associated with increased PA, $\hat{\gamma}_{10} = 0.05$, 95% CI $[0.02, 0.09]$, $p = .006$ (see Table 3).[7]

[7] This effect, however, did not persist in the model including desire for social contact, which restricted the sample to times when participants where alone right before the assessment.

Table 3

Fixed Effects of Detected Conversations, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.76	[4.62, 4.91]	< .001	2.04	[1.90, 2.18]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.04	[-0.13, 0.06]	.456	-0.06	[-0.15, 0.02]	.137
Female, $\hat{\gamma}_{01}$	-0.10	[-0.30, 0.09]	.288	-0.15	[-0.34, 0.04]	.126
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.007	0.00	[-0.01, 0.00]	.365
Conv. (BP), $\hat{\gamma}_{03}$	0.02	[-0.07, 0.12]	.638	-0.01	[-0.11, 0.08]	.795
Conv. (WP), $\hat{\gamma}_{10}$	0.05	[0.02, 0.09]	.006	0.00	[-0.03, 0.04]	.812
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.18	[-0.28, -0.08]	< .001	0.12	[0.02, 0.21]	.019
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.31, -0.21]	< .001	0.20	[0.15, 0.25]	< .001
Conv. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.04	[-0.15, 0.06]	.397	0.05	[-0.05, 0.15]	.334
Conv. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	-0.02	[-0.06, 0.03]	.511	0.01	[-0.03, 0.06]	.593
Conv. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.02	[-0.02, 0.06]	.294	0.00	[-0.04, 0.04]	.897
Conv. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.00	[-0.04, 0.04]	.926	0.02	[-0.02, 0.06]	.265
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.56	[4.40, 4.72]	< .001	2.11	[1.95, 2.26]	< .001
Weekend, $\hat{\gamma}_{40}$	0.02	[-0.08, 0.12]	.679	-0.07	[-0.17, 0.02]	.131
Female, $\hat{\gamma}_{01}$	-0.08	[-0.31, 0.14]	.471	-0.21	[-0.43, 0.01]	.063
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.019	0.00	[-0.01, 0.00]	.416
Conv. (BP), $\hat{\gamma}_{03}$	0.06	[-0.06, 0.17]	.323	-0.07	[-0.18, 0.03]	.184
Conv. (WP), $\hat{\gamma}_{10}$	0.03	[-0.02, 0.08]	.208	0.02	[-0.03, 0.07]	.444
Desire Contact (BP), $\hat{\gamma}_{04}$	0.16	[0.04, 0.27]	.008	-0.07	[-0.18, 0.04]	.222
Desire Contact (WP), $\hat{\gamma}_{20}$	0.12	[0.07, 0.18]	< .001	-0.05	[-0.09, 0.00]	.040
Conv. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.06	[-0.05, 0.17]	.295	0.02	[-0.09, 0.13]	.690
Conv. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.03	[-0.02, 0.09]	.230	-0.03	[-0.08, 0.01]	.179
Conv. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	-0.03	[-0.07, 0.02]	.301	-0.02	[-0.07, 0.02]	.356
Conv. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	-0.01	[-0.05, 0.04]	.814	0.02	[-0.02, 0.07]	.322

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S11 and S12. CI = confidence interval, Conv. = proportion of detected conversations in an episode, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Unlike for self-reported personal contact, there were no interaction effects for detected conversations and either social desire variable.

Participants were in at least one call in around 11% of ESM episodes (M_{calls} = 0.17, SD_{calls} = 0.58, max_{calls} = 12). In episodes in which calls occurred, they lasted on average

6.47 min ($SD_{duration} = 9.40$). In the multilevel models (see Tables S13 & S14), within-person fluctuations in the number and duration of calls were unrelated to affect (as were between-person effects).

Communication apps were used on average 4.96 times per episode ($SD = 6.21$; see Table S1), with an average aggregated duration of 3.42 min ($SD = 6.12$ min) per episode. Using communication apps more frequently than usual was related to higher NA, $\hat{\gamma}_{10} = 0.04$, 95% CI $[0.00, 0.07]$, $p = .030$, in the models including desire for social contact (i.e., when alone before answering the questionnaire). Apart from this effect, communication app usage was unrelated to affect (see Tables S15 & S16).

Social media apps were used less frequently than communication apps: on average, 1.73 times per episode ($SD = 3.58$) with an aggregated duration of 3.17 min ($SD = 7.45$ min) per episode. Although some between-person effects indicated that participants with higher social media app usage had worse affect, no significant within-person effects emerged (see Tables S17 & S18).

Figure 4 sums up the within-person effects of the exploratory analyses. A higher than usual desire to be alone was consistently related to large decreases in affect (PA and NA). In turn, a higher than usual desire for social contact was associated with significant increases in affect, which were somewhat smaller in size, and generally larger for PA than NA. Main effects of the different social contact indicators as well as interaction effects of contact and social desire were small and only significant in the few cases described above.

Discussion

In a multi-method study of the relation between dynamics of social contact and daily-life affective experiences, we found that episodes of social oversatiation (i.e., being in social contact but desiring to be alone) were accompanied by decreases in positive affect and increases in negative affect (supporting H2a). Episodes of social deprivation (i.e., being alone but desiring social contact) were unrelated to affect (contrary to H1a). Findings were

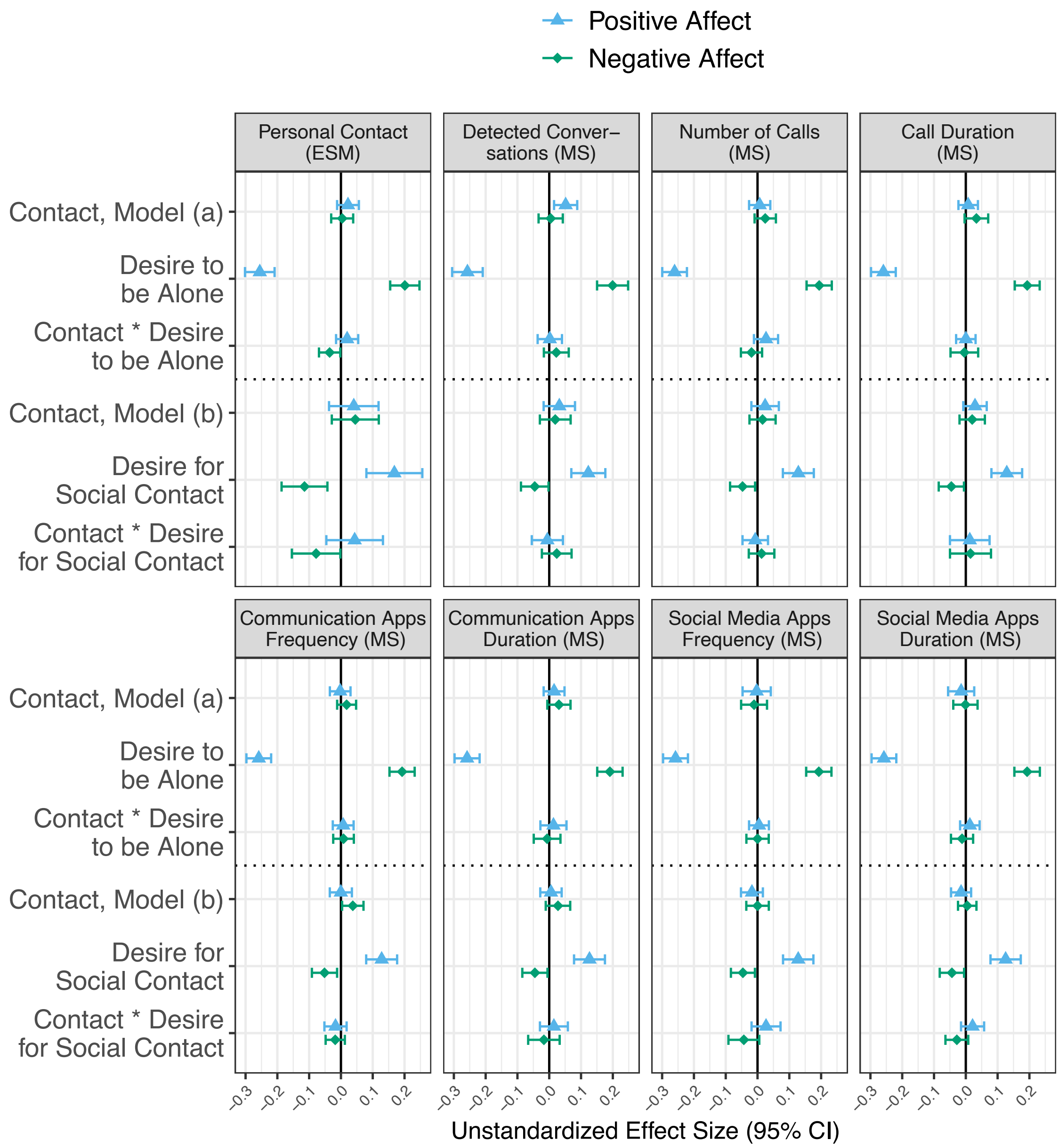

Figure 4

Summary Plot of the Exploratory Within-Person Effects Using Different Indicators of Social Contact. Displayed are unstandardized effect sizes of the interaction models (multilevel regression coefficients $\hat{\gamma}_{10}$, $\hat{\gamma}_{20}$, and $\hat{\gamma}_{30}$; see Tables 2, 3, S13, S14, S15, S16, S17, & S18). Error bars represent 95% confidence intervals. Contact, Model (a) = *indicator* ($\hat{\gamma}_{10}$) *in models containing desire to be alone,* Contact, Model (b) = *indicator* ($\hat{\gamma}_{10}$) *in models containing desire for social contact,* ESM = *experience sampling method,* MS = *mobile sensing.*

robust to different specifications of defining social dynamics episodes. People with different levels of social traits did not change differently in affect when undergoing social deprivation or social oversatiation (contrary to H3). Exploratory follow-up analyses showed that a higher desire to be alone was consistently associated with decreased affect on the within-person level, whereas a higher desire for social contact was in most cases associated with increased affect. Finally, mobile sensing indicators of social contact helped to provide further insights into social dynamics in daily life. Our analysis showcased ways to investigate social dynamics with reduced participant burden, less reporting bias (e.g., recall bias), and, potentially, a higher temporal resolution. Mobile sensing results also emphasized the importance of face-to-face conversations for positive affect.

Social Contact, Social Desire, and Momentary Affect

Social Oversatiation and the Desire to be Alone

SOE were consistently associated with decreased PA and increased NA. Individuals experienced a mismatch between social desire and actual social contact (i.e., being in contact with others while desiring to be alone) as averse in terms of affect, even if the mismatch only lasted for a few hours. This finding is consistent with theories on the role of affect in social need regulation as the outcome of a failure to realign behavior toward need satisfaction (Hall & Davis, 2017; O'Connor & Rosenblood, 1996; Sheldon, 2011). It also fits empirical research on solitude-seeking and well-being: A higher desire for solitude was associated with decreased PA in middle-aged adults (but not in older adults, Lay, Pauly, et al., 2020). People had more positive and less negative affective experiences in chosen as compared to unchosen solitary activities, and in chosen compared to unchosen social activities (Tse et al., 2022; Uziel & Schmidt-Barad, 2022). From a theoretical standpoint, people may seek out solitude voluntarily to attain broad benefits to well-being through creative or spiritual pursuits, self-discovery, increased productivity, or recuperation (Long et al., 2003). Volition can be considered a precondition for a match between social contact status and momentary social desire and is therefore related to the social dynamics analyzed in this study. Higher volition of social interaction status has consistently been linked to higher well-being (Hall et al., 2021; Hall & Merolla, 2020; Uziel & Schmidt-Barad, 2022).

Ambiguous effects of being alone on well-being were referred to in past research as paradoxical (Coplan et al., 2017). Empirical research is only beginning to tease apart the roles of interaction status, social desire, volition, types of activities, interaction partners, and contact mode (Kroencke et al., 2022; Nguyen et al., 2018; Tse et al., 2022). Our study has shown detrimental effects on affective well-being during social oversatiation, that is, when individuals are momentarily unable to fulfill the need to be alone. Our exploratory results support this finding by underscoring the importance of assessing momentary social desire in research designs investigating the relationship between (no) social contact and affect (Coplan et al., 2019; Nguyen et al., 2018). The basic effect of longer personal contact on higher PA and lower NA disappeared in models including desire for social contact or desire to be alone (except for conversations detected through mobile sensing, see below). This might partly explain previous ambiguous effects of being alone or of social contact on affect (e.g., Birditt et al., 2019; Pauly et al., 2017) when momentary social desire was not accounted for.

The effect of SOE is also in line with findings of diminished affective returns or even losses at high levels of (unwanted) social contact (Luo, Macdonald, et al., 2022; Ren et al., 2021; Stavrova & Ren, 2021). Consistent with theoretical deliberations on daily-life social dynamics (Nezlek, 2001), normative obligations may compel people to endure unwanted social contact at the cost of affective decline (e.g., in work meetings, see Möwisch et al., 2019).

In terms of temporal sequencing, our specification curve analyses showed that SOE effects were mostly robust when defined as one, two, or three (consecutive) ESM episodes (of approximately 80 minutes). Previous research found that fatigue increased roughly two to three hours after extraverted states (Leikas & Ilmarinen, 2017), although social desire was not assessed. These studies and our findings are consistent with theory on the regulation of everyday social contact, describing an interplay of affiliative or social motivation and the motivation to conserve energy (Hall & Davis, 2017). In older adults, longer social interaction periods were followed by increasingly long periods of solitude on the within-person level, which might indicate social oversatiation (Luo, Pauly, et al., 2022).

Social Deprivation and the Desire for Social Contact

In contrast to SOE, there were no effects of SDE on affect. Exploratory analyses shed further light on these results in two ways: First, a higher than usual desire for social contact was generally associated with *increased* affective well-being, although effects were not as large as those for desire to be alone, and larger for PA than for NA. This is in line with the finding of bidirectional relationships between social contact and affect (e.g., Liu et al., 2021) and the idea that happiness is a prerequisite for pursuing further social contact (Elmer, 2021; cf. Quoidbach, Taquet, et al., 2019). However, this assumption requires further research, for example, using network models.

Second, the negative within-person interaction between desire for social contact and personal contact (see Figure 3a,b) shows that for NA, the effect of above-average personal contact on momentary affect depended on how much the individual desired social contact with others. The higher the momentary social desire, the less participants' NA increased with additional personal contact. Still, this interaction effect was relatively small, and conditional slopes of personal contact were not significant at higher values of desire for social contact.

Another explanation for the lack of effects of SDE is that states of being alone coupled with unfulfilled social needs have to accumulate over longer time periods. In one study with assessment periods between five and 28 days, participants' global well-being was negatively associated with unmet social needs throughout the day (Hall & Merolla, 2020). The null or beneficial effects we found also suggest that theoretical expectations of lowered affect when below the ideal level of social contact (Hall & Davis, 2017; Sheldon, 2011) do not apply to time frames of a few hours.

No Interindividual Differences in Reaction to Social Dynamics

We found no evidence that social traits moderate the effects of SDE and SOE on affective well-being. Specification curve analyses revealed only a minority of significant specifications (if any) for a few of the investigated traits. For affiliation motive, these results are in contrast to previous findings of affective contingencies (Dufner et al., 2015; Kersten et al., 2022). For extraversion and neuroticism, however, our null-results are in line with studies that found no differential reactivity to social interactions for affect (Lucas et al., 2008) and other well-being components (Ren et al., 2021; Sun et al., 2020). A recent study on voluntary and involuntary solitude and social contact found no moderation of effects on well-being outcomes (including affect) by extraversion, supporting our null findings in part (Tse et al., 2022).

Post-hoc power simulations using parameter values from our empirical models indicated that we were able to detect cross-level interaction effects of 0.19 (SOE and NA by extraversion) to 0.29 scale points (SDE and PA by affiliation motive) with a power of at least 80% in the current sample.

Combining ESM and Mobile Sensing Data

The present study made a new contribution to the study of social dynamics by combining subjective ESM self-report and objective mobile sensing behavioral data (Harari et al., 2016). This is important because relying only on self-report data potentially produces inflated estimates due to common method bias (Podsakoff et al., 2003; Shaw et al., 2020). In our exploratory analyses, we applied identical analytical strategies to self-reported personal contact duration and different indicators of social contact assessed with mobile sensing to comprehensively compare their effects on momentary affect. Results showed that having more conversations than usual—as detected by the audio-sampling algorithm[8]—was associated with higher PA (for happiness, see Sun et al., 2020). Conversely, using communication apps such as WhatsApp more frequently when alone was related to increased NA. A comparable result was found in a recent daily diary study (Lin & Lachman, 2021). Besides these two within-person effects and a few between-person effects, we did not find consistent effects of calling and app usage behavior, whether we controlled for momentary social desire or not. Throughout, social desire remained a significant and strong predictor of affect when added to the models.

In the ongoing debate on the ramifications of phone and social media use on well-being and health (Kushlev et al., 2019; Orben & Przybylski, 2019; Shaw et al., 2020), our results underline the need for nuance and the importance of a) distinguishing within- and between-person variance, b) including measures of momentary social desire which reliably predicted affect, and c) collecting behavioral data extracted from logs of smartphone use to avoid common method bias (Podsakoff et al., 2003) when predicting self-reported affect.

Limitations and Future Directions

We presented an innovative, multi-method approach to the relationship between social dynamics and affective well-being in daily life. Nevertheless, several limitations of the current study need to be mentioned: Our confirmatory and exploratory models investigated within-person effects. The coding of social dynamics episodes for confirmatory analyses ensured that SDE and SOE were preceded by a "neutral" baseline episode. Even so, these methods were not sufficient to establish clear causal relationships between social dynamics and momentary affect and the directionality of the underlying processes (Rohrer

[8] From a technical standpoint, further refinement and validation of the functionality of conversation detection algorithms such as the AWARE Conversations Plugin is needed across devices. Previous studies have often reported conversation detection data too uncritically regarding potential misclassification when used in the field and missingness caused by technical problems. In our data, self-reported personal contact duration and the proportion of algorithm-detected conversations during an episode correlated with $r = 0.24$, indicating that signal was picked up by the algorithm to some degree (for further discussion of cross-method agreement, see Roos et al., 2023).

& Murayama, 2022).

Another limitation is that our assessment period of two days (Friday and Saturday) does not allow for conclusions about on how social dynamics unfold over several days and relate to affect (e.g., Neubauer et al., 2018). To compare different methods of assessing social contact throughout the day (see Roos et al., 2023), we opted for this fine-grained ESM assessment schedule but restricted it to two days to not overburden participants (Wrzus & Neubauer, 2023).

Third, the current sample was stratified by age groups and gender and was diverse with respect to employment, education, and family background. Still, results reported here are specific to German-speaking and similar cultural contexts. Studies on solitude that have investigated the broader cultural context in relation to the experience of affect have found subtle differences between nations and depending on how connected people felt to their (host) culture (Jiang et al., 2019; Lay, Fung, et al., 2020). Another study reported that affective motivational processes related to the pursuit of pleasant or unpleasant activities were largely similar in people from Japan and the United States (Quoidbach, Sugitani, et al., 2019).

Looking toward future research, models using machine learning algorithms would be able to incorporate all relevant variables from this dataset (and many more) to predict momentary affect (see Schoedel, Kunz, et al., 2022; Stachl, Au, et al., 2020, for prediction models of situation perception and personality traits). Such a data-driven approach could account for complex nonlinear and interaction effects in the large, multi-method variable space and shed light on the most important predictors of affect that, in turn, could be investigated in more depth (Stachl, Pargent, et al., 2020). However, machine learning techniques require even more data points and—with the different ultimate goal of prediction (Mõttus et al., 2020)—go beyond the scope of the current article.

Conclusion

How do temporal dynamics in the regulation of social needs and social contact relate to affect? In a combination of preregistered and exploratory analyses using a diverse set of assessment and analysis methods, we aimed to establish boundary conditions (Moeller et al., 2022) of social deprivation and social oversatiation in their effects on momentary affect. Across analyses, we consistently found that social oversatiation and a high desire to be alone were associated with a marked affective decline on the within-person level. Results were less straightforward for social deprivation: Our approach to mismatches between a high social desire and no actual social interactions indicated that social deprivation did not influence affect, which the specification curve analyses wholly supported. Our exploratory analyses indicated slight affective benefits associated with a higher desire for social contact which was further contextualized by an interaction effect with personal contact duration for NA. Future studies employing different schedules of assessment will be able to build on our results and provide more detailed accounts of the exact temporal makeup of these processes (Hopwood et al., 2022). There was no consistent support for the hypothesis that individual differences in social traits moderated the effects. Finally, models including indicators of social contact derived from unobtrusive mobile sensing demonstrated support for the notion that having more conversations was related to higher PA and writing more text messages when currently alone to higher NA—even if we accounted for momentary social desire. We advocate for the combined use of self-report snapshots and mobile sensing because relying on passive mobile sensing alone would miss psychological insights only accessible through introspection.

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References

Aust, F., & Barth, M. (2022). *papaja: Prepare reproducible APA journal articles with R Markdown*. https://github.com/crsh/papaja

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Birditt, K. S., Manalel, J. A., Sommers, H., Luong, G., & Fingerman, K. L. (2019). Better off alone: Daily solitude is associated with lower negative affect in more conflictual social networks. *The Gerontologist*, *59*(6), 1152–1161. https://doi.org/10.1093/geront/gny060

Buijs, V. L., Jeronimus, B. F., Lodder, G. M. A., Steverink, N., & de Jonge, P. (2021). Social needs and happiness: A life course perspective. *Journal of Happiness Studies*, *22*(4), 1953–1978. https://doi.org/10.1007/s10902-020-00287-9

Carver, C. S., & Scheier, M. F. (1998). *On the self-regulation of behavior.* Cambridge University Press. https://doi.org/10.1017/CBO9781139174794

Coplan, R. J., Hipson, W. E., Archbell, K. A., Ooi, L. L., Baldwin, D., & Bowker, J. C. (2019). Seeking more solitude: Conceptualization, assessment, and implications of aloneliness. *Personality and Individual Differences*, *148*, 17–26. https://doi.org/10.1016/j.paid.2019.05.020

Coplan, R. J., Zelenski, J. M., & Bowker, J. C. (2017). Leave well enough alone? The costs and benefits of solitude. In J. E. Maddux (Ed.), *Subjective well-being and life satisfaction* (pp. 129–147). Routledge.

Danner, D., Rammstedt, B., Bluemke, M., Treiber, L., Berres, S., Soto, C., & John, O. (2016). *Die deutsche Version des Big Five Inventory 2 (BFI-2).* https://doi.org/10.6102/zis247

daSilva, A. W., Huckins, J. F., Wang, W., Wang, R., Campbell, A. T., & Meyer, M. L. (2021). Daily perceived stress predicts less next day social interaction: Evidence from a naturalistic mobile sensing study. *Emotion*, *21*(8), 1760–1770. https://doi.org/10.1037/emo0000994

DeYoung, C. G., Weisberg, Y., Quilty, L., & Peterson, J. (2013). Unifying the aspects of the Big Five, the interpersonal circumplex, and trait affiliation. *Journal of Personality*, *81*, 465–475. https://doi.org/10.1111/jopy.12020

Dufner, M., Arslan, R. C., Hagemeyer, B., Schönbrodt, F. D., & Denissen, J. J. A. (2015). Affective contingencies in the affiliative domain: Physiological assessment, associations with the affiliation motive, and prediction of behavior. *Journal of Personality and Social Psychology*, *109*(4), 662–676. https://doi.org/10.1037/pspp0000025

Elmer, T. (2021). In which direction does happiness predict subsequent social interactions? A commentary on Quoidbach et al. (2019). *Psychological Science*, *32*(6), 955–959. https://doi.org/10.1177/0956797620956981

Ferreira, D., & Mulukutla, R. (2020). *AWARE Plugin: Conversations*. https://github.com/denzilferreira/com.aware.plugin.studentlife.audio_final

Hagemeyer, B., Neyer, F. J., Neberich, W., & Asendorpf, J. B. (2013). The ABC of social desires: Affiliation, being alone, and closeness to partner. *European Journal of Personality*, *27*(5), 442–457. https://doi.org/10.1002/per.1857

Hall, J. A. (2017). The regulation of social interaction in everyday life: A replication and extension of O'Connor and Rosenblood (1996). *Journal of Social and Personal Relationships*, *34*(5), 699–716. https://doi.org/10.1177/0265407516654580

Hall, J. A., & Davis, D. C. (2017). Proposing the communicate bond belong theory: Evolutionary intersections with episodic interpersonal communication. *Communication Theory*, *27*(1), 21–47. https://doi.org/10.1111/comt.12106

Hall, J. A., & Merolla, A. J. (2020). Connecting everyday talk and time alone to global well-being. *Human Communication Research*, *46*(1), 86–111. https://doi.org/10.1093/hcr/hqz014

Hall, J. A., Mihailova, T., & Merolla, A. J. (2021). Typicality and volition as fundamental features of everyday relational communication. *Personal Relationships*, *28*(3), 607–626. https://doi.org/10.1111/pere.12387

Harari, G. M., Lane, N. D., Wang, R., Crosier, B. S., Campbell, A. T., & Gosling, S. D. (2016). Using smartphones to collect behavioral data in psychological science: Opportunities, practical considerations, and challenges. *Perspectives on Psychological Science*, *11*(6), 838–854. https://doi.org/10.1177/1745691616650285

Hofer, J., & Busch, H. (2011). Satisfying one's needs for competence and relatedness: Consequent domain-specific well-being depends on strength of implicit motives. *Personality and Social Psychology Bulletin*, *37*(9), 1147–1158. https://doi.org/10.1177/0146167211408329

Hofer, J., & Hagemeyer, B. (2018). Social bonding: Affiliation motivation and intimacy motivation. In J. Heckhausen & H. Heckhausen (Eds.), *Motivation and action* (pp. 305–334). Springer International Publishing. https://doi.org/10.1007/978-3-319-65094-4_7

Hoffman, L. (2015). *Longitudinal analysis: Modeling within-person fluctuation and change.* Routledge/Taylor & Francis Group.

Hoffman, L., & Walters, R. W. (2022). Catching up on multilevel modeling. *Annual Review of Psychology*, *73*(1), 659–689. https://doi.org/10.1146/annurev-psych-020821-103525

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, *10*(2), 227–237. https://doi.org/10.1177/1745691614568352

Hopwood, C. J., Bleidorn, W., & Wright, A. G. C. (2022). Connecting theory to methods in longitudinal research. *Perspectives on Psychological Science*, *17*(3), 884–894. https://doi.org/10.1177/17456916211008407

Jacques-Hamilton, R., Sun, J., & Smillie, L. D. (2019). Costs and benefits of acting extraverted: A randomized controlled trial. *Journal of Experimental Psychology: General*, *148*(9), 1538–1556. https://doi.org/10.1037/xge0000516

Jiang, D., Fung, H. H., Lay, J. C., Ashe, M. C., Graf, P., & Hoppmann, C. A. (2019). Everyday solitude, affective experiences, and well-being in old age: The role of culture versus immigration. *Aging & Mental Health*, *23*(9), 1095–1104. https://doi.org/10.1080/13607863.2018.1479836

Kashdan, T. B., Yarbro, J., McKnight, P. E., & Nezlek, J. B. (2014). Laughter with someone else leads to future social rewards: Temporal change using experience sampling methodology. *Personality and Individual Differences*, *58*, 15–19. https://doi.org/10.1016/j.paid.2013.09.025

Kersten, P., Borschel, E., Neyer, F. J., & Mund, M. (2022). The social side of personality: Do affiliation and intimacy motives moderate associations of personal relationships with well-being? *Journal of Personality*. https://doi.org/10.1111/jopy.12746

Krämer, M. D., Roos, Y., Richter, D., & Wrzus, C. (2022). Resuming social contact after months of contact restrictions: Social traits moderate associations between changes in social contact and well-being. *Journal of Research in Personality*, *98*, 104223. https://doi.org/10.1016/j.jrp.2022.104223

Kroencke, L., Harari, G., Back, M., & Wagner, J. (2022). Well-being in social interactions: Examining personality-situation dynamics in face-to-face and computer-mediated communication. *Journal of Personality and Social Psychology*, *Advance online publication*. https://doi.org/10.1037/pspp0000422

Kushlev, K., Dwyer, R., & Dunn, E. W. (2019). The social price of constant connectivity: Smartphones impose subtle costs on well-being. *Current Directions in Psychological Science*, *28*(4), 347–352. https://doi.org/10.1177/0963721419847200

Kushlev, K., Heintzelman, S. J., Oishi, S., & Diener, E. (2018). The declining marginal utility of social time for subjective well-being. *Journal of Research in Personality*, *74*, 124–140. https://doi.org/10.1016/j.jrp.2018.04.004

Lane, N., Rabbi, M., Lin, M., Yang, X., lu, H., Ali, S., Doryab, A., Berke, E., Choudhury, T., & Campbell, A. (2011). BeWell: A smartphone application to monitor, model and promote wellbeing. *Proceedings of the 5th International ICST Conference on Pervasive Computing Technologies for Healthcare.* https://doi.org/10.4108/icst.pervasivehealth.2011.246161

Lay, J. C., Fung, H. H., Jiang, D., Lau, C. H., Mahmood, A., Graf, P., & Hoppmann, C. A. (2020). Solitude in context: On the role of culture, immigration, and acculturation in the experience of time to oneself. *International Journal of Psychology*, *55*(4), 562–571. https://doi.org/10.1002/ijop.12641

Lay, J. C., Pauly, T., Graf, P., Biesanz, J. C., & Hoppmann, C. A. (2019). By myself and liking it? Predictors of distinct types of solitude experiences in daily life. *Journal of Personality*, *87*(3), 633–647. https://doi.org/10.1111/jopy.12421

Lay, J. C., Pauly, T., Graf, P., Mahmood, A., & Hoppmann, C. A. (2020). Choosing solitude: Age differences in situational and affective correlates of solitude-seeking in midlife and older adulthood. *The Journals of Gerontology: Series B*, *75*(3), 483–493. https://doi.org/10.1093/geronb/gby044

Leikas, S., & Ilmarinen, V.-J. (2017). Happy now, tired later? Extraverted and conscientious behavior are related to immediate mood gains, but to later fatigue. *Journal of Personality*, *85*(5), 603–615. https://doi.org/10.1111/jopy.12264

Lin, X. Y., & Lachman, M. E. (2021). Daily stress and affect across adulthood: The role of social interactions via different communication modes. *Technology, Mind, and Behavior*, *1*(3). https://doi.org/10.1037/tmb0000026

Liu, H., Fang, B., Li, Y., & Lou, V. W. Q. (2021). Initially negative affect predicts lower satisfaction with future social contact: A time-lagged analysis using ecological momentary assessment. *The Journals of Gerontology: Series B*, *76*(2), 295–305. https://doi.org/10.1093/geronb/gbaa024

Liu, H., Xie, Q. W., & Lou, V. W. Q. (2019). Everyday social interactions and intra-individual variability in affect: A systematic review and meta-analysis of ecological momentary assessment studies. *Motivation and Emotion*, *43*(2), 339–353.

https://doi.org/10.1007/s11031-018-9735-x

Long, C. R., Seburn, M., Averill, J. R., & More, T. A. (2003). Solitude experiences: Varieties, settings, and individual differences. *Personality and Social Psychology Bulletin*, *29*(5), 578–583. https://doi.org/10.1177/0146167203029005003

Lucas, R. E., Le, K., & Dyrenforth, P. S. (2008). Explaining the extraversion/positive affect relation: Sociability cannot account for extraverts' greater happiness. *Journal of Personality*, *76*(3), 385–414. https://doi.org/10.1111/j.1467-6494.2008.00490.x

Luhmann, M., Krasko, J., & Terwiel, S. (2021). Subjective well-being as a dynamic construct. In J. F. Rauthmann (Ed.), *The Handbook of Personality Dynamics and Processes* (pp. 1231–1249). Academic Press. https://doi.org/10.1016/B978-0-12-813995-0.00048-0

Luo, M., Macdonald, B., & Hülür, G. (2022). Not "the more the merrier": Diminishing returns to daily face-to-face social interaction frequency for well-being in older age. *The Journals of Gerontology: Series B*, *77*(8), 1431–1441. https://doi.org/10.1093/geronb/gbac010

Luo, M., Pauly, T., Röcke, C., & Hülür, G. (2022). Alternating time spent on social interactions and solitude in healthy older adults. *British Journal of Psychology*, *113*(4), 987–1008. https://doi.org/10.1111/bjop.12586

Luong, G., Wrzus, C., Wagner, G. G., & Riediger, M. (2016). When bad moods may not be so bad: Valuing negative affect is associated with weakened affect–health links. *Emotion*, *16*(3), 387–401. https://doi.org/10.1037/emo0000132

Masur, P. K., & Scharkow, M. (2019). *Specr: Statistical functions for conducting specification curve analyses (version 0.2.1)*. https://github.com/masurp/specr

Matthews, G., Jones, D. M., & Chamberlain, A. G. (1990). Refining the measurement of mood: The UWIST Mood Adjective Checklist. *British Journal of Psychology*, *81*(1), 17–42. https://doi.org/10.1111/j.2044-8295.1990.tb02343.x

Milek, A., Butler, E. A., Tackman, A. M., Kaplan, D. M., Raison, C. L., Sbarra, D. A., Vazire, S., & Mehl, M. R. (2018). “Eavesdropping on happiness” revisited: A pooled, multisample replication of the association between life satisfaction and observed daily conversation quantity and quality. *Psychological Science*, *29*(9), 1451–1462. https://doi.org/10.1177/0956797618774252

Moeller, J., Dietrich, J., Neubauer, A., Brose, A., Kühnel, J., Dehne, M., Jähne, M., Schmiedek, F., Bellhäuser, H., Malmberg, L.-E., Stockinger, K., Riediger, M., & Pekrun, R. (2022). Generalizability crisis meets heterogeneity revolution: Determining under which boundary conditions findings replicate and generalize. *PsyArXiv*. https://doi.org/10.31234/osf.io/5wsna

Mõttus, R., Wood, D., Condon, D. M., Back, M. D., Baumert, A., Costantini, G., Epskamp, S., Greiff, S., Johnson, W., Lukaszewski, A., Murray, A., Revelle, W., Wright, A. G. C., Yarkoni, T., Ziegler, M., & Zimmermann, J. (2020). Descriptive, predictive and explanatory personality research: Different goals, different approaches, but a shared need to move beyond the big few traits. *European Journal of Personality*, *34*(6), 1175–1201. https://doi.org/10.1002/per.2311

Möwisch, D., Schmiedek, F., Richter, D., & Brose, A. (2019). Capturing affective well-being in daily life with the day reconstruction method: A refined view on positive and negative affect. *Journal of Happiness Studies*, *20*(2), 641–663. https://doi.org/10.1007/s10902-018-9965-3

Neubauer, A. B., Voss, A., & Ditzen, B. (2018). Exploring need dynamics within and across days in everyday life: A three-level analysis. *Journal of Research in Personality*, *77*, 101–112. https://doi.org/10.1016/j.jrp.2018.10.001

Nezlek, J. B. (2001). The motivational and cognitive dynamics of day-to-day social life. In J. P. Forgas, K. D. Williams, & L. Wheeler (Eds.), *The social mind: Cognitive and motivational aspects of interpersonal behavior* (pp. 92–111). Cambridge University Press.

Nguyen, T. T., Ryan, R. M., & Deci, E. L. (2018). Solitude as an approach to affective self-regulation. *Personality and Social Psychology Bulletin*, *44*(1), 92–106. https://doi.org/10.1177/0146167217733073

O'Connor, S. C., & Rosenblood, L. K. (1996). Affiliation motivation in everyday experience: A theoretical comparison. *Journal of Personality and Social Psychology*, *70*(3), 513–522. https://doi.org/10.1037/0022-3514.70.3.513

Orben, A., & Przybylski, A. K. (2019). Screens, teens, and psychological well-being: Evidence from three time-use-diary studies. *Psychological Science*, *30*(5), 682–696. https://doi.org/10.1177/0956797619830329

Pauly, T., Lay, J. C., Nater, U. M., Scott, S. B., & Hoppmann, C. A. (2017). How we experience being alone: Age differences in affective and biological correlates of momentary solitude. *Gerontology*, *63*(1), 55–66. https://doi.org/10.1159/000450608

Pinheiro, J. C., & Bates, D. M. (2000). *Mixed-effects models in s and s-PLUS*. Springer. https://doi.org/10.1007/b98882

Podsakoff, P. M., MacKenzie, S. B., Jeong-Yeon, L., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Quoidbach, J., Sugitani, Y., Gross, J. J., Taquet, M., & Akutsu, S. (2019). From affect to action: How pleasure shapes everyday decisions in Japan and the U.S. *Motivation and Emotion*, *43*(6), 948–955. https://doi.org/10.1007/s11031-019-09785-7

Quoidbach, J., Taquet, M., Desseilles, M., de Montjoye, Y.-A., & Gross, J. J. (2019). Happiness and social behavior. *Psychological Science*, *30*(8), 1111–1122. https://doi.org/10.1177/0956797619849666

R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

Rabbi, M., Ali, S., Choudhury, T., & Berke, E. (2011). Passive and in-situ assessment of mental and physical well-being using mobile sensors. *UbiComp'11 - Proceedings of the*

2011 ACM Conference on Ubiquitous Computing, 2011. https://doi.org/10.1145/2030112.2030164

Read, S. J., Monroe, B. M., Brownstein, A. L., Yang, Y., Chopra, G., & Miller, L. C. (2010). A neural network model of the structure and dynamics of human personality. *Psychological Review*, *117*(1), 61–92. https://doi.org/10.1037/a0018131

Ren, D., Stavrova, O., & Loh, W. W. (2021). Nonlinear effect of social interaction quantity on psychological well-being: Diminishing returns or inverted U? *Journal of Personality and Social Psychology*, *122*(6), 1056–1074. https://doi.org/10.1037/pspi0000373

Rohrer, J. M., & Murayama, K. (2022). These are not the effects you are looking for: Causality and the within-/between-person distinction in longitudinal data analysis. *Advances in Methods and Practices in Psychological Science.* https://doi.org/10.31234/osf.io/tg4vj

Roos, Y., Krämer, M. D., Richter, D., Schoedel, R., & Wrzus, C. (2023). Does your smartphone "know" your social life? A methodological comparison of day reconstruction, experience sampling, and mobile sensing. *(Under Review).*

Sandstrom, G. M., & Dunn, E. W. (2014). Social interactions and well-being: The surprising power of weak ties. *Personality and Social Psychology Bulletin*, *40*(7), 910–922. https://doi.org/10.1177/0146167214529799

Schimmack, U. (2008). The structure of subjective well-being. In M. Eid & R. J. Larsen (Eds.), *The science of subjective well-being.* (pp. 97–123). Guilford Press.

Schoedel, R., Kunz, F., Bergmann, M., Bemmann, F., Buehner, M., & Sust, L. (2022). Snapshots of daily life: Situations investigated through the lens of smartphone sensing. *PsyArXiv.* https://doi.org/10.31234/osf.io/f3htz

Schoedel, R., Oldemeier, M., Bonauer, L., & Sust, L. (2022). Systematic categorisation of 3,091 smartphone applications from a large-scale smartphone sensing dataset. *Journal of Open Psychology Data*, *10*(1), 7. https://doi.org/10.5334/jopd.59

Schönbrodt, F. D., & Gerstenberg, F. X. R. (2012). An IRT analysis of motive questionnaires: The Unified Motive Scales. *Journal of Research in Personality, 46*(6), 725–742. https://doi.org/10.1016/j.jrp.2012.08.010

Shaw, H., Ellis, D. A., Geyer, K., Davidson, B. I., Ziegler, F. V., & Smith, A. (2020). Quantifying smartphone "use": Choice of measurement impacts relationships between "usage" and health. *Technology, Mind, and Behavior*, *1*, 1–15. https://doi.org/10.1037/tmb0000022

Sheldon, K. M. (2011). Integrating behavioral-motive and experiential-requirement perspectives on psychological needs: A two process model. *Psychological Review*, *118*(4), 552–569. https://doi.org/10.1037/a0024758

Simonsohn, U., Simmons, J. P., & Nelson, L. D. (2020). Specification curve analysis. *Nature Human Behaviour*, *4*(11), 1208–1214. https://doi.org/10.1038/s41562-020-0912-z

Smillie, L. D., Wilt, J., Kabbani, R., Garratt, C., & Revelle, W. (2015). Quality of social experience explains the relation between extraversion and positive affect. *Emotion*, *15*(3), 339–349. https://doi.org/10.1037/emo0000047

Soto, C. J., & John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*(1), 117–143. https://doi.org/10.1037/pspp0000096

Stachl, C., Au, Q., Schoedel, R., Gosling, S. D., Harari, G. M., Buschek, D., Völkel, S. T., Schuwerk, T., Oldemeier, M., Ullmann, T., Hussmann, H., Bischl, B., & Bühner, M. (2020). Predicting personality from patterns of behavior collected with smartphones. *Proceedings of the National Academy of Sciences*, *117*(30), 17680. https://doi.org/10.1073/pnas.1920484117

Stachl, C., Pargent, F., Hilbert, S., Harari, G. M., Schoedel, R., Vaid, S., Gosling, S. D., & Bühner, M. (2020). Personality research and assessment in the era of machine learning. *European Journal of Personality*, *34*(5), 613–631. https://doi.org/10.1002/per.2257

Stavrova, O., & Ren, D. (2021). Is more always better? Examining the nonlinear association of social contact frequency with physical health and longevity. *Social Psychological and Personality Science*, *12*(6), 1058–1070. https://doi.org/10.1177/1948550620961589

Suls, J., & Martin, R. (2005). The daily life of the garden-variety neurotic: Reactivity, stressor exposure, mood spillover, and maladaptive coping. *Journal of Personality*, *73*(6), 1485–1510. https://doi.org/10.1111/j.1467-6494.2005.00356.x

Sun, J., Harris, K., & Vazire, S. (2020). Is well-being associated with the quantity and quality of social interactions? *Journal of Personality and Social Psychology*, *119*(6), 1478–1496. https://doi.org/10.1037/pspp0000272

Teo, A. R., Choi, H., & Valenstein, M. (2013). Social relationships and depression: Ten-year follow-up from a nationally representative study. *PLOS ONE*, *8*(4), e62396. https://doi.org/10.1371/journal.pone.0062396

Tse, D. C. K., Lay, J. C., & Nakamura, J. (2022). Autonomy matters: Experiential and individual differences in chosen and unchosen solitary activities from three experience sampling studies. *Social Psychological and Personality Science*, *13*(5), 946–956. https://doi.org/10.1177/19485506211048066

Uziel, L., & Schmidt-Barad, T. (2022). Choice matters more with others: Choosing to be with other people is more consequential to well-being than choosing to be alone. *Journal of Happiness Studies*, *23*, 2469–2489. https://doi.org/10.1007/s10902-022-00506-5

Watson, D., & Clark, L. A. (1999). *The PANAS-X: Manual for the positive and negative affect schedule: Expanded form*. The University of Iowa.

Weber, C., Quintus, M., Egloff, B., Luong, G., Riediger, M., & Wrzus, C. (2020). Same old, same old? Age differences in the diversity of daily life. *Psychology and Aging*, *35*(3), 434–448. https://doi.org/10.1037/pag0000407

Wei, T., & Simko, V. (2017). *R package "corrplot": Visualization of a correlation matrix* [R package version 0.84]. https://github.com/taiyun/corrplot

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T. L., Miller, E., Bache, S. M., Müller, K., Ooms, J., Robinson, D., Seidel, D. P., Spinu, V., … Yutani, H. (2019). Welcome to the tidyverse. *Journal of Open Source Software*, *4*(43), 1686. https://doi.org/10.21105/joss.01686

Wrzus, C., Luong, G., Wagner, G. G., & Riediger, M. (2015). Can't get it out of my head: Age differences in affective responsiveness vary with preoccupation and elapsed time after daily hassles. *Emotion*, *15*(2), 257–269. https://doi.org/10.1037/emo0000019

Wrzus, C., & Neubauer, A. B. (2023). Ecological momentary assessment: A meta-analysis on designs, samples, and compliance across research fields. *Assessment*, *30*(3), 825–846. https://doi.org/10.1177/10731911211067538

Wrzus, C., Wagner, G. G., & Riediger, M. (2016). Personality-situation transactions from adolescence to old age. *Journal of Personality and Social Psychology*, *110*(5), 782–799. https://doi.org/10.1037/pspp0000054

Yaremych, H. E., Preacher, K. J., & Hedeker, D. (2021). Centering categorical predictors in multilevel models: Best practices and interpretation. *Psychological Methods*, *Advance online publication*. https://doi.org/10.1037/met0000434

Zygar, C., Hagemeyer, B., Pusch, S., & Schönbrodt, F. D. (2018). From motive dispositions to states to outcomes: An intensive experience sampling study on communal motivational dynamics in couples. *European Journal of Personality*, *32*(3), 306–324. https://doi.org/10.1002/per.2145

Chapter 5

Discussion

2 Discussion

This dissertation comprises three empirical studies that examined relationships between personality, well-being, and social relationships in four longitudinal samples with different levels of temporal resolution (from yearly to hourly). The main research questions that this dissertation aimed to answer were (1) how personality development occurs in middle or old adulthood through the addition of a new social role, namely becoming a grandparent, (2) what role individual differences play in social contact frequency and associated well-being during the lifting of COVID-19-related contact restrictions, and (3) how momentary positive and negative affect are related to dynamics in social contact and social desire, specifically to states of mismatch between experienced social contact and momentary social desire. Thus, the dissertation dealt with two of the three main areas of personality psychology, that is, personality processes and personality development (Baumert et al., 2017).[3]

2.1 Summary of Empirical Findings

2.1.1 Study I

For Study I, we used panel data from two representative panel studies, the Longitudinal Internet Studies for the Social Sciences (LISS) panel from the Netherlands, and the Health and Retirement Study (HRS) from the United States, to analyze first-time grandparents' Big Five and life satisfaction development in terms of mean-level changes, interindividual differences in change, and rank-order stability. We also tested gender, paid employment, and grandchild care as moderators of mean-level changes. To address confounding bias, we used a twofold propensity score matching design matching first-time grandparents with parents as well as with nonparents. This allowed us to address selection effects more comprehensively than previous studies in the sense that parents who eventually become grandparents might

[3] Regarding the third area, personality structure, Baumert et al. (2017) stated that to better understand why certain behaviors co-occur on a structural level (e.g., the behavioral patterns in social relationships subsumed under trait extraversion) we need to identify generative processes of behavior and individual differences in these processes (e.g., in the processes that generate social approach behavior).

already differ from those without any children. Importantly, we also followed guidelines from the causal inference literature to make informed decisions on covariate choice (VanderWeele, 2019; VanderWeele et al., 2020), which we included in the preregistration.

Longitudinal multilevel models demonstrated high stability in mean levels of the Big Five and life satisfaction over the transition to grandparenthood. The few small significant effects of grandparenthood on personality development did not replicate across samples. Importantly, personality development trajectories also did not differ consistently depending on the examined moderators of change including whether grandparents provided a minimal level of grandchild care or not. Contrary to expectations, we also found no consistent evidence for larger interindividual differences in change in the grandparents or for smaller rank-order stability compared to the matched parent or nonparent groups. As discussed in more detail below, these findings can be seen in light of other recent re-examinations of the social investment principle and extend the theoretical discussion to older age groups and a social role that was previously neglected in research on personality development.

2.1.2 Study II

Study II investigated changes in both contact frequency and well-being over a time period of successively eased contact restrictions. Using an age- and gender-heterogeneous online sample, we tested four social traits as potential moderators of these within-person processes—extraversion, affiliation motive, need to be alone, and social anxiety. At the first assessment, we found support for the strong situation hypothesis (Cooper & Withey, 2009; Schmitt et al., 2013). Personal contact was restricted and did not vary with individual differences in social traits as would be expected under other circumstances. Instead, only indirect contact frequency (i.e., calls, video calls, and texts) varied with these individual differences: Extraversion and affiliation motive were associated with a higher frequency of indirect contact (Harari et al., 2019), and social anxiety with a lower frequency of indirect contact possibly due to smaller social networks people could fall back on (Van Zalk et al., 2011) or a lower preference for talking with people on the phone (Lee et al., 2014). In participants' longitudinal trajectories, we found that affiliation motive and need to be alone moderated both steps of the assumed need regulation process: first, the degree by which people resumed personal contacts once governmental contact restrictions were loosened and, second, the effects on well-being that shifts in contact frequency were associated with.

While people with a higher affiliation motive increased their personal contact frequency to a higher degree, people with a higher need to be alone did so to a lower degree. This finding was in line with our preregistered hypotheses and with theoretical considerations of need regulation of social contact: Contact restrictions created an environment that—for most people—deviated from the ideal level of social closeness (Entringer & Gosling, 2022). When the situation opened up and allowed for more opportunities to regulate one's needs effectively, people resumed personal contact. The slope of this increase varied between persons depending on the affiliation motive and need to be alone. Still, we did not find support for all our hypotheses regarding contact frequency. On the one hand, changes in personal contact frequency were not found to be moderated by either extraversion or social anxiety. On the other hand, changes in indirect contact frequency were only moderated by extraversion. The higher people's extraversion the more their indirect contact decreased over time (cf. Montag et al., 2014, 2015).

Results on well-being add insight into how differences in social traits shape our response to the resumption of social contact. Having more frequent personal contact compared to the first assessment under strict lockdown was associated with higher life satisfaction benefits for those with a lower need to be alone. Similarly, engaging in indirect contact more frequently compared to the first assessment was associated with higher life satisfaction benefits for those with a higher affiliation motive. In contrast, people high in trait social anxiety increased in their PHQ-4 score—a marker for depressive and anxiety symptoms—as their personal and indirect contact became more frequent, again.

2.1.3 Study III

In Study III, we used a multi-method approach of assessing indicators of social contact over a period of two days (Friday and Saturday). Social contact, in addition with self-reports of momentary social desire (i.e., the desire for social contact or the desire to be alone), was used to predict states of positive and negative affect. Using an app-based assessment design that combined active experience sampling methodology with passive mobile sensing made it possible to study social dynamics directly in people’s daily lives. The research app unobtrusively tracked participants’ conversation, calling, and app usage behavior.

In the confirmatory analyses of the within-person effects of social dynamics we found that states of social oversatiation were consistently related with decreases in positive affect and increases in negative affect, whereas states of social deprivation were consistently unrelated to affect. The operationalization of these states with a coding scheme of episodes was further scrutinized in preregistered specification curve analyses (Simonsohn et al., 2020). These specification curve analyses provided broad support for our conclusions under various alternative operationalization assumptions. While the episode coding scheme had the advantage of creating a theory-based and easy-to-interpret construct, it had the disadvantage that participants experienced episodes of social deprivation defined in that way rather rarely (which is also theoretically plausible).

In the exploratory analyses, we used multilevel models with linear indicators of social contact frequency, social desire, and their interaction to predict momentary affect (instead of defining distinct states). Exploratory analyses had the additional focus of testing different indicators of social contact derived from experience sampling (personal contact duration) and mobile sensing (proportion of tracked conversations, calling frequency/duration, communication app usage frequency/duration, social media app usage frequency/duration). We found that a higher than usual desire to be alone (when in personal contact) was consistently related to lower affective well-being, whereas a higher desire for social contact (when currently alone) was related to higher affective well-being. It was counter to theoretical expectations that a higher desire for social contact when alone (i.e., the expression of being below the ideal level of social contact) was related to higher affective well-being.

Effects of more than usual social contact were small and few of them were significant in models that also controlled for social desire. For example, self-reported personal contact duration did not remain a significant predictor once social desire variables were added to the model. From the mobile sensing indicators, however, two variables predicted affective well-being in adjusted models: Having more conversations than usual was related to higher positive affect when controlling for the desire to be alone, and engaging in more frequent communication app usage than usual was related to higher negative affect when controlling for the desire for social contact.

From a theoretical standpoint, we were particularly interested in the interaction effects of social contact and social desire on affect in the exploratory models. Theoretically, a higher than usual social desire[4] combined with more frequent social contact than usual would be expected to be associated with increased positive affect and decreased negative affect, whereas mismatches between the two constructs (e.g., lower than usual social desire combined with more frequent social contact) should be associated with decreased positive affect and increased negative affect. However, interaction effects were only significant for negative affect and self-reported personal contact duration, but not for positive affect. Having a higher than usual desire for social contact was associated with a more pronounced decrease

[4] That is, a higher desire for social contact or a lower desire to be alone. Depending on the status of being in contact or alone at the time of the assessment, either of these items was assessed.

in negative affect with longer personal contact. Participants also experienced a more pronounced decrease in negative affect when they had a higher desire to be alone and longer personal contact than usual. This was unexpected based on our theoretical conception of experiencing states of *lower* affective well-being during discrepancies between experienced and desired social contact.[5] No such interaction effects were found for social contact indicators derived from mobile sensing.

2.2 Theoretical Implications

2.2.1 Implications for Research on Personality Development

We comprehensively investigated personality and well-being development over the transition to grandparenthood. Even though we mostly found evidence for stability instead of systematic development of the Big Five and life satisfaction in grandparents, the study makes several contributions to the personality development literature.

First, Study I contrasted previous studies that (inconsistently) reported beneficial effects of grandparenthood on life satisfaction or other well-being outcomes with a new perspective based on a causal inference design. We tested three components of development (mean-level changes, rank-order stability, and interindividual differences in intraindividual change) against matched control groups. Our conclusion is that previously reported effects in unadjusted designs were most likely due to already existing between-person differences (i.e., selection effects into the treatment of grandparenthood) and not due to within-person changes caused by the treatment (Danielsbacka et al., 2019; Sheppard & Monden, 2019).

Second, we tested the previously proposed function of the transition to grandparenthood as an important developmental task for the Big Five in middle or older

[5] While this interaction effect was unexpected from a theoretical standpoint, it was evident from follow-up analyses that the slope of longer than usual personal contact was only significant with a very weak desire to be alone. Further, people with a higher than usual desire to be alone (e.g., at +2 SD) still experienced higher negative affect than those at the mean regardless of how long personal contact lasted (see Study III, Figure 3). Again, this is evidence for the strength of the effects of unwanted social interactions—whether operationalized as social oversatiation or as a higher than usual desire to be alone in the linear models.

adulthood (Hutteman et al., 2014). We did not find evidence for grandparenthood as a cause of development—at least in the more universal, nomothetic sense. Around retirement, recent studies have demonstrated inconsistent results of Big Five mean-level development (Asselmann & Specht, 2021; Schwaba & Bleidorn, 2019). Nevertheless, personality development in middle and old adulthood is still quite prevalent (Seifert et al., 2021; Specht, 2017), even though it remains unclear whether changes in environmental factors or life circumstances systematically cause variation in development. Therefore, it has become clear that new theoretical frameworks or at least major adjustments to theories of personality development for older adulthood are needed. These theories should aim to explain mechanisms of personality development that unfold alongside changes in social relationships and networks (e.g., Huxhold et al., 2022), daily-life routines and responsibilities (e.g., Sander et al., 2021; Weber et al., 2020), as well as physical and cognitive functioning (e.g., J. Luo & Roberts, 2015; Stephan et al., 2018; Wagner et al., 2016; Wettstein et al., 2017).

Third, specifically for the social investment principle, the null results in the context of grandparenthood are another piece of evidence that adds to a growing body of literature challenging the principle across the entire life span. This literature deals with the question whether personality development is caused by life events and environmental transitions that involve the adoption of normative social roles. Despite initial evidence of systematic event-related changes in personality (e.g., Specht et al., 2011), research over the last decade using more diverse data sources and more refined longitudinal designs (Luhmann, Orth, et al., 2014) has given rise to the understanding that within-person mean-level changes (i.e., socialization effects) are generally very small, typically not in line with theoretical predictions of social investment theory (apart from a few exceptions; see Lüdtke et al., 2011; Wagner et al., 2015), and often don't replicate across large-scale panel studies (Bleidorn et al., 2018; Bühler et al., 2023). This dissertation extends this view to a previously under-researched phase of the life span (in terms of social investment).

Several explanations for these diverging and inconsistent findings have been put forward which all point in the same direction—to the existence of large interindividual differences in how people experience and react to changes in environmental factors (Schwaba & Bleidorn, 2018). Some initial work has attempted to address interindividual differences in change: Roberts et and colleagues have extended the theoretical framework of the social investment principle by arguing that individuals differ in how they perceive competency and mastery of acting out new social roles, and that these differences might explain differential development (Roberts & Davis, 2016; Roberts & Nickel, 2017). In a similar vein, Luhmann et al. have developed and tested a multi-faceted dimensional taxonomy of the perception of event-related characteristics (Kritzler et al., 2023; Luhmann, Fassbender, et al., 2021). First results showed, for example, that the perceived valence of a major life event was associated with changes in neuroticism. However, associations between event perceptions and event-related change in these first studies were very small and some of the associations did not replicate across samples (Haehner et al., 2022, 2023). Therefore, additional work is needed to

Thus, to make sense of interindividual differences between grandparents in their change trajectories, we need better insight into how the role of grandparent was executed (behaviorally) and self-perceived (cognitively and affectively). First, grandparents differ widely in how close they are with their children (often also limited by physical distance between residencies) and how involved in grandchild care they become (Condon et al., 2013; Fingerman et al., 2020; Meyer & Kandic, 2017; Thiele & Whelan, 2006). Second, the cognitive and affective appraisal of behavioral changes differs both between and within grandparents. For example, grandparents may perceive additional responsibilities and social involvement as mostly overwhelming. Even before becoming a grandparent, expectations of and longing for grandparenthood have been shown to differ (Dorry et al., 2023).

Lastly, research into motivational and need fulfillment aspects of the grandparent role is lacking (cf. Mackenzie et al., 2018). The transition to grandparenthood could potentially cause shifts to the dynamics of seeking out or avoiding social contact—depending on grandparents' trait-like social needs and their momentary, state-like social dynamics. In other words, grandparents might conceive of contact with their child's family as joyous and alleviating to loneliness (i.e., satisfying social needs) or as burdensome and disturbing to daily routines (i.e., thwarting need satisfaction). Accumulation of these states over time may explain personality development in the long run. It is also to be expected that the time scales in which the accumulation and shift in states occurs differ between people. Taken together, many of the routes for further investigation into effects of grandparenthood require data on a finer time scale and with more variables than general, broad-topic panel studies can provide. To gain these detailed insights into grandparents' daily lives, experience sampling or other ambulatory assessment methods (e.g., mobile sensing; Harari et al., 2015) are needed.

In summary, this dissertation contributes another piece in the puzzle of research on environmental sources of personality development in the form of social investment—specifically in late adulthood during the transition to grandparenthood. The bigger picture, however, remains blurry in the sense that research on social investment has so far failed to comprehensively explain and theoretically integrate interindividual differences in change. Previous research designs based on yearly panel data may be insufficient to achieve this.

2.2.2 Individual Differences in Social Traits Matter for Social Need Regulation, but Only to the Extent the Situation Allows Trait Expression

Compared to behavioral and affective components of personality in social relationships, previous research has also somewhat neglected motivational aspects related to social needs.

This dissertation demonstrates that individual differences in social traits are associated with differences in social need regulation. We specifically showed in Study II that the reuptake of social contact when governmental contact restrictions were gradually eased was moderated by social traits. Further, well-being changed with more social contact compared to the first assessment depending on social traits. However, at the first assessment social contact quantity was not associated with any of the four social traits we examined—an unusual finding considering the pervasive main effects of these traits under normal circumstances (e.g., DeYoung et al., 2013; Hagemeyer et al., 2016). Strong situational demands of governmental contact restrictions and the high threat level of the pandemic constrained the expression of individual differences. Only once infection numbers went down and restrictions were gradually lifted, did social traits act in expected ways, again. For example, participants with a higher affiliation motive resumed personal contact to a greater extent, and participants with high social anxiety were lower in well-being when they resumed personal contact.

Data collection for Study III was undertaken when almost no governmental contact restrictions were in place, anymore. While not a focus of the paper, we found that individual differences in social traits were correlated with the frequency of social deprivation and oversatiation episodes over the study period (see Figure S24, Appendix C). With a higher affiliation motive, participants experienced episodes of social deprivation more frequently over the study period and episodes of social oversatiation less frequently. Conversely, with a higher need to be alone, participants experienced more episodes of social oversatiation and less episodes of social deprivation. This indicates that the situations participants in Study III experienced were not as constrained in terms of their potential for seeking social contact as in Study II at the height of lockdown. Self-report questions on the pandemic situation from the participants confirm this view (data not shown).

Applying the idea of situational constraints to Study I, it is possible that many grandparents would have wished for a higher social investment but were not able to do so on a regular and personal level due to situational constraints such as a long distance between residencies. This might be compensated to some degree by indirect contact (Arpino et al., 2022; Nowland et al., 2017), but probably not to the extent that daily life routines are shifted in a large enough fashion to trigger personality development.

Taken together, the subfields of personality development and personality processes can advance their understanding of individual differences in social relationships by integrating situational variation more tightly into research designs (Horstmann et al., 2021; Kuper, Breil, et al., 2022; Kuper, Garrel, et al., 2022). Both when people react differently to equivalent situations and when they react in the same way to different situations can be informative of the way personality functions and develops. Social relationships are also influenced by the constraints and affordances of the surrounding socio-cultural context and norms that are subject to change across historical time (Drewelies et al., 2019; Huxhold et al., 2022).

2.2.3 Affective Contingencies and the Role of Social Traits for Well-Being Outcomes in Social Need Regulation

In both research on social need regulation (under the term *affective contingencies*) and research on social behavior in the context of the Big Five (usually under the term *differential reactivity*)[6], debate is ongoing whether engaging in social contact is associated with the same well-being benefits for everyone, or whether it differs depending on people's traits. Some have argued that people high in extraversion simply engage in *more* positive social contact which explains their higher positive affect (Lucas et al., 2008; Margolis et al., 2020; Ren et

[6] Although similar questions are asked, there are conceptual differences. The investigation of affective contingencies is more closely tied to the question of whether satisfying one's social needs through social contact has equal well-being benefits, whereas most research on differential reactivity has looked at the relationship between social contact frequency and well-being without evaluative or motivational aspects (e.g., Lucas et al., 2008).

al., 2021). Others have found that experiencing satisfying social contact does indeed feel different depending on the strength of affiliative motives (Dufner et al., 2015, 2023; Kersten et al., 2022).

In Study II, need to be alone and social anxiety moderated the association between increasing personal contact frequency compared to the first assessment and well-being changes. If we assume that the pandemic created an undesirable situation of social deprivation which people wanted to alleviate to regulate their social needs as soon as it was permitted, then we can view the findings on well-being as contrary to Sheldon's (2011) hypothesis that people experience well-being benefits of need satisfaction independent of their social traits. Instead, it is more in line with affective contingencies according to motive disposition theory (McClelland, 1987): People differ in how satisfying need satisfaction feels in the social-affiliative domain (Kersten et al., 2022). At the same time, moderation effect sizes were quite small, and effects were specific to some of the social traits we examined.

The fine-grained assessment schedule of the two-day design in Study III allowed for a more detailed investigation of how social need regulation operates dynamically within persons. Unlike some of the previous research on affective contingencies (Dufner et al., 2015; Kersten et al., 2022), we examined how states of social need *dissatisfaction* were experienced affectively. We tested affiliation motive, neuroticism, extraversion, sociability, and need to be alone as moderators and found that these traits did not moderate how people experienced social deprivation and social oversatiation affectively (see specification curve analyses, Figures S4-S15, Appendix C). Due to the very infrequent occurrence in the sample, we were unfortunately unable to study the recovery from these states of need dissatisfaction in Study III, as originally planned (see preregistration, https://osf.io/4syhg). Still, the principle of affective contingencies would predict differential affective experiences for states of dissatisfaction, too (see also the discussion in Dufner et al., 2023).

Related to the previous discussion point, another possibility should also be pointed out for social oversatiation, where we consistently found main effects on affect (unlike for social deprivation) but no moderation by social traits. The types of situations that induced social oversatiation were potentially quite restrictive and did not allow for individual differences due to social traits in the affective reactions to unfold in the time frames we examined. Still, affective contingencies might have occurred with a temporal delay similar to exhaustion states that previous research has shown to occur roughly three hours after highly extraverted behavior (Leikas, 2020; Leikas & Ilmarinen, 2017). Future studies could further investigate the role of situational demands with our data.

Taken together, this dissertation underlines that the investigation of affective contingencies using observational experience sampling data requires nuance regarding (1) the timing of need regulation processes, (2) situational demands and the voluntariness of social contact, and (3) the specificity of the different social traits, that is, which of the empirically overlapping social traits theory predicts to moderate which processes.

2.2.4 Dynamic Processes of Social Need Regulation Matter for Affective Well-Being

Another important contribution of this dissertation is that it shows the relevance of social need regulation processes for momentary affective well-being (Hall & Davis, 2017; O'Connor & Rosenblood, 1996). Study III found that experiencing even short states of social oversatiation was consistently associated with decreases in positive affect and increases in negative affect. This affective decline replicated in the exploratory analyses when participants reported a higher than usual desire to be alone. Although Study II did not directly assess affect, the PHQ-4 measure of depression/anxiety overlaps with negative affect. Here, increases in social contact frequency relative to the time when strict governmental contact restrictions were in place were associated with worse well-being outcomes for people depending on their social traits. This finding could be interpreted as unwanted social contact when people still desired solitude—either as a health precaution or because they preferred spending less time with others outside their own household.

Therefore, the results of this dissertation fit in with the emerging literature on preference for solitude (Choi et al., 2023; Coplan et al., 2019; Nguyen et al., 2021; Tse et al., 2022; Uziel & Schmidt-Barad, 2022) and findings of diminished returns in well-being when people are at the higher end of social contact quantity (M. Luo et al., 2022; Ren et al., 2021; Stavrova & Ren, 2021). Especially because the effects of social oversatiation and a higher desire to be alone on affective well-being were so consistent, they are worth to be studied in more detail. At this point, several questions remain regarding the specific makeup of social interactions that contribute to social oversatiation. Contextual factors such as the types of social activities and the relationship categories of the involved persons relate to the quality of social interactions and can potentially explain under which conditions these social dynamics emerge.

Opposite of voluntary solitude, research has established loneliness (i.e., perceived social isolation) as a serious public health issue with important societal consequences (Beller, 2023; Hawkley & Cacioppo, 2010; Holt-Lunstad et al., 2015, 2017). Measures of loneliness like the UCLA Loneliness Scale (Russell, 1996) inherently cover the motivational aspect of social needs (e.g., “I lack companionship”) but do not distinguish it clearly from behavioral and affective aspects. Beyond loneliness research, studies on social contact and relationships have often neglected motivational aspects focusing on quantity of contact or sometimes qualitative aspects such as pleasantness instead. This dissertation encourages future research to include assessments of people’s social needs (as a motivational trait) and their momentary social desire (as motivational states), separately from quantitative and qualitative aspects of actual social interactions. States that are highly relevant to affect such as social oversatiation could otherwise be missed or only picked up indirectly by way of nonlinear relationships of social contact quantity and well-being (Ren et al., 2021; Stavrova & Ren, 2021).

2.3 Methodological Implications

One strength of Study I was the use of two panel studies with different time lags between assessments and different strengths and weaknesses in their design. While the conclusions from both studies were highly similar, this is not necessarily always the case and using data with several different assessment schedules may reveal critical information on the time scale on which processes of development operate (Hopwood et al., 2022). Additionally, this approach lends itself to examine cross-cultural differences in personality development (Bleidorn et al., 2013; Chopik et al., 2020; Chopik & Kitayama, 2018; Kitayama et al., 2020). For some research questions, the approach can be extended to a coordinated data analysis of multiple panel studies (Graham et al., 2022) or mega-analysis (Beck & Jackson, 2022a). This would help generate even more extensive knowledge on the generalizability of the findings.

Another strength of the data sources included in this dissertation is the combined use of experience sampling methodology (actively collected self-report data) and mobile sensing (passively collected behavioral trace data) to study social dynamics and affect in Study III. One advantage of assessing social contact passively with mobile sensing is avoiding common-method bias (Podsakoff et al., 2003) when one analyzes social contact jointly with self-reported momentary social desire, affect, or other self-report variables. Using self-report measures exclusively also limits the types of research questions that can be addressed because of the limited temporal resolution (Bleidorn, Hopwood, Back, et al., 2020) and the high participant burden and demand characteristics many repeated assessments exert (Wrzus & Neubauer, 2023). In addition, mobile sensing indicators gave insights into social dynamics in daily life beyond in-person contact and in more detail than self-report measures of indirect contact provided. Therefore, the potential of using mobile sensing measures of behavior for studying personality processes is high (Geukes et al., 2018; Harari et al., 2020; Stachl et al., 2020).

At the same time, the field just started to establish best practices of assessment using mobile sensing and to evaluate agreement of sensing measures with other methods (Roos et al., in press). This dissertation also made some progress in creating preprocessing pipelines of mobile sensing data (building on Schoedel, Kunz, et al., 2022) and devising blueprints for analysis designs. Results based on the mobile sensing indicators of social contact may also provide comparative benchmarks for future studies that aim to reduce participant burden by relying on mobile sensing and including fewer self-report questions. This is especially relevant for research on social dynamics that requires many data points to be able to model temporal effects unfolding over short time spans. Still, a lot of work remains to be done in determining optimal practices with these types of data (Roos et al., in press; Struminskaya et al., 2020), for example, how to best aggregate continuous app usage data in relation to the construct of interest.

Another important methodological consideration when analyzing longitudinal data is the separation of between-person and within-person variation. Different methods exist to achieve this separation such as fixed-effects regression (McNeish & Kelley, 2019), centering in multilevel (mixed) models (Hoffman, 2020; Hoffman & Walters, 2022), or random intercept cross-lagged panel models (Hamaker et al., 2015; Mulder & Hamaker, 2020). The main research interests of this dissertation concerned within-person processes and their moderation by relatively stable traits. In Studies II and III, we used person-mean centering and baseline centering in multilevel models, that is, two variations of variable-centering (Hoffman, 2015, 2019). It has also recently been shown that even binary and categorical variables that vary within persons should ideally be centered to avoid blended estimates of within- and between-person variation (Yaremych et al., 2021). In Study III, which used binary dummy predictor variables, we added this as a robustness check and found highly similar results. In the future, substantive and methodological research should continue to engage in close dialogue about best practices of research when investigating dynamic processes and development.

2.4 Practical Implications

When thinking about the practical relevance of the results of this dissertation, first of all, caution should be taken because many effects were comparatively small and await replication in independent samples. Still, basic research can over time become part of a larger picture that informs applied research, interventions, or policy. Interventions to combat loneliness (Grillich et al., 2023) or to foster voluntary personality change (Hudson et al., 2019; Hudson & Fraley, 2015) also rely on insights on how personality functions in daily life and develops over the life span. Furthermore, research has pointed out the importance of personality traits to enhance our understanding of mental health issues (Hopwood et al., 2012; Kendler & Myers, 2010; Kotov et al., 2010; Waszczuk et al., 2022; see also, Bleidorn et al., 2019; Bleidorn, Hopwood, Ackerman, et al., 2020). For example, identifying the processes by which social deprivation and social oversatiation influence affective well-being may help design more extensive studies on the conditions in which states of social need dissatisfaction accumulate over weeks and months and potentially lead to social isolation later and loneliness or depression.

In Study II, we found that people with different traits differed in their reaction to the COVID-19 pandemic. Contact restrictions which were put in place to safeguard against mass infections also affected our social lives and constrained opportunities for social activities. As a potential side effect, social isolation and loneliness became concerns with mental health ramifications for many people (Buecker & Horstmann, 2021; Entringer et al., 2020; Entringer & Gosling, 2022). While the expression of social traits was constrained during contact restrictions, we showed that social traits still played a role in social need regulation, especially once people successively resumed personal contacts. Together with other research demonstrating the role of personality during the COVID-19 pandemic (Anglim & Horwood, 2021; Götz et al., 2021; H. Peters et al., 2022; Zettler et al., 2022), these findings have practical implications for future pandemics that require social contact restrictions. Public health interventions might be tailored to encourage adherence to contact restrictions or vaccination uptake among diverse populations with different trait profiles. Individuals high in social anxiety likely react differently to a public health information campaign designed with people with a strong affiliation motive in mind.

The current dissertation also reinforces recent proposals for collaborative efforts in social relationships and personality research (Back et al., 2023; Bleidorn, Hopwood, Back, et al., 2020; Finnigan & Vazire, 2017). Large intensive-longitudinal and multi-method data sets are needed to explore boundary conditions of small effects across different types of person-situation interactions. Pooling several data sources that rely on similar setups for data collection could make this possible.

2.5 Limitations

Besides the limitations already mentioned in the three studies, a few additional ones are relevant in the broader context of this dissertation. First, the investigation of personality development in Study I relied solely on self-report personality data and did neither include other-reports by family members or friends (Luan et al., 2017; McCrae, 2018; McCrae & Mõttus, 2019; Mõttus et al., 2019; Schwaba et al., 2022) nor more direct behavioral measures. Thus, our results might be influenced by common method bias (Podsakoff et al., 2003). It is conceivable that grandparents' development occurred on a behavioral level that was recognizable to close others but was not internalized to the degree to be reflected in self-reports. Large-scale panel data incorporating both self- and other-reports of personality over time would be needed to address this issue (e.g., Oltmanns et al., 2020).

It has also been pointed out that life events or role transitions often do not occur as isolated instances (e.g., considering the sequence cohabitation, marriage, and childbirth) and need to be viewed in the context of other concurrent and preceding life events (Kettlewell et al., 2020; Krämer et al., 2023; Luhmann, Orth, et al., 2014). For grandparenthood, retirement, loss of a partner, and serious illness or disability are particularly relevant co-occurring life events (Arpino & Bellani, 2022; Tanskanen et al., 2021). We addressed confounding by time-stable covariates through the propensity score matching design (e.g., retirement status at the time of matching). Still, confounding by time-varying covariates such as changes in health or socio-economic status (e.g., entering retirement in the same year as becoming a grandparent) was not addressed in our design.[7] It could be the case that differences in these time-varying confounds give rise to the large event-related interindividual differences in change.

A more conceptual critique concerns the way that personality processes are studied in conjunction with traits. Several authors have pointed out the issue of fuzzy concepts of the structure of stable individual differences in personality processes research (Back, 2021; Baumert et al., 2017, 2019). For example, if a self-report measure of extraversion asks about tendencies of sociability (e.g., "I am someone who is outgoing, sociable" in BFI-2, see Soto & John, 2017) and is used to explain variance in social interaction processes, the underlying logic might become circular. As Baumert et al. stated, "traits cannot serve as explanations for those behaviours they summarize" (2017, p. 512). This concern might also matter for the interpretation of results in Study III where we tested moderation by social traits (e.g., extraversion, affiliation motive) of the effect of social dynamics on momentary affect. In this

[7] Research designs from the causal inference literature such as inverse probability of treatment weighting can flexibly control for time-varying confounds but require careful deliberation of the underlying causal structure and the way it is unfolding over time (Thoemmes & Ong, 2016).

case, I would argue that we don't necessarily run into the problem described above because the concepts of social dynamics we tested dealt with mismatches between actual social interactions and momentary social desire. Thus, they contained both a behavioral and a motivational component, reducing conceptual overlap. Still, when investigating affective contingencies, higher conceptual precision is needed (Baumert et al., 2017) concerning both the time frames on which social dynamics are assumed to operate as well as the nomological net of different measures.

Finally, for Studies II and III, we recruited age- and gender-heterogeneous samples in view of age differences in both daily-life social and affective experiences and, specifically for Study II, well-being reactions to the COVID-19 pandemic (Carstensen et al., 2011, 2020; Charles & Luong, 2013; Luong et al., 2010; Weber et al., 2020). Collecting data online ensured that recruitment was possible and safe in times of the COVID-19 pandemic and not geographically limited to the surrounding area of the involved institutions. Still, relying on samples recruited mostly online might hinder representativeness and external validity of the results compared to a probability sample of the population as often drawn for large scale panel studies (Mercer et al., 2017; Newman et al., 2021). This would be problematic if factors influencing selection into the sample (e.g., higher openness to experience) were also causally related to the processes under study (Elwert & Winship, 2014; Rohrer, 2023). To investigate this comprehensively, we can use data from the second part of the data collection effort of the mobile sensing project which ran in the SOEP Innovation Sample (SOEP-IS; Richter & Schupp, 2015) at the end of 2022. All respondents interviewed in wave 2022 were invited to take part in the additional 14-day mobile sensing study. Based on this sample, we can investigate whether the willingness to participate in a mobile sensing study relates to socio-demographic and personality factors (for preregistration, see Schoedel, Krämer, et al., 2022).

2.6 Reflection on Dissertation Research

Before moving on to future directions, I want to briefly reflect on my dissertation research from a research practices perspective, that is, to share a few of the challenges and lessons learned. First, just under five months after the start of my PhD, the COVID-19 pandemic caused us to reassess the original time schedule of the DFG-funded "DIPS" project that had the purpose to use mobile sensing in the study of personality and social relationship dynamics. Instead of altering the goals of the project, we postponed data collection to be able to assess social dynamics under "normal", unrestricted circumstances as originally planned. This coincided with a one-year gap in data collection in the SOEP-IS in 2021 for financial reasons. Thus, instead of completing data collection in the first half of the PhD, we moved it to the second half. Consequently, the paper on grandparenthood shifted from being a side project to the foreground of the dissertation. To make use of the unique opportunity that widespread governmental contact restrictions presented for research into social need regulation, we also planned an impromptu data collection effort with an online sample in the spring of 2020. Thus, one lesson I would take with me would be to react spontaneously but not rashly to changed circumstances to conduct research.

Second, as someone with initial experience of working with the SOEP data, this dissertation involved a much greater extent of data cleaning and preprocessing than I was involved in previously. The HRS and LISS data provided valuable sources of information to study grandparents' personality development but were in many ways less user-friendly and less well documented than the SOEP data. The data from the research app that recorded experience sampling and mobile sensing data, however, posed much greater challenges in data preprocessing. Working together with the people who had developed the app at LMU Munich and had already written some functions to extract features from the mobile sensing data, meant that we could adapt parts of this code to our use case. Still, every new study brings along its own unexpected problems. For example, even though the experience sampling data recorded through the app was more straightforward to clean than the mobile sensing data, we encountered unexpected duplicate questionnaire entries and timestamp issues here. Throughout, it was helpful to stick to principles such as communicating regularly with collaborators, annotating and documenting code carefully, and using Git for version control and collaborative coding efforts. The learning curve for this preprocessing work was at times quite steep. In my opinion, psychology can do a better job in teaching students (B.Sc., M.Sc., and PhD) not only statistics but also applied programming for the social sciences ("data science"), even if it is only done as elective modules. Such skills are highly advantageous for various careers in and outside of academia. In the end, it is the responsibility of publicly funded research to be able to produce not only replicable but also computationally reproducible and transparent scientific output, which increasingly relies on sophisticated types of data collection, preprocessing, and modeling (McElreath, 2020).

Third, for all three studies contained in this dissertation we followed open science principles (i.e., open data, open materials, preregistration; see Crüwell et al., 2019). This proved to be both challenging and rewarding. Preregistering analyses before data collection was challenging for the mobile sensing study because, at the time, we were still unsure what types of variables we would extract from the mobile sensing data and at which temporal level we would aggregate them. Therefore, in the submitted paper we ran both confirmatory and exploratory analyses which worked out well for gaining insights into the phenomena of interest but was tricky for the flow of a manuscript that also needs to adhere to a word limit. Further, we publicly shared the aggregated and deidentified data as well as all relevant data preprocessing scripts for Study III but could not share access to the server containing the mobile sensing raw data to prevent identification of participants. Thus, ensuring that no identification of participants would be possible from the shared materials and data proved to be another challenge when working with the mobile sensing data. For all three papers, I attempted to create manuscripts that are fully reproducible from the data using R Markdown and the 'papaja' package (Aust & Barth, 2020). The main challenge for this proved to be differences in the local computing environments and intermittent updates to R packages. As a first step to further bolster reproducibility, I used the 'renv' package (Ushey, 2022) in Studies II and III to implement version control for R package dependencies. However, more extensive frameworks for computationally reproducible research exist which, for example, also include the containerization software Docker to safeguard against basic differences between or changes in the computing environment (Peikert et al., 2021; Peikert & Brandmaier, 2021).

Avenues for Future Research

The findings of Study III raise the question of the directionality of effects over time, that is, whether it is primarily social contact that influences subsequent affect or the other way around, and how momentary social desire plays into this relationship. In a recent study, reciprocal relationships between basic need satisfaction and affect surfaced in one of the two samples, whereas the other sample indicated that variation in positive affect predicted need satisfaction but not vice versa (Unanue et al., 2023). Another study provided evidence that associations between satisfaction with social contact and momentary affect are bidirectional over time (Liu et al., 2021). Network analyses (or Gaussian graphical models) can investigate relationships between multiple variables using partial correlations in a multivariate space (Epskamp et al., 2018; Jordan et al., 2020). Using time-series data, network analyses (e.g., multi-level graphical autoregression models) estimate three types of networks: a temporal within-person network that indicates lagged directed relationships between variables, a contemporaneous within-person network that indicates undirected relationships between variables at the same time point, and a between-person network that indicates undirected relationships at the person level (for recent applications, see daSilva et al., 2021; Fischer & Karl, 2022).

For Study III, we aggregated four emotion items to form scores of positive affect (“happy”, “relaxed”, “energetic”, and “content”) and negative affect (“angry”, “downcast”, “disappointed”, and “nervous”), respectively. However, it might also be informative to investigate discrete emotions, instead, especially with a research focus on life span differences. Theoretical predictions from the life span theory of discrete emotions (Kunzmann et al., 2014) and the strength and vulnerability integration model (SAVI; Charles, 2010; Charles & Luong, 2013) state that daily emotional experiences vary with age—in particular when examining affective well-being on the level of discrete emotions—and that the ability to regulate emotions generally increases with age. The emotions anger and sadness that are aggregated as negative affect in the case of Study III develop differently across the life span (Kunzmann et al., 2014). In short, anger is particularly prevalent in younger adults, whereas sadness becomes more prevalent in old age. Future research should examine how situational triggers relate to the experience of discrete emotions such as anger and sadness in different age groups, and how social resources can be used to effectively regulate emotion (Charles & Luong, 2013). For example, it is hypothesized that sadness is often triggered by low perceived situational control.

Finally, as described in the introduction, the ideal design to bridge the gap between personality processes and personality development would be a measurement burst design (e.g., Neubauer, Smyth, et al., 2018; Quintus et al., 2021; Wrzus et al., 2021). This type of design combines the features of a long-term longitudinal study with repeated phases of intensive experience sampling measurement and allows for the separation of different sources of variation in within-person variability. Several design decisions need to be weighed when devising a measurement burst design to investigate the development of traits relevant for social contexts (e.g., extraversion) through shifts in social behavioral states and associated internal reflections (see Wrzus & Roberts, 2017). One important take-away from this dissertation is the benefit of combining several methods of assessing social behavior. Including more objective behavioral measures has the advantages that we get closer to actual behavior by avoiding self-report biases and prevent common methods bias in conjunction with self-report measures. For some constructs such as affect or reflective processes, that require internal psychological insights, self-report methods are still indispensable.[8]

Another important point for a measurement burst design is a high temporal resolution of measures that are taken in daily life without much retrospective bias. Both can be achieved by using mobile phones as assessment devices and combining active experience sampling methods and passive mobile sensing during the measurement burst phases of the design (Finnigan & Vazire, 2017). The temporal sequencing and length of the different measurement burst phases also plays a central role because they determine whether the processes of interest can be uncovered (Sliwinski, 2008). To sample social interaction dynamics within each measurement burst, assessment periods of at least one but preferably two weeks or more are needed because social rhythms often follow weekly cycles. Gaps between the measurement burst phases can be several months long and should span at least two to three years in total (see Borghuis et al., 2020; Wrzus et al., 2021). In addition, a relatively long follow up after the last measurement burst of at least two years would help determine if perhaps only the demand characteristics of the study facilitated transient trait change or if traits really changed sustainably. Although the study is not as an intervention per se, it is also advisable to ask people in the beginning about their intentions to change their personality towards an ideal state. Research on volitional personality change interventions has shown that these implementation intentions can relate to actual change in traits (Allemand & Flückiger, 2017;

[8] More advanced algorithms may detect reliable signal in affect based on text and audio features.

Hudson & Fraley, 2015; cf. Quintus, 2019). One of the challenges with measurement burst designs is participant attrition over time. To combat this, regular contact with participants should be established (e.g., with updates on first study results) and compensation should reward protocol adherence throughout.

2.7 General Conclusion

Social relationships are central to human well-being and shape the way that individuals organize their lives. Personality psychology recognizes the universality of social needs and the general importance of meaningful social contact across the whole life span, but also emphasizes that differences exist between people in how much social contact they seek and engage in, how much well-being they derive from social experiences, and how their social tendencies develop over time. These differences are important research subjects because they ultimately define us as unique individuals who are able to strive in different sets of situations and broader social contexts and adapt to changes in them. The current dissertation examined interrelations between personality and social relationships from three angles to give insight on both personality development over several years and personality processes over months and days in daily life.

- Study I tested the social investment principle of personality development in first-time grandparents and found no consistent evidence for systematic development of the Big Five personality traits and life satisfaction through the adoption of the grandparent social role.
- Study II examined changes in social contact frequency and associated well-being during contact restrictions due to the COVID-19 pandemic that were successively relaxed over several months. Social traits moderated how quickly participants resumed in-person contact (moderators: affiliation motive, need to be alone) and

how their well-being changed with increased contact (moderators: need to be alone, social anxiety).

- Study III investigated how processes of short-term social dynamics in the form of mismatches between social desire and actual social contact are associated with positive and negative affect in daily life. Experience sampling reports indicated that social oversatiation was consistently related to lower positive affect and higher negative affect, whereas social deprivation was not associated with changes in affective well-being. In addition, exploratory models tested different indicators of social contact assessed with mobile sensing as predictors of affective well-being and showed small within-person effects of above-average conversation frequency and communication app usage. Exploratory models also generally corroborated the importance of (self-reported) momentary social desire for affective well-being.

As mapped out above, future research should aim to use the insights of this dissertation to devise more sophisticated research designs that can integrate the perspectives of personality processes and personality development. This dissertation also endorses the adoption of a more inclusive framework of personality organized along ABCD domains (affect, behavior, cognition, desire; Wilt & Revelle, 2015) as well as the collection of multi-method intensive longitudinal data with behavioral assessments through mobile sensing.

References for Chapters 1 and 5

Allemand, M., & Flückiger, C. (2017). Changing personality traits: Some considerations from psychotherapy process-outcome research for intervention efforts on intentional personality change. *Journal of Psychotherapy Integration*, *27*, 476–494. https://doi.org/10.1037/int0000094

Anglim, J., & Horwood, S. (2021). Effect of the COVID-19 pandemic and Big Five personality on subjective and psychological well-being. *Social Psychological and Personality Science*, *12*(8), 1527–1537. https://doi.org/10.1177/1948550620983047

Anglim, J., Horwood, S., Smillie, L. D., Marrero, R. J., & Wood, J. K. (2020). Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychological Bulletin*, *146*(4), 279–323. https://doi.org/10.1037/bul0000226

Antonucci, T. C., Ajrouch, K. J., & Birditt, K. S. (2014). The convoy model: Explaining social relations from a multidisciplinary perspective. *The Gerontologist*, *54*(1), 82–92. https://doi.org/10.1093/geront/gnt118

Anusic, I., & Schimmack, U. (2016). Stability and change of personality traits, self-esteem, and well-being: Introducing the meta-analytic stability and change model of retest correlations. *Journal of Personality and Social Psychology*, *110*(5), 766–781. https://doi.org/10.1037/pspp0000066

Appel, M., Marker, C., & Gnambs, T. (2020). Are social media ruining our lives? A review of meta-analytic evidence. *Review of General Psychology*, *24*(1), 60–74. https://doi.org/10.1177/1089268019880891

Aravindakshan, A., Boehnke, J., Gholami, E., & Nayak, A. (2020). Preparing for a future COVID-19 wave: Insights and limitations from a data-driven evaluation of non-pharmaceutical interventions in Germany. *Scientific Reports*, *10*(1), 20084. https://doi.org/10.1038/s41598-020-76244-6

Arpino, B., & Bellani, D. (2022). Juggling grandchild care and labor force participation: The effect on psychological wellbeing of older women. *Frontiers in Sociology*, *6*. https://www.frontiersin.org/article/10.3389/fsoc.2021.806099

Arpino, B., Meli, E., Pasqualini, M., Tomassini, C., & Cisotto, E. (2022). Determinants of grandparent–grandchild digital contact in Italy. *Genus*, *78*(1), 20. https://doi.org/10.1186/s41118-022-00167-5

Asselmann, E., & Specht, J. (2020). Taking the ups and downs at the rollercoaster of love: Associations between major life events in the domain of romantic relationships and the Big Five personality traits. *Developmental Psychology*, *56*(9), 1803–1816. https://doi.org/10.1037/dev0001047

Asselmann, E., & Specht, J. (2021). Personality maturation and personality relaxation: Differences of the Big Five personality traits in the years around the beginning and ending of working life. *Journal of Personality*, *89*(6), 1126–1142. https://doi.org/10.1111/jopy.12640

Aust, F., & Barth, M. (2020). *papaja: Prepare reproducible APA journal articles with R Markdown* [R package version 0.1.0.9997]. https://github.com/crsh/papaja/

Back, M. D. (2015). Opening the process black box: Mechanisms underlying the social consequences of personality. *European Journal of Personality*, *29*(2), 91–96. https://doi.org/10.1002/per.1999

Back, M. D. (2021). Social interaction processes and personality. In J. F. Rauthmann (Ed.), *The Handbook of Personality Dynamics and Processes*. Elsevier. https://psyarxiv.com/evm4n/

Back, M. D., Baumert, A., Denissen, J. J. A., Hartung, F.-M., Penke, L., Schmukle, S. C., Schönbrodt, F. D., Schröder-Abé, M., Vollmann, M., Wagner, J., & Wrzus, C. (2011). PERSOC: A unified framework for understanding the dynamic interplay of personality and social relationships. *European Journal of Personality*, *25*(2), 90–107. https://doi.org/10.1002/per.811

Back, M. D., Branje, S., Eastwick, P. W., Human, L. J., Penke, L., Sadikaj, G., Slatcher, R. B., Thielmann, I., Zalk, M. H. W. van, & Wrzus, C. (2023). Personality and social relationships: What do we know and where do we go. *Personality Science*, *4*, 1–32. https://doi.org/10.5964/ps.7505

Back, M. D., & Vazire, S. (2015). The social consequences of personality: Six suggestions for future research. *European Journal of Personality*, *29*(2), 296–307. https://doi.org/10.1002/per.1998

Baird, B. M., Lucas, R. E., & Donnellan, M. B. (2010). Life satisfaction across the lifespan: Findings from two nationally representative panel studies. *Social Indicators Research*, *99*(2), 183–203. https://doi.org/10.1007/s11205-010-9584-9

Bartram, D. (2021). Age and life satisfaction: Getting control variables under control. *Sociology*, *55*(2), 421–437. https://doi.org/10.1177/0038038520926871

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Baumert, A., Schmitt, M., & Perugini, M. (2019). Towards an explanatory personality psychology: Integrating personality structure, personality process, and personality development. *Personality and Individual Differences*, *147*, 18–27. https://doi.org/10.1016/j.paid.2019.04.016

Baumert, A., Schmitt, M., Perugini, M., Johnson, W., Blum, G., Borkenau, P., Costantini, G., Denissen, J. J. A., Fleeson, W., Grafton, B., Jayawickreme, E., Kurzius, E., MacLeod, C., Miller, L. C., Read, S. J., Roberts, B., Robinson, M. D., Wood, D., & Wrzus, C. (2017). Integrating personality structure, personality process, and personality development. *European Journal of Personality*, *31*(5), 503–528. https://doi.org/10.1002/per.2115

Beck, E. D., & Jackson, J. J. (2020). Idiographic traits: A return to Allportian approaches to personality. *Current Directions in Psychological Science*, *29*(3), 301–308. https://doi.org/10.1177/0963721420915860

Beck, E. D., & Jackson, J. J. (2022a). A mega-analysis of personality prediction: Robustness and boundary conditions. *Journal of Personality and Social Psychology*, *122*(3), 523–553. https://doi.org/10.1037/pspp0000386

Beck, E. D., & Jackson, J. J. (2022b). Idiographic personality coherence: A quasi experimental longitudinal ESM study. *European Journal of Personality*, *36*(3), 391–412. https://doi.org/10.1177/08902070211017746

Beck, E. D., & Jackson, J. J. (2022c). Detecting idiographic personality change. *Journal of Personality Assessment*, *104*(4), 467–483. https://doi.org/10.1080/00223891.2021.1984246

Beller, J. (2023). Loneliness and mortality: The moderating effect of positive affect. *Applied Psychology: Health and Well-Being*, *Advance online publication*. https://doi.org/10.1111/aphw.12354

Bengtson, V. L. (2001). Beyond the nuclear family: The increasing importance of multigenerational bonds. *Journal of Marriage and Family*, *63*(1), 1–16. https://doi.org/10.1111/j.1741-3737.2001.00001.x

Bleidorn, W. (2012). Hitting the road to adulthood: Short-term personality development during a major life transition. *Personality and Social Psychology Bulletin*, *38*(12), 1594–1608. https://doi.org/10.1177/0146167212456707

Bleidorn, W. (2015). What accounts for personality maturation in early adulthood? *Current Directions in Psychological Science*, *24*(3), 245–252. https://doi.org/10.1177/0963721414568662

Bleidorn, W., Hill, P. L., Back, M. D., Denissen, J. J. A., Hennecke, M., Hopwood, C. J., Jokela, M., Kandler, C., Lucas, R. E., Luhmann, M., Orth, U., Wagner, J., Wrzus, C., Zimmermann, J., & Roberts, B. W. (2019). The policy relevance of personality traits. *American Psychologist*, *74*(9), 1056–1067. https://doi.org/10.1037/amp0000503

Bleidorn, W., Hopwood, C. J., Ackerman, R. A., Witt, E. A., Kandler, C., Riemann, R., Samuel, D. B., & Donnellan, M. B. (2020). The healthy personality from a basic trait perspective. *Journal of Personality and Social Psychology*, *118*(6), 1207–1225. https://doi.org/10.1037/pspp0000231

Bleidorn, W., Hopwood, C. J., Back, M. D., Denissen, J. J. A., Hennecke, M., Hill, P. L., Jokela, M., Kandler, C., Lucas, R. E., Luhmann, M., Orth, U., Roberts, B. W., Wagner, J., Wrzus, C., & Zimmermann, J. (2021). Personality trait stability and change. *Personality Science*, *2*(1), 1–20. https://doi.org/10.5964/ps.6009

Bleidorn, W., Hopwood, C. J., Back, M. D., Denissen, J. J. A., Hennecke, M., Jokela, M., Kandler, C., Lucas, R. E., Luhmann, M., Orth, U., Roberts, B. W., Wagner, J., Wrzus, C., & Zimmermann, J. (2020). Longitudinal experience–wide association studies—A framework for studying personality change. *European Journal of Personality*, *34*(3), 285–300. https://doi.org/10.1002/per.2247

Bleidorn, W., Hopwood, C. J., & Lucas, R. E. (2018). Life events and personality trait change. *Journal of Personality*, *86*(1), 83–96. https://doi.org/10.1111/jopy.12286

Bleidorn, W., Kandler, C., & Caspi, A. (2014). The behavioural genetics of personality development in adulthood—Classic, contemporary, and future trends. *European Journal of Personality*, *28*(3), 244–255. https://doi.org/10.1002/per.1957

Bleidorn, W., Klimstra, T. A., Denissen, J. J. A., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2013). Personality maturation around the world: A cross-cultural examination of social-investment theory. *Psychological Science*, *24*(12), 2530–2540. https://doi.org/10.1177/0956797613498396

Bleidorn, W., & Schwaba, T. (2017). Personality development in emerging adulthood. In J. Specht (Ed.), *Personality Development Across the Lifespan* (pp. 39–51). Academic Press. https://doi.org/10.1016/B978-0-12-804674-6.00004-1

Bleidorn, W., Schwaba, T., Zheng, A., Hopwood, C. J., Sosa, S. S., Roberts, B. W., & Briley, D. A. (2022). Personality stability and change: A meta-analysis of longitudinal studies. *Psychological Bulletin*, *148*, 588–619. https://doi.org/10.1037/bul0000365

Blum, G. S., Rauthmann, J. F., Göllner, R., Lischetzke, T., & Schmitt, M. (2018). The Nonlinear Interaction of Person and Situation (NIPS) Model: Theory and Empirical Evidence. *European Journal of Personality*, *32*(3), 286–305. https://doi.org/10.1002/per.2138

Borghuis, J., Bleidorn, W., Sijtsma, K., Branje, S., Meeus, W. H. J., & Denissen, J. J. A. (2020). Longitudinal associations between trait neuroticism and negative daily experiences in adolescence. *Journal of Personality and Social Psychology*, *118*(2), 348–363. https://doi.org/10.1037/pspp0000233

Boursier, V., Gioia, F., Musetti, A., & Schimmenti, A. (2020). Facing loneliness and anxiety during the COVID-19 isolation: The role of excessive social media use in a sample of italian adults. *Frontiers in Psychiatry*, *11*, 586222–586222. PubMed. https://doi.org/10.3389/fpsyt.2020.586222

Breil, S. M., Geukes, K., Wilson, R. E., Nestler, S., Vazire, S., & Back, M. D. (2019). Zooming into real-life extraversion – How personality and situation shape sociability in social interactions. *Collabra: Psychology*, *5*(7). https://doi.org/10.1525/collabra.170

Briley, D. A., & Tucker-Drob, E. M. (2014). Genetic and environmental continuity in personality development: A meta-analysis. *Psychological Bulletin*, *140*, 1303–1331. https://doi.org/10.1037/a0037091

Buchinger, L., Entringer, T. M., Richter, D., Wagner, G. G., Gerstorf, D., & Bleidorn, W. (2022). *Co-development of life goals and the Big Five personality traits across adulthood and old age* [Manuscript submitted for publication].

Buchinger, L., Richter, D., & Heckhausen, J. (2022). The development of life goals across the adult life span. *The Journals of Gerontology: Series B*, *77*(5), 905–915. https://doi.org/10.1093/geronb/gbab154

Buecker, S., & Horstmann, K. T. (2021). Loneliness and social isolation during the COVID-19 pandemic: A systematic review enriched with empirical evidence from a large-scale diary study. *European Psychologist*, *26*(4), 272–284.

Bühler, J. L., Mund, M., Neyer, F. J., & Wrzus, C. (2023). A developmental perspective on personality–relationship transactions: Evidence from three nationally representative samples. *Journal of Personality*, Advance online publication. https://doi.org/10.1111/jopy.12757

Burger, J. M. (1995). Individual differences in preference for solitude. *Journal of Research in Personality*, *29*(1), 85–108. https://doi.org/10.1006/jrpe.1995.1005

Carmichael, C. L., Reis, H. T., & Duberstein, P. R. (2015). In your 20s it's quantity, in your 30s it's quality: The prognostic value of social activity across 30 years of adulthood. *Psychology and Aging*, *30*(1), 95–105. PubMed. https://doi.org/10.1037/pag0000014

Carstensen, L. L., Shavit, Y. Z., & Barnes, J. T. (2020). Age advantages in emotional experience persist even under threat from the COVID-19 pandemic. *Psychological Science*, *31*(11), 1374–1385. https://doi.org/10.1177/0956797620967261

Carstensen, L. L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G. R., Brooks, K. P., & Nesselroade, J. R. (2011). Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging*, *26*(1), 21–33. https://doi.org/10.1037/a0021285

Caspi, A., & Moffitt, T. E. (1993). When do individual differences matter? A paradoxical theory of personality coherence. *Psychological Inquiry*, *4*(4), 247–271. https://doi.org/10.1207/s15327965pli0404_1

Caspi, A., Roberts, B. W., & Shiner, R. L. (2005). Personality development: Stability and change. *Annual Review of Psychology*, *56*(1), 453–484. https://doi.org/10.1146/annurev.psych.55.090902.141913

Charles, S. T. (2010). Strength and vulnerability integration: A model of emotional well-being across adulthood. *Psychological Bulletin*, *136*(6), 1068–1091. https://doi.org/10.1037/a0021232

Charles, S. T., & Luong, G. (2013). Emotional experience across adulthood: The theoretical model of strength and vulnerability integration. *Current Directions in Psychological Science*, *22*(6), 443–448. https://doi.org/10.1177/0963721413497013

Chereches, F. S., Brehmer, Y., & Olaru, G. (2022). Personality and limitations in instrumental activities of daily living in old age: Reciprocal associations across 12 years. *European Journal of Personality*, 08902070221111856. https://doi.org/10.1177/08902070221111856

Choi, Y., Pauly, T., Zambrano Garza, E., Broen, T., Gerstorf, D., & Hoppmann, C. A. (2023). Having time to oneself in times of extended togetherness: Solitude experiences during the COVID-19 pandemic. *Applied Psychology: Health and Well-Being*, Advance online publication. https://doi.org/10.1111/aphw.12401

Chopik, W. J., & Kitayama, S. (2018). Personality change across the life span: Insights from a cross-cultural, longitudinal study. *Journal of Personality*, *86*(3), 508–521. https://doi.org/10.1111/jopy.12332

Chopik, W. J., Oh, J., Kim, E. S., Schwaba, T., Krämer, M. D., Richter, D., & Smith, J. (2020). Changes in optimism and pessimism in response to life events: Evidence from three large panel studies. *Journal of Research in Personality*, *88*, 103985. https://doi.org/10.1016/j.jrp.2020.103985

Coall, D. A., & Hertwig, R. (2011). Grandparental investment: A relic of the past or a resource for the future? *Current Directions in Psychological Science*, *20*(2), 93–98. https://doi.org/10.1177/0963721411403269

Coall, D. A., Hilbrand, S., Sear, R., & Hertwig, R. (2018). Interdisciplinary perspectives on grandparental investment: A journey towards causality. *Contemporary Social Science*, *13*(2), 159–174. https://doi.org/10.1080/21582041.2018.1433317

Condon, J., Corkindale, C., Luszcz, M., & Gamble, E. (2013). The Australian first-time grandparents study: Time spent with the grandchild and its predictors. *Australasian Journal on Ageing*, *32*(1), 21–27. https://doi.org/10.1111/j.1741-6612.2011.00588.x

Cooper, W. H., & Withey, M. J. (2009). The strong situation hypothesis. *Personality and Social Psychology Review*, *13*(1), 62–72. https://doi.org/10.1177/1088868308329378

Coplan, R. J., Hipson, W. E., Archbell, K. A., Ooi, L. L., Baldwin, D., & Bowker, J. C. (2019). Seeking more solitude: Conceptualization, assessment, and implications of aloneliness. *Personality and Individual Differences*, *148*, 17–26. https://doi.org/10.1016/j.paid.2019.05.020

Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences*, *13*(6), 653–665. https://doi.org/10.1016/0191-8869(92)90236-I

Costa, P. T., McCrae, R. R., & Löckenhoff, C. E. (2019). Personality across the life span. *Annual Review of Psychology*, *70*(1), 423–448. https://doi.org/10.1146/annurev-psych-010418-103244

Côté, S., & Moskowitz, D. S. (1998). On the dynamic covariation between interpersonal behavior and affect: Prediction from neuroticism, extraversion, and agreeableness. *Journal of Personality and Social Psychology*, *75*(4), 1032–1046. https://doi.org/10.1037/0022-3514.75.4.1032

Crüwell, S., van Doorn, J., Etz, A., Makel, M. C., Moshontz, H., Niebaum, J. C., Orben, A., Parsons, S., & Schulte-Mecklenbeck, M. (2019). Seven easy steps to open science. *Zeitschrift Für Psychologie*, *227*(4), 237–248. https://doi.org/10.1027/2151-2604/a000387

Cucinotta, D., & Vanelli, M. (2020). WHO declares COVID-19 a pandemic. *Acta Bio-Medica*, *91*(1), 157–160. PubMed. https://doi.org/10.23750/abm.v91i1.9397

Danielsbacka, M., Tanskanen, A. O., Coall, D. A., & Jokela, M. (2019). Grandparental childcare, health and well-being in Europe: A within-individual investigation of longitudinal data. *Social Science & Medicine*, *230*, 194–203. https://doi.org/10.1016/j.socscimed.2019.03.031

Danvers, A. F., Sbarra, D. A., & Mehl, M. R. (2020). Understanding Personality through Patterns of Daily Socializing: Applying Recurrence Quantification Analysis to Naturalistically Observed Intensive Longitudinal Social Interaction Data. *European Journal of Personality*, *34*(5), 777–793. https://doi.org/10.1002/per.2282

daSilva, A. W., Huckins, J. F., Wang, W., Wang, R., Campbell, A. T., & Meyer, M. L. (2021). Daily perceived stress predicts less next day social interaction: Evidence from a naturalistic mobile sensing study. *Emotion*, *21*(8), 1760–1770. https://doi.org/10.1037/emo0000994

de Vries, R. E., Tybur, J. M., Pollet, T. V., & van Vugt, M. (2016). Evolution, situational affordances, and the HEXACO model of personality. *Evolution and Human Behavior*, *37*(5), 407–421. https://doi.org/10.1016/j.evolhumbehav.2016.04.001

Del Fava, E., Cimentada, J., Perrotta, D., Grow, A., Rampazzo, F., Gil-Clavel, S., & Zagheni, E. (2021). Differential impact of physical distancing strategies on social contacts relevant for the spread of SARS-CoV-2: Evidence from a cross-national online survey, March–April 2020. *BMJ Open*, *11*(10), e050651. https://doi.org/10.1136/bmjopen-2021-050651

Demir, M., & Özdemir, M. (2010). Friendship, need satisfaction and happiness. *Journal of Happiness Studies*, *11*(2), 243–259. https://doi.org/10.1007/s10902-009-9138-5

Denissen, J. J. A., Luhmann, M., Chung, J. M., & Bleidorn, W. (2019). Transactions between life events and personality traits across the adult lifespan. *Journal of Personality and Social Psychology*, *116*(4), 612–633. https://doi.org/10.1037/pspp0000196

Denzinger, F., & Brandstätter, V. (2018). Stability of and changes in implicit motives: A narrative review of empirical studies. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.00777

Deventer, J., Wagner, J., Lüdtke, O., & Trautwein, U. (2019). Are personality traits and relationship characteristics reciprocally related? Longitudinal analyses of codevelopment in the transition out of high school and beyond. *Journal of Personality and Social Psychology*, *116*(2), 331–347. https://doi.org/10.1037/pspp0000191

DeWall, C. N., Deckman, T., Pond Jr., R. S., & Bonser, I. (2011). Belongingness as a core personality trait: How social exclusion influences social functioning and personality expression. *Journal of Personality*, *79*(6), 1281–1314. https://doi.org/10.1111/j.1467-6494.2010.00695.x

DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology*, *93*(5), 880–896. https://doi.org/10.1037/0022-3514.93.5.880

DeYoung, C. G., Weisberg, Y., Quilty, L., & Peterson, J. (2013). Unifying the aspects of the Big Five, the interpersonal circumplex, and trait affiliation. *Journal of Personality*, *81*, 465–475. https://doi.org/10.1111/jopy.12020

Diener, E., & Emmons, R. A. (1984). The independence of positive and negative affect. *Journal of Personality and Social Psychology*, *47*(5), 1105–1117. https://doi.org/10.1037/0022-3514.47.5.1105

Diener, E., Lucas, R. E., & Scollon, C. N. (2006). Beyond the hedonic treadmill: Revising the adaptation theory of well-being. *American Psychologist*, *61*(4), 305–314. https://doi.org/10.1037/0003-066X.61.4.305

Diener, E., Oishi, S., & Tay, L. (2018). Advances in subjective well-being research. *Nature Human Behaviour*, *2*(4), 253–260. https://doi.org/10.1038/s41562-018-0307-6

Doré, B., & Bolger, N. (2018). Population- and individual-level changes in life satisfaction surrounding major life stressors. *Social Psychological and Personality Science*, *9*(7), 875–884. https://doi.org/10.1177/1948550617727589

Dorry, J., Burk, C. L., Stertz, A. M., & Wiese, B. S. (2023). Longing for grandparenthood: Its association with life satisfaction in late middle adulthood. *Psychology and Aging*, *Advance online publication*. https://doi.org/10.1037/pag0000723

Drewelies, J., Huxhold, O., & Gerstorf, D. (2019). The role of historical change for adult development and aging: Towards a theoretical framework about the how and the why. *Psychology and Aging*, *34*(8), 1021–1039. https://doi.org/10.1037/pag0000423

Dufner, M., Arslan, R. C., Hagemeyer, B., Schönbrodt, F. D., & Denissen, J. J. A. (2015). Affective contingencies in the affiliative domain: Physiological assessment, associations with the affiliation motive, and prediction of behavior. *Journal of Personality and Social Psychology*, *109*(4), 662–676. https://doi.org/10.1037/pspp0000025

Dufner, M., Wieg, F., Kraft, L., Grapsas, S., & Hagemeyer, B. (2023). Motive-specific affective contingencies and their relevance for personality and motivated behavior. *European Journal of Personality*, *Advance online publication*, 1–16. https://doi.org/10.1177/08902070231156842

Dweck, C. S. (2017). From needs to goals and representations: Foundations for a unified theory of motivation, personality, and development. *Psychological Review*, *124*, 689–719. https://doi.org/10.1037/rev0000082

Eid, M., & Diener, E. (2004). Global judgments of subjective well-being: Situational variability and long-term stability. *Social Indicators Research*, *65*(3), 245–277. https://doi.org/10.1023/B:SOCI.0000003801.89195.bc

Eid, M., & Larsen, R. J. (2008). *The science of subjective well-being*. Guilford Press.

Ellis, D. A., Davidson, B. I., Shaw, H., & Geyer, K. (2019). Do smartphone usage scales predict behavior? *International Journal of Human-Computer Studies*, *130*, 86–92. https://doi.org/10.1016/j.ijhcs.2019.05.004

Elwert, F., & Winship, C. (2014). Endogenous selection bias: The problem of conditioning on a collider variable. *Annual Review of Sociology*, *40*(1), 31–53. https://doi.org/10.1146/annurev-soc-071913-043455

Entringer, T. M., & Gosling, S. D. (2022). Loneliness during a nationwide lockdown and the moderating effect of extroversion. *Social Psychological and Personality Science*, *13*(3), 769–780. https://doi.org/10.1177/19485506211037871

Entringer, T. M., Kröger, H., Schupp, J., Kühne, S., Liebig, S., Goebel, J., Grabka, M. M., Graeber, D., Kroh, M., Schröder, C., Seebauer, J., & Zinn, S. (2020). *Psychische Krise durch Covid-19? Sorgen sinken, Einsamkeit steigt, Lebenszufriedenheit bleibt stabil* (SOEPpapers on Multidisciplinary Panel Data Research No. 1087). Deutsches Institut für Wirtschaftsforschung (DIW). http://hdl.handle.net/10419/222647

Epskamp, S., Waldorp, L. J., Mõttus, R., & Borsboom, D. (2018). The Gaussian graphical model in cross-sectional and time-series data. *Multivariate Behavioral Research*, *53*(4), 453–480. https://doi.org/10.1080/00273171.2018.1454823

Fingerman, K. L., Huo, M., & Birditt, K. S. (2020). A decade of research on intergenerational ties: Technological, economic, political, and demographic changes. *Journal of Marriage and Family*, *82*(1), 383–403. https://doi.org/10.1111/jomf.12604

Finnigan, K. M., & Vazire, S. (2017). Personality research is going to get harder. *European Journal of Personality*, *31*(5), 542–543. Academic Search Ultimate. https://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=125952756&site=ehost-live

Fischer, R., & Karl, J. A. (2022). Unraveling values and well-being—Disentangling within- and between-person dynamics via a psychometric network perspective. *Journal of Personality and Social Psychology*, No Pagination Specified-No Pagination Specified. https://doi.org/10.1037/pspp0000449

Flaxman, S., Mishra, S., Gandy, A., Unwin, H. J. T., Mellan, T. A., Coupland, H., Whittaker, C., Zhu, H., Berah, T., Eaton, J. W., Monod, M., Perez-Guzman, P. N., Schmit, N., Cilloni, L., Ainslie, K. E. C., Baguelin, M., Boonyasiri, A., Boyd, O., Cattarino, L., … Imperial College COVID-19 Response Team. (2020). Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe. *Nature*, *584*(7820), 257–261. https://doi.org/10.1038/s41586-020-2405-7

Fleeson, W. (2001). Toward a structure- and process-integrated view of personality: Traits as density distributions of states. *Journal of Personality and Social Psychology*, *80*(6), 1011–1027. https://doi.org/10.1037/0022-3514.80.6.1011

Fleeson, W., & Jayawickreme, E. (2015). Whole Trait Theory. *Journal of Research in Personality*, *56*, 82–92. https://doi.org/10.1016/j.jrp.2014.10.009

Gabbiadini, A., Baldissarri, C., Durante, F., Valtorta, R. R., De Rosa, M., & Gallucci, M. (2020). Together apart: The mitigating role of digital communication technologies on negative affect during the COVID-19 outbreak in Italy. *Frontiers in Psychology*, *11*, 2763. https://doi.org/10.3389/fpsyg.2020.554678

Geukes, K., van Zalk, M., & Back, M. D. (2018). Understanding personality development: An integrative state process model. *International Journal of Behavioral Development*, *42*(1), 43–51. https://doi.org/10.1177/0165025416677847

Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist*, *48*(1), 26–34. https://doi.org/10.1037/0003-066X.48.1.26

Golle, J., Rose, N., Göllner, R., Spengler, M., Stoll, G., Hübner, N., Rieger, S., Trautwein, U., Lüdtke, O., Roberts, B. W., & Nagengast, B. (2019). School or work? The choice may change your personality. *Psychological Science*, *30*(1), 32–42. https://doi.org/10.1177/0956797618806298

Götz, F. M., Gvirtz, A., Galinsky, A. D., & Jachimowicz, J. M. (2021). How personality and policy predict pandemic behavior: Understanding sheltering-in-place in 55 countries at the onset of COVID-19. *American Psychologist*, *76*(1), 39–49. https://doi.org/10.1037/amp0000740

Graham, E. K., Weston, S. J., Gerstorf, D., Yoneda, T. B., Booth, T., Beam, C. R., Petkus, A. J., Drewelies, J., Hall, A. N., Bastarache, E. D., Estabrook, R., Katz, M. J., Turiano, N. A., Lindenberger, U., Smith, J., Wagner, G. G., Pedersen, N. L., Allemand, M., Spiro Iii, A., … Mroczek, D. K. (2020). Trajectories of Big Five Personality Traits: A Coordinated Analysis of 16 Longitudinal Samples. *European Journal of Personality*, Advance Online Publication. https://doi.org/10.1002/per.2259

Graham, E. K., Willroth, E. C., Weston, S. J., Muniz-Terrera, G., Clouston, S. A. P., Hofer, S. M., Mroczek, D. K., & Piccinin, A. M. (2022). Coordinated data analysis: Knowledge accumulation in lifespan developmental psychology. *Psychology and Aging*, *37*(1), 125–135. https://doi.org/10.1037/pag0000612

Grillich, L., Titscher, V., Klingenstein, P., Kostial, E., Emprechtinger, R., Klerings, I., Sommer, I., Nikitin, J., & Laireiter, A.-R. (2023). The effectiveness of interventions to prevent loneliness and social isolation in the community-dwelling and old population: An overview of systematic reviews and meta-analysis. *European Journal of Public Health*, *Advance online publication*. https://doi.org/10.1093/eurpub/ckad006

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

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

Hagemeyer, B., Dufner, M., & Denissen, J. J. A. (2016). Double dissociation between implicit and explicit affiliative motives: A closer look at socializing behavior in dyadic interactions. *Journal of Research in Personality*, *65*, 89–93. https://doi.org/10.1016/j.jrp.2016.08.003

Hagemeyer, B., Neyer, F. J., Neberich, W., & Asendorpf, J. B. (2013). The ABC of social desires: Affiliation, being alone, and closeness to partner. *European Journal of Personality*, *27*(5), 442–457. https://doi.org/10.1002/per.1857

Haidt, J. (2023, February 22). Social media is a major cause of the mental illness epidemic in teen girls. Here's the evidence. [Substack newsletter]. *After Babel*. https://jonathanhaidt.substack.com/p/social-media-mental-illness-epidemic

Hall, J. A. (2017). The regulation of social interaction in everyday life: A replication and extension of O'Connor and Rosenblood (1996). *Journal of Social and Personal Relationships*, *34*(5), 699–716. https://doi.org/10.1177/0265407516654580

Hall, J. A., & Davis, D. C. (2017). Proposing the communicate bond belong theory: Evolutionary intersections with episodic interpersonal communication. *Communication Theory*, *27*(1), 21–47. https://doi.org/10.1111/comt.12106

Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. P. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods*, *20*(1), 102–116. https://doi.org/10.1037/a0038889

Harari, G. M., Gosling, S. D., Wang, R., & Campbell, A. T. (2015). Capturing situational information with smartphones and mobile sensing methods. *European Journal of Personality*, *29*(5), 509–511. https://doi.org/10.1002/per.2032

Harari, G. M., Müller, S. R., Stachl, C., Wang, R., Wang, W., Bühner, M., Rentfrow, P. J., Campbell, A. T., & Gosling, S. D. (2019). Sensing sociability: Individual differences in young adults' conversation, calling, texting, and app use behaviors in daily life. *Journal of Personality and Social Psychology*, Advance Online Publication. https://doi.org/10.1037/pspp0000245

Harari, G. M., Vaid, S. S., Müller, S. R., Stachl, C., Marrero, Z., Schoedel, R., Bühner, M., & Gosling, S. D. (2020). Personality sensing for theory development and assessment in the digital age. *European Journal of Personality*, *34*(5), 649–669. https://doi.org/10.1002/per.2273

Harris, K., & Vazire, S. (2016). On friendship development and the Big Five personality traits. *Social and Personality Psychology Compass*, *10*(11), 647–667. https://doi.org/10.1111/spc3.12287

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine*, *40*(2), 218–227. https://doi.org/10.1007/s12160-010-9210-8

Hayslip, B., Fruhauf, C. A., & Dolbin-MacNab, M. L. (2019). Grandparents raising grandchildren: What have we learned over the past decade? *The Gerontologist*, *59*(3), e152–e163. https://doi.org/10.1093/geront/gnx106

Headey, B. (2010). The set point theory of well-being has serious flaws: On the eve of a scientific revolution? *Social Indicators Research*, *97*(1), 7–21. https://doi.org/10.1007/s11205-009-9559-x

Heller, D., Komar, J., & Lee, W. B. (2007). The dynamics of personality states, goals, and well-being. *Personality and Social Psychology Bulletin*, *33*(6), 898–910. https://doi.org/10.1177/0146167207301010

Hennecke, M., Bleidorn, W., Denissen, J. J. A., & Wood, D. (2014). A three-part framework for self-regulated personality development across adulthood. *European Journal of Personality*, *28*(3), 289–299. https://doi.org/10.1002/per.1945

Hennecke, M., & Freund, A. M. (2017). The development of goals and motivation. In J. Specht (Ed.), *Personality development across the lifespan* (pp. 257–273). Academic Press. https://doi.org/10.1016/B978-0-12-804674-6.00016-8

Heyman, J. L., & Kushlev, K. (2023). Did smartphones enhance or diminish well-being during the COVID-19 pandemic? *Frontiers in Psychology*, *14*. https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1094196

Hill, C. A. (2009). Affiliation motivation. In M. R. Leary & R. H. Hoyle (Eds.), *Handbook of individual differences in social behavior* (pp. 410–425). The Guilford Press.

Hofer, J., & Busch, H. (2011). Satisfying one's needs for competence and relatedness: Consequent domain-specific well-being depends on strength of implicit motives. *Personality and Social Psychology Bulletin*, *37*(9), 1147–1158. https://doi.org/10.1177/0146167211408329

Hofer, J., & Hagemeyer, B. (2018). Social bonding: Affiliation motivation and intimacy motivation. In J. Heckhausen & H. Heckhausen (Eds.), *Motivation and action* (pp. 305–334). Springer International Publishing. https://doi.org/10.1007/978-3-319-65094-4_7

Hoffman, L. (2015). *Longitudinal analysis: Modeling within-person fluctuation and change*. Routledge/Taylor & Francis Group.

Hoffman, L. (2019). On the interpretation of parameters in multivariate multilevel models across different combinations of model specification and estimation. *Advances in Methods and Practices in Psychological Science*, *2*(3), 288–311. https://doi.org/10.1177/2515245919842770

Hoffman, L. (2020). Disaggregating between-person time slope effects from within-person effects. *PsyArXiv*. https://doi.org/10.31234/osf.io/6q2sm

Hoffman, L., & Walters, R. W. (2022). Catching up on multilevel modeling. *Annual Review of Psychology*, *73*(1), 659–689. https://doi.org/10.1146/annurev-psych-020821-103525

Holt-Lunstad, J., Robles, T. F., & Sbarra, D. A. (2017). Advancing social connection as a public health priority in the United States. *American Psychologist*, *72*(6), 517–530. https://doi.org/10.1037/amp0000103

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, *10*(2), 227–237. https://doi.org/10.1177/1745691614568352

Hopwood, C. J. (2018). Interpersonal dynamics in personality and personality disorders. *European Journal of Personality*, *32*(5), 499–524. https://doi.org/10.1002/per.2155

Hopwood, C. J., Bleidorn, W., & Wright, A. G. C. (2022). Connecting theory to methods in longitudinal research. *Perspectives on Psychological Science*, *17*(3), 884–894. https://doi.org/10.1177/17456916211008407

Hopwood, C. J., Thomas, K. M., Markon, K. E., Wright, A. G. C., & Krueger, R. F. (2012). DSM-5 personality traits and DSM–IV personality disorders. *Journal of Abnormal Psychology*, *121*, 424–432. https://doi.org/10.1037/a0026656

Horstmann, K. T., Rauthmann, J. F., Sherman, R. A., & Ziegler, M. (2021). Distinguishing simple and residual consistencies in functionally equivalent and non-equivalent situations: Evidence from experimental and observational longitudinal data. *European Journal of Personality*, *35*(6), 833–860. https://doi.org/10.1177/08902070211014029

Hudson, N. W., Briley, D. A., Chopik, W. J., & Derringer, J. (2019). You have to follow through: Attaining behavioral change goals predicts volitional personality change. *Journal of Personality and Social Psychology*, *117*(4), 839–857. https://doi.org/10.1037/pspp0000221

Hudson, N. W., & Fraley, R. C. (2015). Volitional personality trait change: Can people choose to change their personality traits? *Journal of Personality and Social Psychology*, *109*(3), 490–507. https://doi.org/10.1037/pspp0000021

Hutteman, R., Hennecke, M., Orth, U., Reitz, A. K., & Specht, J. (2014). Developmental tasks as a framework to study personality development in adulthood and old age. *European Journal of Personality*, *28*(3), 267–278. https://doi.org/10.1002/per.1959

Huxhold, O., Fiori, K. L., Webster, N. J., & Antonucci, T. C. (2020). The strength of weaker ties: An underexplored resource for maintaining emotional well-being in later life. *The Journals of Gerontology: Series B*, *75*(7), 1433–1442. https://doi.org/10.1093/geronb/gbaa019

Huxhold, O., Fiori, K. L., & Windsor, T. (2022). Rethinking social relationships in adulthood: The differential investment of resources model. *Personality and Social Psychology Review*, *26*(1), 57–82. https://doi.org/10.1177/10888683211067035

Infurna, F. J., Wiest, M., Gerstorf, D., Ram, N., Schupp, J., Wagner, G. G., & Heckhausen, J. (2017). Changes in life satisfaction when losing one's spouse: Individual differences in anticipation, reaction, adaptation and longevity in the German Socio-economic Panel Study (SOEP). *Ageing & Society*, *37*(5), 899–934. https://doi.org/10.1017/S0144686X15001543

Jayawickreme, E., Fleeson, W., Beck, E. D., Baumert, A., & Adler, J. M. (2021). Personality dynamics. *Personality Science*, *2*(1), 1–18. https://doi.org/10.5964/ps.6179

Jayawickreme, E., Zachry, C. E., & Fleeson, W. (2019). Whole trait theory: An integrative approach to examining personality structure and process. *Personality and Individual Differences*, *136*, 2–11. https://doi.org/10.1016/j.paid.2018.06.045

Jensen-Campbell, L. A., & Graziano, W. G. (2001). Agreeableness as a moderator of interpersonal conflict. *Journal of Personality*, *69*(2), 323–362. https://doi.org/10.1111/1467-6494.00148

Jokela, M., Hakulinen, C., Singh-Manoux, A., & Kivimäki, M. (2014). Personality change associated with chronic diseases: Pooled analysis of four prospective cohort studies. *Psychological Medicine*, *44*(12), 2629–2640. https://doi.org/10.1017/S0033291714000257

Jordan, D. G., Winer, E. S., & Salem, T. (2020). The current status of temporal network analysis for clinical science: Considerations as the paradigm shifts? *Journal of Clinical Psychology*, *76*(9), 1591–1612. https://doi.org/10.1002/jclp.22957

Kafetsios, K., Chatzakou, D., Tsigilis, N., & Vakali, A. (2017). Experience of emotion in face to face and computer-mediated social interactions: An event sampling study. *Computers in Human Behavior*, *76*, 287–293. https://doi.org/10.1016/j.chb.2017.07.033

Kandler, C., Zimmermann, J., & Mcadams, D. (2014). Core and Surface Characteristics for the Description and Theory of Personality Differences and Development. *European Journal of Personality*, *28*(3), 231–243. https://doi.org/10.1002/per.1952

Kendler, K. S., & Myers, J. (2010). The genetic and environmental relationship between major depression and the five-factor model of personality. *Psychological Medicine*, *40*(5), 801–806. https://doi.org/10.1017/S0033291709991140

Kersten, P., Borschel, E., Neyer, F. J., & Mund, M. (2022). The social side of personality: Do affiliation and intimacy motives moderate associations of personal relationships with well-being? *Journal of Personality*. https://doi.org/10.1111/jopy.12746

Kettlewell, N., Morris, R. W., Ho, N., Cobb-Clark, D. A., Cripps, S., & Glozier, N. (2020). The differential impact of major life events on cognitive and affective wellbeing. *SSM - Population Health*, *10*, 1–9. https://doi.org/10.1016/j.ssmph.2019.100533

Kitayama, S., Berg, M. K., & Chopik, W. J. (2020). Culture and well-being in late adulthood: Theory and evidence. *American Psychologist*, *75*, 567–576. https://doi.org/10.1037/amp0000614

Kornadt, A. E., Hagemeyer, B., Neyer, F. J., & Kandler, C. (2018). Sound body, sound mind? The interrelation between health change and personality change in old age. *European Journal of Personality*, *32*(1), 30–45. https://doi.org/10.1002/per.2135

Kotov, R., Gamez, W., Schmidt, F., & Watson, D. (2010). Linking "big" personality traits to anxiety, depressive, and substance use disorders: A meta-analysis. *Psychological Bulletin*, *136*, 768–821. https://doi.org/10.1037/a0020327

Krämer, M. D., Rohrer, J. M., Lucas, R. E., & Richter, D. (2023). *Life events and life satisfaction: Estimating effects of multiple and repeated events in combined models*. In preparation.

Kratz, F., & Brüderl, J. (2021). *The age trajectory of happiness*. PsyArXiv. https://doi.org/10.31234/osf.io/d8f2z

Kritzler, S., Rakhshani, A., Terwiel, S., Fassbender, I., Donnellan, M. B., Lucas, R. E., & Luhmann, M. (2023). How are common major live events perceived? Exploring differences between and variability of different typical event profiles and raters. *European Journal of Personality*, *37*(2), 171–186. https://doi.org/10.1177/08902070221076586

Kroencke, L., Harari, G., Back, M., & Wagner, J. (2022). Well-being in social interactions: Examining personality-situation dynamics in face-to-face and computer-mediated communication. *Journal of Personality and Social Psychology*, *Advance online publication*. https://doi.org/10.1037/pspp0000422

Kunzmann, U., Kappes, C., & Wrosch, C. (2014). Emotional aging: A discrete emotions perspective. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.00380

Kuper, N., Breil, S. M., Horstmann, K. T., Roemer, L., Lischetzke, T., Sherman, R. A., Back, M. D., Denissen, J. J. A., & Rauthmann, J. F. (2022). Individual differences in contingencies between situation characteristics and personality states. *Journal of Personality and Social Psychology*, *123*, 1166–1198. https://doi.org/10.1037/pspp0000435

Kuper, N., Garrel, A. S. von, Wiernik, B. M., Phan, L. V., Modersitzki, N., & Rauthmann, J. (2022). *Distinguishing four types of person × situation interactions: An integrative framework and empirical examination*. PsyArXiv. https://doi.org/10.31234/osf.io/2g63c

Kuper, N., Modersitzki, N., Phan, L. V., & Rauthmann, J. (2021a). The situation during the COVID-19 pandemic: A snapshot in Germany. *PLOS ONE*, *16*(2), e0245719. https://doi.org/10.1371/journal.pone.0245719

Kuper, N., Modersitzki, N., Phan, L. V., & Rauthmann, J. F. (2021b). The dynamics, processes, mechanisms, and functioning of personality: An overview of the field. *British Journal of Psychology*, *112*(1), 1–51. https://doi.org/10.1111/bjop.12486

Kushlev, K., Dwyer, R., & Dunn, E. W. (2019). The social price of constant connectivity: Smartphones impose subtle costs on well-being. *Current Directions in Psychological Science*, *28*(4), 347–352. https://doi.org/10.1177/0963721419847200

Lades, L. K., Laffan, K., Daly, M., & Delaney, L. (2020). Daily emotional well-being during the COVID-19 pandemic. *British Journal of Health Psychology*, *25*(4), 902–911. https://doi.org/10.1111/bjhp.12450

Lay, J. C., Pauly, T., Graf, P., Biesanz, J. C., & Hoppmann, C. A. (2019). By myself and liking it? Predictors of distinct types of solitude experiences in daily life. *Journal of Personality*, *87*(3), 633–647. https://doi.org/10.1111/jopy.12421

Leary, M. R., & Kelly, K. M. (2009). Belonging motivation. In M. R. Leary & R. H. Hoyle (Eds.), *Handbook of individual differences in social behavior* (pp. 400–409). The Guilford Press.

Lee, S., Tam, C. L., & Chie, Q. T. (2014). Mobile phone usage preferences: The contributing factors of personality, social anxiety and loneliness. *Social Indicators Research*, *118*(3), 1205–1228. https://doi.org/10.1007/s11205-013-0460-2

Leikas, S. (2020). Sociable behavior is related to later fatigue: Moment-to-moment patterns of behavior and tiredness. *Heliyon*, *6*(5), e04033. https://doi.org/10.1016/j.heliyon.2020.e04033

Leikas, S., & Ilmarinen, V.-J. (2017). Happy now, tired later? Extraverted and conscientious behavior are related to immediate mood gains, but to later fatigue. *Journal of Personality*, *85*(5), 603–615. https://doi.org/10.1111/jopy.12264

Liu, H., Fang, B., Li, Y., & Lou, V. W. Q. (2021). Initially negative affect predicts lower satisfaction with future social contact: A time-lagged analysis using ecological momentary assessment. *The Journals of Gerontology: Series B*, *76*(2), 295–305. https://doi.org/10.1093/geronb/gbaa024

Liu, H., Xie, Q. W., & Lou, V. W. Q. (2019). Everyday social interactions and intra-individual variability in affect: A systematic review and meta-analysis of ecological momentary assessment studies. *Motivation and Emotion*, *43*(2), 339–353. https://doi.org/10.1007/s11031-018-9735-x

Lo, M.-T., Hinds, D. A., Tung, J. Y., Franz, C., Fan, C.-C., Wang, Y., Smeland, O. B., Schork, A., Holland, D., Kauppi, K., Sanyal, N., Escott-Price, V., Smith, D. J., O'Donovan, M., Stefansson, H., Bjornsdottir, G., Thorgeirsson, T. E., Stefansson, K., McEvoy, L. K., … Chen, C.-H. (2017). Genome-wide analyses for personality traits identify six genomic loci and show correlations with psychiatric disorders. *Nature Genetics*, *49*(1), 152–156. https://doi.org/10.1038/ng.3736

Lodi-Smith, J., & Roberts, B. W. (2007). Social investment and personality: A meta-analysis of the relationship of personality traits to investment in work, family, religion, and volunteerism. *Personality and Social Psychology Review*, *11*(1), 68–86. https://doi.org/10.1177/1088868306294590

Long, C. R., Seburn, M., Averill, J. R., & More, T. A. (2003). Solitude experiences: Varieties, settings, and individual differences. *Personality and Social Psychology Bulletin*, *29*(5), 578–583. https://doi.org/10.1177/0146167203029005003

Luan, Z., Hutteman, R., Denissen, J. J. A., Asendorpf, J. B., & van Aken, M. A. G. (2017). Do you see my growth? Two longitudinal studies on personality development from childhood to young adulthood from multiple perspectives. *Journal of Research in Personality*, *67*, 44–60. https://doi.org/10.1016/j.jrp.2016.03.004

Lubinski, D. (2000). Scientific and social significance of assessing individual differences: "Sinking shafts at a few critical points." *Annual Review of Psychology*, *51*(1), 405–444. https://doi.org/10.1146/annurev.psych.51.1.405

Lucas, R. E. (2007). Long-term disability is associated with lasting changes in subjective well-being: Evidence from two nationally representative longitudinal studies. *Journal of Personality and Social Psychology*, *92*(4), 717–730. https://doi.org/10.1037/0022-3514.92.4.717

Lucas, R. E., Clark, A. E., Georgellis, Y., & Diener, E. (2003). Reexamining adaptation and the set point model of happiness: Reactions to changes in marital status. *Journal of Personality and Social Psychology*, *84*(3), 527–539. https://doi.org/10.1037/0022-3514.84.3.527

Lucas, R. E., Clark, A. E., Georgellis, Y., & Diener, E. (2004). Unemployment alters the set point for life satisfaction. *Psychological Science*, *15*(1), 8–13. https://doi.org/10.1111/j.0963-7214.2004.01501002.x

Lucas, R. E., Le, K., & Dyrenforth, P. S. (2008). Explaining the extraversion/positive affect relation: Sociability cannot account for extraverts' greater happiness. *Journal of Personality*, *76*(3), 385–414. https://doi.org/10.1111/j.1467-6494.2008.00490.x

Lüdtke, O., Roberts, B. W., Trautwein, U., & Nagy, G. (2011). A random walk down university avenue: Life paths, life events, and personality trait change at the transition to university life. *Journal of Personality and Social Psychology*, *101*(3), 620–637. https://doi.org/10.1037/a0023743

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

Luhmann, M., Hofmann, W., Eid, M., & Lucas, R. E. (2012). Subjective well-being and adaptation to life events: A meta-analysis. *Journal of Personality and Social Psychology*, *102*(3), 592–615. https://doi.org/10.1037/a0025948

Luhmann, M., & Intelisano, S. (2018). Hedonic adaptation and the set point for subjective well-being. In *Handbook of well-being*. Salt Lake City: DEF Publishers.

Luhmann, M., Krasko, J., & Terwiel, S. (2021). Subjective well-being as a dynamic construct. In J. F. Rauthmann (Ed.), *The Handbook of Personality Dynamics and Processes* (pp. 1231–1249). Academic Press. https://doi.org/10.1016/B978-0-12-813995-0.00048-0

Luhmann, M., Orth, U., Specht, J., Kandler, C., & Lucas, R. E. (2014). Studying changes in life circumstances and personality: It's about time. *European Journal of Personality*, *28*(3), 256–266. https://doi.org/10.1002/per.1951

Luhmann, M., Weiss, P., Hosoya, G., & Eid, M. (2014). Honey, I got fired! A longitudinal dyadic analysis of the effect of unemployment on life satisfaction in couples. *Journal of Personality and Social Psychology*, *107*(1), 163–180. https://doi.org/10.1037/a0036394

Luo, J., & Roberts, B. W. (2015). Concurrent and longitudinal relations among conscientiousness, stress, and self-perceived physical health. *Journal of Research in Personality*, *59*, 93–103. https://doi.org/10.1016/j.jrp.2015.10.004

Luo, M., Macdonald, B., & Hülür, G. (2022). Not "the more the merrier": Diminishing returns to daily face-to-face social interaction frequency for well-being in older age. *The Journals of Gerontology: Series B*, *77*(8), 1431–1441. https://doi.org/10.1093/geronb/gbac010

Luong, G., Charles, S. T., & Fingerman, K. L. (2010). Better with age: Social relationships across adulthood. *Journal of Social and Personal Relationships*, *28*(1), 9–23. https://doi.org/10.1177/0265407510391362

Lykken, D., & Tellegen, A. (1996). Happiness is a stochastic phenomenon. *Psychological Science*, *7*(3), 186–189. https://doi.org/10.1111/j.1467-9280.1996.tb00355.x

Mackenzie, C. S., Karaoylas, E. C., & Starzyk, K. B. (2018). Lifespan differences in a self determination theory model of eudaimonia: A cross-sectional survey of younger, middle-aged, and older adults. *Journal of Happiness Studies*, *19*(8), 2465–2487. https://doi.org/10.1007/s10902-017-9932-4

Margolis, S., Stapley, A. L., & Lyubomirsky, S. (2020). The association between Extraversion and well-being is limited to one facet. *Journal of Personality*, *88*(3), 478–484. https://doi.org/10.1111/jopy.12504

Matz, S. C., & Harari, G. M. (2021). Personality–place transactions: Mapping the relationships between Big Five personality traits, states, and daily places. *Journal of*

Personality and Social Psychology, *120*(5), 1367–1385. https://doi.org/10.1037/pspp0000297

McCabe, K. O., & Fleeson, W. (2012). What is extraversion for? Integrating trait and motivational perspectives and identifying the purpose of extraversion. *Psychological Science*, *23*(12), 1498–1505. https://doi.org/10.1177/0956797612444904

McClelland, D. C. (1987). *Human motivation.* Cambridge University Press.

McCrae, R. R. (2018). Method biases in single-source personality assessments. *Psychological Assessment*, *30*(9), 1160–1173. https://doi.org/10.1037/pas0000566

McCrae, R. R., & Costa, P. T. (1999). A Five-Factor theory of personality. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (pp. 139–153). Guilford Press.

McCrae, R. R., & Mõttus, R. (2019). What personality scales measure: A new psychometrics and its implications for theory and assessment. *Current Directions in Psychological Science*, *28*(4), 415–420. https://doi.org/10.1177/0963721419849559

McElreath, R. (2020, September 26). *Science as amateur software development*. YouTube. https://www.youtube.com/watch?v=zwRdO9_GGhY

McNeish, D., & Kelley, K. (2019). Fixed effects models versus mixed effects models for clustered data: Reviewing the approaches, disentangling the differences, and making recommendations. *Psychological Methods*, *24*(1), 20–35. https://doi.org/10.1037/met0000182

Mehl, M. R., Gosling, S. D., & Pennebaker, J. W. (2006). Personality in its natural habitat: Manifestations and implicit folk theories of personality in daily life. *Journal of Personality and Social Psychology*, *90*(5), 862–877. https://doi.org/10.1037/0022-3514.90.5.862

Mercer, A. W., Kreuter, F., Keeter, S., & Stuart, E. A. (2017). Theory and Practice in Nonprobability Surveys: Parallels between Causal Inference and Survey Inference. *Public Opinion Quarterly*, *81*(S1), 250–271. https://doi.org/10.1093/poq/nfw060

Meyer, M. H., & Kandic, A. (2017). Grandparenting in the United States. *Innovation in Aging*, *1*(2), 1–10. https://doi.org/10.1093/geroni/igx023

Milek, A., Butler, E. A., Tackman, A. M., Kaplan, D. M., Raison, C. L., Sbarra, D. A., Vazire, S., & Mehl, M. R. (2018). “Eavesdropping on happiness” revisited: A pooled, multisample replication of the association between life satisfaction and observed daily conversation quantity and quality. *Psychological Science*, *29*(9), 1451–1462. https://doi.org/10.1177/0956797618774252

Monninger, M., Aggensteiner, P.-M., Pollok, T. M., Kaiser, A., Reinhard, I., Hermann, A., Reichert, M., Ebner-Priemer, U. W., Meyer-Lindenberg, A., Brandeis, D., Banaschewski, T., & Holz, N. E. (2023). The importance of high quality real-life social interactions during the COVID-19 pandemic. *Scientific Reports*, *13*(1), Article 1. https://doi.org/10.1038/s41598-023-30803-9

Montag, C., Błaszkiewicz, K., Lachmann, B., Andone, I., Sariyska, R., Trendafilov, B., Reuter, M., & Markowetz, A. (2014). Correlating personality and actual phone usage. *Journal of Individual Differences*, *35*(3), 158–165. https://doi.org/10.1027/1614-0001/a000139

Montag, C., Błaszkiewicz, K., Sariyska, R., Lachmann, B., Andone, I., Trendafilov, B., Eibes, M., & Markowetz, A. (2015). Smartphone usage in the 21st century: Who is active on WhatsApp? *BMC Research Notes*, *8*(1), 331. https://doi.org/10.1186/s13104-015-1280-z

Moore, K., & March, E. (2022). Socially Connected during COVID-19: Online social connections mediate the relationship between loneliness and positive coping strategies. *Journal of Stress, Trauma, Anxiety & Resilience*, *1*(1), 1–20. https://doi.org/10.55319/js.v1i1.9

Mõttus, R., Allik, J., & Realo, A. (2019). Do self-reports and informant-ratings measure the same personality constructs? *European Journal of Psychological Assessment*, 1–7. https://doi.org/10.1027/1015-5759/a000516

Mõttus, R., Johnson, W., & Deary, I. J. (2012). Personality traits in old age: Measurement and rank-order stability and some mean-level change. *Psychology and Aging*, *27*(1), 243–249. https://doi.org/10.1037/a0023690

Mõttus, R., & Rozgonjuk, D. (2021). Development is in the details: Age differences in the Big Five domains, facets, and nuances. *Journal of Personality and Social Psychology*, *120*(4), 1035–1048. https://doi.org/10.1037/pspp0000276

Mueller, S., Wagner, J., Drewelies, J., Duezel, S., Eibich, P., Specht, J., Demuth, I., Steinhagen-Thiessen, E., Wagner, G. G., & Gerstorf, D. (2016). Personality development in old age relates to physical health and cognitive performance: Evidence from the Berlin Aging Study II. *Journal of Research in Personality*, *65*, 94–108. https://doi.org/10.1016/j.jrp.2016.08.007

Mueller, S., Wagner, J., Smith, J., Voelkle, M. C., & Gerstorf, D. (2018). The interplay of personality and functional health in old and very old age: Dynamic within-person interrelations across up to 13 years. *Journal of Personality and Social Psychology*, *115*, 1127–1147. https://doi.org/10.1037/pspp0000173

Mulder, J. D., & Hamaker, E. L. (2020). Three extensions of the random intercept cross-lagged panel model. *Structural Equation Modeling: A Multidisciplinary Journal*, 1–11. https://doi.org/10.1080/10705511.2020.1784738

Neubauer, A. B., Smyth, J. M., & Sliwinski, M. J. (2018). When you see it coming: Stressor anticipation modulates stress effects on negative affect. *Emotion*, *18*, 342–354. https://doi.org/10.1037/emo0000381

Neubauer, A. B., Voss, A., & Ditzen, B. (2018). Exploring need dynamics within and across days in everyday life: A three-level analysis. *Journal of Research in Personality*, *77*, 101–112. https://doi.org/10.1016/j.jrp.2018.10.001

Newman, A., Bavik, Y. L., Mount, M., & Shao, B. (2021). Data collection via online platforms: Challenges and recommendations for future research. *Applied Psychology*, *70*(3), 1380–1402. https://doi.org/10.1111/apps.12302

Neyer, F. J., & Lehnart, J. (2007). Relationships matter in personality development: Evidence from an 8-year longitudinal study across young adulthood. *Journal of Personality*, *75*(3), 535–568. https://doi.org/10.1111/j.1467-6494.2007.00448.x

Neyer, F. J., Mund, M., Zimmermann, J., & Wrzus, C. (2014). Personality-relationship transactions revisited. *Journal of Personality*, *82*(6), 539–550. https://doi.org/10.1111/jopy.12063

Neyer, F. J., Wrzus, C., Wagner, J., & Lang, F. R. (2011). Principles of relationship differentiation. *European Psychologist*, *16*(4), 267–277. https://doi.org/10.1027/1016-9040/a000055

Nezlek, J. B. (2001). The motivational and cognitive dynamics of day-to-day social life. In J. P. Forgas, K. D. Williams, & L. Wheeler (Eds.), *The social mind: Cognitive and motivational aspects of interpersonal behavior* (pp. 92–111). Cambridge University Press.

Nguyen, T. T., Weinstein, N., & Ryan, R. M. (2021). The possibilities of aloneness and solitude. In R. J. Coplan, J. C. Bowker, & L. J. Nelson (Eds.), *The handbook of solitude* (pp. 224–239). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119576457.ch16

Nowland, R., Necka, E. A., & Cacioppo, J. T. (2017). Loneliness and social internet use: Pathways to reconnection in a digital world? *Perspectives on Psychological Science*, *13*(1), 70–87. https://doi.org/10.1177/1745691617713052

O'Connor, S. C., & Rosenblood, L. K. (1996). Affiliation motivation in everyday experience: A theoretical comparison. *Journal of Personality and Social Psychology*, *70*(3), 513–522. https://doi.org/10.1037/0022-3514.70.3.513

Oltmanns, J. R., Jackson, J. J., & Oltmanns, T. F. (2020). Personality change: Longitudinal self-other agreement and convergence with retrospective-reports. *Journal of Personality and Social Psychology*, *118*(5), 1065–1079. https://doi.org/10.1037/pspp0000238

Orben, A., & Przybylski, A. K. (2019). Screens, teens, and psychological well-being: Evidence from three time-use-diary studies. *Psychological Science*, *30*(5), 682–696. https://doi.org/10.1177/0956797619830329

Orben, A., & Przybylski, A. K. (2020). Reply to: Underestimating digital media harm. *Nature Human Behaviour*, *4*(4), 349–351. https://doi.org/10.1038/s41562-020-0840-y

Ozer, D. J., & Benet-Martínez, V. (2006). Personality and the prediction of consequential outcomes. *Annual Review of Psychology*, *57*(1), 401–421. https://doi.org/10.1146/annurev.psych.57.102904.190127

Peikert, A., & Brandmaier, A. M. (2021). A reproducible data analysis workflow with R Markdown, Git, Make, and Docker. *Quantitative and Computational Methods in Behavioral Sciences*, *1*(1), 1–27. https://doi.org/10.5964/qcmb.3763

Peikert, A., van Lissa, C. J., & Brandmaier, A. M. (2021). Reproducible research in R: A tutorial on how to do the same thing more than once. *Psych*, *3*(4), 836–867. https://doi.org/10.3390/psych3040053

Penke, L., & Jokela, M. (2016). The evolutionary genetics of personality revisited. *Current Opinion in Psychology*, *7*, 104–109. https://doi.org/10.1016/j.copsyc.2015.08.021

Peters, H., Götz, F. M., Ebert, T., Müller, S. R., Rentfrow, P. J., Gosling, S. D., Obschonka, M., Ames, D., Potter, J., & Matz, S. C. (2022). Regional personality differences predict variation in early COVID-19 infections and mobility patterns indicative of social distancing. *Journal of Personality and Social Psychology*, *Advance online publication*. https://doi.org/10.1037/pspp0000439

Peters, L., Sunderland, M., Andrews, G., Rapee, R. M., & Mattick, R. P. (2012). Development of a short form Social Interaction Anxiety (SIAS) and Social Phobia Scale (SPS) using nonparametric item response theory: The SIAS-6 and the SPS-6. *Psychological Assessment*, *24*(1), 66–76. https://doi.org/10.1037/a0024544

Podsakoff, P. M., MacKenzie, S. B., Jeong-Yeon, L., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the Goldilocks hypothesis: Quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychological Science*, *28*(2), 204–215. https://doi.org/10.1177/0956797616678438

Pusch, S., Mund, M., Hagemeyer, B., & Finn, C. (2019). Personality development in emerging and young adulthood: A study of age differences. *European Journal of Personality*, *33*(3), 245–263. https://doi.org/10.1002/per.2181

Quintus, M. (2019). *Personality development in adulthood: The role of life transitions, goals to change personality, and momentary processes* [Johannes Gutenberg-Universität Mainz]. https://doi.org/10.25358/OPENSCIENCE-4823

Quintus, M., Egloff, B., & Wrzus, C. (2021). Daily life processes predict long-term development in explicit and implicit representations of Big Five traits: Testing predictions from the TESSERA (Triggering situations, Expectancies, States and State Expressions, and ReActions) framework. *Journal of Personality and Social Psychology*, *120*(4), 1049–1073. https://doi.org/10.1037/pspp0000361

Quirin, M., Malekzad, F., Paudel, D., Knoll, A. C., & Mirolli, M. (2022). Dynamics of personality: The Zurich model of motivation revived, extended, and applied to personality. *Journal of Personality*, *Advance online publication*. https://doi.org/10.1111/jopy.12805

Quirin, M., Robinson, M. D., Rauthmann, J. F., Kuhl, J., Read, S. J., Tops, M., & DeYoung, C. G. (2020). The dynamics of personality approach (DPA): 20 tenets for uncovering the causal mechanisms of personality. *European Journal of Personality*, *34*(6), 947–968. https://doi.org/10.1002/per.2295

Rauthmann, J. F., & Sherman, R. A. (2020). The situation of situation research: Knowns and unknowns. *Current Directions in Psychological Science*, *29*, 473–480. https://doi.org/10.1177/0963721420925546

Rauthmann, J. F., Sherman, R. A., Nave, C. S., & Funder, D. C. (2015). Personality-driven situation experience, contact, and construal: How people's personality traits predict characteristics of their situations in daily life. *Journal of Research in Personality*, *55*, 98–111. https://doi.org/10.1016/j.jrp.2015.02.003

Read, S. J., Monroe, B. M., Brownstein, A. L., Yang, Y., Chopra, G., & Miller, L. C. (2010). A neural network model of the structure and dynamics of human personality. *Psychological Review*, *117*(1), 61–92. https://doi.org/10.1037/a0018131

Read, S. J., Smith, B. J., Droutman, V., & Miller, L. C. (2017). Virtual personalities: Using computational modeling to understand within-person variability. *Journal of Research in Personality*, *69*, 237–249. https://doi.org/10.1016/j.jrp.2016.10.005

Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: The role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin*, *26*(4), 419–435. https://doi.org/10.1177/0146167200266002

Ren, D., Stavrova, O., & Loh, W. W. (2021). Nonlinear effect of social interaction quantity on psychological well-being: Diminishing returns or inverted U? *Journal of Personality and Social Psychology*, *122*(6), 1056–1074. https://doi.org/10.1037/pspi0000373

Revelle, W., Wilt, J., & Condon, D. (2011). Individual differences and differential psychology: A brief history and prospect. In T. Chamorro-Premuzic, S. von Stumm, & A. Furnham (Eds.), *The Wiley-Blackwell handbook of individual differences* (pp. 3–38). Blackwell Publishing Ltd. https://doi.org/10.1002/9781405184359.ch1

Richter, D., & Schupp, J. (2015). The SOEP Innovation Sample (SOEP-IS). *Schmollers Jahrbuch: Journal of Applied Social Science Studies*, *135*(3), 389–400. https://doi.org/10.3790/schm.135.3.389

Roberts, B. W. (2018). A revised sociogenomic model of personality traits. *Journal of Personality*, *86*(1), 23–35. https://doi.org/10.1111/jopy.12323

Roberts, B. W., & Davis, J. P. (2016). Young adulthood is the crucible of personality development. *Emerging Adulthood*, *4*(5), 318–326. https://doi.org/10.1177/2167696816653052

Roberts, B. W., & Jackson, J. J. (2008). Sociogenomic personality psychology. *Journal of Personality*, *76*(6), 1523–1544. https://doi.org/10.1111/j.1467-6494.2008.00530.x

Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological Science*, *2*(4), 313–345. https://doi.org/10.1111/j.1745-6916.2007.00047.x

Roberts, B. W., Luo, J., Briley, D. A., Chow, P. I., Su, R., & Hill, P. L. (2017). A systematic review of personality trait change through intervention. *Psychological Bulletin*, *143*, 117–141. https://doi.org/10.1037/bul0000088

Roberts, B. W., & Nickel, L. B. (2017). A critical evaluation of the Neo-Socioanalytic Model of personality. In J. Specht (Ed.), *Personality Development Across the Lifespan* (pp. 157–177). Academic Press. https://doi.org/10.1016/B978-0-12-804674-6.00011-9

Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin*, *132*, 1–25. https://doi.org/10.1037/0033-2909.132.1.1

Roberts, B. W., & Wood, D. (2006). Personality development in the context of the neo-socioanalytic model of personality. In D. K. Mroczek & T. D. Little (Eds.), *Handbook of Personality Development*. Routledge.

Roberts, B. W., & Yoon, H. J. (2022). Personality psychology. *Annual Review of Psychology*, *73*(1), 489–516. https://doi.org/10.1146/annurev-psych-020821-114927

Rohrer, J. M. (2023, March 7). Non-representative samples! What could possibly go wrong? *The 100% CI*. https://www.the100.ci/2023/03/07/non-representative-samples-what-could-possibly-go-wrong/

Roos, Y., Krämer, M. D., Richter, D., Schoedel, R., & Wrzus, C. (in press). Does your smartphone "know" your social life? A methodological comparison of day reconstruction, experience sampling, and mobile sensing. *Advances in Methods and Practices in Psychological Science*.

Roshanaei, M., Vaid, S. S., Courtney, A., Soh, S., Zaki, J., & Harari, G. M. (2023). *Contextualizing meaningful social interactions and momentary well-being in everyday life*. PsyArXiv. https://doi.org/10.31234/osf.io/gu4pv

Russell, D. W. (1996). UCLA loneliness scale (version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, *66*(1), 20–40. https://doi.org/10.1207/s15327752jpa6601_2

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Sander, J., Schumann, P., Richter, D., & Specht, J. (2021). Leisure Activities as a Driver of Personality Development? A Random-Intercept Cross-lagged Panel Model Across 13 Years in Adulthood. *Collabra: Psychology*, *7*(1), 23473. https://doi.org/10.1525/collabra.23473

Sander, J., Schupp, J., & Richter, D. (2017). Getting together: Social contact frequency across the life span. *Developmental Psychology*, *53*(8), 1571–1588. https://doi.org/10.1037/dev0000349

Sandstrom, G. M., & Dunn, E. W. (2014). Social interactions and well-being: The surprising power of weak ties. *Personality and Social Psychology Bulletin*, *40*(7), 910–922. https://doi.org/10.1177/0146167214529799

Schimmack, U. (2008). The structure of subjective well-being. In M. Eid & R. J. Larsen (Eds.), *The science of subjective well-being.* (pp. 97–123). Guilford Press.

Schimmack, U., Krause, P., Wagner, G., & Schupp, J. (2010). Stability and change of well being: An experimentally enhanced latent state-trait-error analysis. *Social Indicators Research*, *95*, 19–31. https://doi.org/10.1007/s11205-009-9443-8

Schmitt, M., Gollwitzer, M., Baumert, A., Blum, G., Gschwendner, T., Hofmann, W., & Rothmund, T. (2013). Proposal of a nonlinear interaction of person and situation (NIPS) model. *Frontiers in Psychology*, *4*, 499–499. PubMed. https://doi.org/10.3389/fpsyg.2013.00499

Schoedel, R., Krämer, M. D., Roos, Y., Wrzus, C., & Richter, D. (2022, June 17). *Willingness to participate in mobile sensing studies: Lessons learned from a large-scale representative panel study*. OSF. https://osf.io/qd9hf

Schoedel, R., Kunz, F., Bergmann, M., Bemmann, F., Buehner, M., & Sust, L. (2022). Snapshots of daily life: Situations investigated through the lens of smartphone sensing. *PsyArXiv*. https://doi.org/10.31234/osf.io/f3htz

Schönbrodt, F. D., & Gerstenberg, F. X. R. (2012). An IRT analysis of motive questionnaires: The Unified Motive Scales. *Journal of Research in Personality*, *46*(6), 725–742. https://doi.org/10.1016/j.jrp.2012.08.010

Schönbrodt, F. D., Zygar-Hoffmann, C., Nestler, S., Pusch, S., & Hagemeyer, B. (2021). Measuring motivational relationship processes in experience sampling: A reliability model for moments, days, and persons nested in couples. *Behavior Research Methods*. https://doi.org/10.3758/s13428-021-01701-7

Schwaba, T., & Bleidorn, W. (2018). Individual differences in personality change across the adult life span. *Journal of Personality*, *86*(3), 450–464. https://doi.org/10.1111/jopy.12327

Schwaba, T., & Bleidorn, W. (2019). Personality trait development across the transition to retirement. *Journal of Personality and Social Psychology*, *116*(4), 651–665. https://doi.org/10.1037/pspp0000179

Schwaba, T., Bleidorn, W., Hopwood, C. J., Manuck, S. B., & Wright, A. G. C. (2022). Refining the maturity principle of personality development by examining facets, close others, and comaturation. *Journal of Personality and Social Psychology*, *122*(5), 942–958. https://doi.org/10.1037/pspp0000400

Schwaba, T., Rhemtulla, M., Hopwood, C. J., & Bleidorn, W. (2020). A facet atlas: Visualizing networks that describe the blends, cores, and peripheries of personality structure. *PLOS ONE*, *15*(7), e0236893. https://doi.org/10.1371/journal.pone.0236893

Seifert, I. S., Rohrer, J. M., Egloff, B., & Schmukle, S. C. (2021). The development of the rank-order stability of the big five across the life span. *Journal of Personality and Social Psychology*. https://doi.org/10.1037/pspp0000398

Shakya, H. B., & Christakis, N. A. (2017). Association of facebook use with compromised well-being: A longitudinal study. *American Journal of Epidemiology*, *185*(3), 203–211. https://doi.org/10.1093/aje/kww189

Shaw, H., Ellis, D. A., Geyer, K., Davidson, B. I., Ziegler, F. V., & Smith, A. (2020). Quantifying smartphone “use”: Choice of measurement impacts relationships between “usage” and health. *Technology, Mind, and Behavior*, *1*, 1–15. https://doi.org/10.1037/tmb0000022

Sheldon, K. M. (2011). Integrating behavioral-motive and experiential-requirement perspectives on psychological needs: A two process model. *Psychological Review*, *118*(4), 552–569. https://doi.org/10.1037/a0024758

Sheppard, P., & Monden, C. (2019). Becoming a first-time grandparent and subjective well-being: A fixed effects approach. *Journal of Marriage and Family*, *81*(4), 1016–1026. https://doi.org/10.1111/jomf.12584

Siedlecki, K. L., Salthouse, T. A., Oishi, S., & Jeswani, S. (2014). The relationship between social support and subjective well-being across age. *Social Indicators Research*, *117*(2), 561–576. https://doi.org/10.1007/s11205-013-0361-4

Simonsohn, U., Simmons, J. P., & Nelson, L. D. (2020). Specification curve analysis. *Nature Human Behaviour*, *4*(11), 1208–1214. https://doi.org/10.1038/s41562-020-0912-z

Sliwinski, M. J. (2008). Measurement-burst designs for social health research. *Social and Personality Psychology Compass*, *2*(1), 245–261. https://doi.org/10.1111/j.1751-9004.2007.00043.x

Soto, C. J. (2019). How replicable are links between personality traits and consequential life outcomes? The life outcomes of personality replication project. *Psychological Science*, *30*(5), 711–727. https://doi.org/10.1177/0956797619831612

Soto, C. J. (2021). Do links between personality and life outcomes generalize? Testing the robustness of trait–outcome associations across gender, age, ethnicity, and analytic approaches. *Social Psychological and Personality Science*, *12*(1), 118–130. https://doi.org/10.1177/1948550619900572

Soto, C. J., & John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*(1), 117–143. https://doi.org/10.1037/pspp0000096

Specht, J. (2017). Personality development in adulthood and old age. In J. Specht (Ed.), *Personality Development Across the Lifespan* (pp. 53–67). Academic Press. https://doi.org/10.1016/B978-0-12-804674-6.00005-3

Specht, J., Bleidorn, W., Denissen, J. J. A., Hennecke, M., Hutteman, R., Kandler, C., Luhmann, M., Orth, U., Reitz, A. K., & Zimmermann, J. (2014). What drives adult personality development? A comparison of theoretical perspectives and empirical evidence. *European Journal of Personality*, *28*(3), 216–230. https://doi.org/10.1002/per.1966

Specht, J., Egloff, B., & Schmukle, S. C. (2011). Stability and change of personality across the life course: The impact of age and major life events on mean-level and rank-order stability of the Big Five. *Journal of Personality and Social Psychology*, *101*(4), 862–882. https://doi.org/10.1037/a0024950

Stachl, C., Pargent, F., Hilbert, S., Harari, G. M., Schoedel, R., Vaid, S., Gosling, S. D., & Bühner, M. (2020). Personality research and assessment in the era of machine learning. *European Journal of Personality*, *34*(5), 613–631. https://doi.org/10.1002/per.2257

Stavrova, O., & Ren, D. (2021). Is more always better? Examining the nonlinear association of social contact frequency with physical health and longevity. *Social Psychological and Personality Science*, *12*(6), 1058–1070. https://doi.org/10.1177/1948550620961589

Stephan, Y., Sutin, A. R., Luchetti, M., Bosselut, G., & Terracciano, A. (2018). Physical activity and personality development over twenty years: Evidence from three longitudinal samples. *Journal of Research in Personality*, *73*, 173–179. https://doi.org/10.1016/j.jrp.2018.02.005

Stieger, M., Flückiger, C., Rüegger, D., Kowatsch, T., Roberts, B. W., & Allemand, M. (2021). Changing personality traits with the help of a digital personality change intervention. *Proceedings of the National Academy of Sciences*, *118*(8). https://doi.org/10.1073/pnas.2017548118

Stijovic, A., Forbes, P. A. G., Tomova, L., Skoluda, N., Feneberg, A. C., Piperno, G., Pronizius, E., Nater, U. M., Lamm, C., & Silani, G. (2023). Homeostatic regulation of energetic arousal during acute social isolation: Evidence from the lab and the field. *Psychological Science*, *Advance online publicaton*. https://doi.org/10.1177/09567976231156413

Struminskaya, B., Lugtig, P., Keusch, F., & Höhne, J. K. (2020). Augmenting surveys with data from sensors and apps: Opportunities and challenges. *Social Science Computer Review*, Advance online publication. https://doi.org/10.1177/0894439320979951

Suls, J., & Martin, R. (2005). The daily life of the garden-variety neurotic: Reactivity, stressor exposure, mood spillover, and maladaptive coping. *Journal of Personality*, *73*(6), 1485–1510. https://doi.org/10.1111/j.1467-6494.2005.00356.x

Sun, J., Harris, K., & Vazire, S. (2020). Is well-being associated with the quantity and quality of social interactions? *Journal of Personality and Social Psychology*, *119*(6), 1478–1496. https://doi.org/10.1037/pspp0000272

Sun, R., Rieble, C., Liu, Y., & Sauter, D. (2022). Connected despite lockdown: The role of social interactions and social media use in wellbeing. *Collabra: Psychology*, *8*(1), 37061. https://doi.org/10.1525/collabra.37061

Tackman, A. M., Baranski, E. N., Danvers, A. F., Sbarra, D. A., Raison, C. L., Moseley, S. A., Polsinelli, A. J., & Mehl, M. R. (2020). 'Personality in its natural habitat' revisited: A pooled, multi-sample examination of the relationships between the Big Five personality traits and daily behaviour and language use. *European Journal of Personality*, *34*(5), 753–776. https://doi.org/10.1002/per.2283

Tanskanen, A. O., Danielsbacka, M., Hämäläinen, H., & Solé-Auró, A. (2021). Does transition to retirement promote grandchild care? Evidence from Europe. *Frontiers in Psychology*, *12*. https://www.frontiersin.org/article/10.3389/fpsyg.2021.738117

Tay, L., & Diener, E. (2011). Needs and subjective well-being around the world. *Journal of Personality and Social Psychology*, *101*(2), 354–365. https://doi.org/10.1037/a0023779

Teo, A. R., Choi, H., Andrea, S. B., Valenstein, M., Newsom, J. T., Dobscha, S. K., & Zivin, K. (2015). Does mode of contact with different types of social relationships predict depression in older adults? Evidence from a nationally representative survey. *Journal of the American Geriatrics Society*, *63*(10), 2014–2022. PubMed. https://doi.org/10.1111/jgs.13667

Teo, A. R., Choi, H., & Valenstein, M. (2013). Social relationships and depression: Ten-year follow-up from a nationally representative study. *PLOS ONE*, *8*(4), e62396. https://doi.org/10.1371/journal.pone.0062396

Terracciano, A. (2014). Pregnancy, marriage, and quitting school nurture personality development? Commentary on Bleidorn, Klimstra, Denissen, Rentfrow, Potter, and Gosling (2013). *Psychological Science*, *25*(4), 1049–1050. https://doi.org/10.1177/0956797613515003

Thiele, D. M., & Whelan, T. A. (2006). The nature and dimensions of the grandparent role. *Marriage & Family Review*, *40*(1), 93–108. https://doi.org/10.1300/J002v40n01_06

Thoemmes, F., & Ong, A. D. (2016). A Primer on Inverse Probability of Treatment Weighting and Marginal Structural Models. *Emerging Adulthood*, *4*(1), 40–59. https://doi.org/10.1177/2167696815621645

Tomori, D. V., Rübsamen, N., Berger, T., Scholz, S., Walde, J., Wittenberg, I., Lange, B., Kuhlmann, A., Horn, J., Mikolajczyk, R., Jaeger, V. K., & Karch, A. (2021). Individual social contact data and population mobility data as early markers of SARS-CoV-2 transmission dynamics during the first wave in Germany—An analysis based on the COVIMOD study. *BMC Medicine*, *19*(1), 271. https://doi.org/10.1186/s12916-021-02139-6

Tse, D. C. K., Lay, J. C., & Nakamura, J. (2022). Autonomy matters: Experiential and individual differences in chosen and unchosen solitary activities from three experience sampling studies. *Social Psychological and Personality Science*, *13*(5), 946–956. https://doi.org/10.1177/19485506211048066

Twenge, J. M. (2023, March 15). Academic pressure cannot explain the mental illness epidemic [Substack newsletter]. *After Babel*. https://jonathanhaidt.substack.com/p/academic-pressure-social-media

Umberson, D., & Karas Montez, J. (2010). Social relationships and health: A flashpoint for health policy. *Journal of Health and Social Behavior*, *51*(1_suppl), S54–S66. https://doi.org/10.1177/0022146510383501

Unanue, W., Martela, F., Vignoles, V. L., & Dittmar, H. (2023). Clarifying the link between psychological need satisfaction and positive affect: Longitudinal within-person tests for bi-directional influence in two cultures. *European Journal of Personality*, Advance online publication. https://doi.org/10.1177/08902070231157149

Ushey, K. (2022). *renv: Project environments* [R package version 0.15.2]. https://rstudio.github.io/renv/

Uziel, L., & Schmidt-Barad, T. (2022). Choice matters more with others: Choosing to be with other people is more consequential to well-being than choosing to be alone. *Journal of Happiness Studies*, *23*, 2469–2489. https://doi.org/10.1007/s10902-022-00506-5

Vaid, S. S., Kroencke, L., Roshanaei, M., Talaifar, S., Hancock, J., Back, M., Gosling, S., Ram, N., & Harari, G. M. (2023). *Social media sensitivity*. PsyArXiv. https://doi.org/10.31234/osf.io/yfp45

van der Horst, M., & Coffé, H. (2012). How friendship network characteristics influence subjective well-being. *Social Indicators Research*, *107*(3), 509–529. https://doi.org/10.1007/s11205-011-9861-2

van Scheppingen, M. A., Jackson, J. J., Specht, J., Hutteman, R., Denissen, J. J. A., & Bleidorn, W. (2016). Personality trait development during the transition to parenthood: A test of social investment theory. *Social Psychological and Personality Science*, *7*(5), 452–462. https://doi.org/10.1177/1948550616630032

Van Zalk, M. H. W., Branje, S. J. T., Denissen, J., Van Aken, M. A. G., & Meeus, W. H. J. (2011). Who benefits from chatting, and why? The roles of extraversion and supportiveness in online chatting and emotional adjustment. *Personality and Social Psychology Bulletin*, *37*(9), 1202–1215. https://doi.org/10.1177/0146167211409053

van Zalk, M. H. W., Nestler, S., Geukes, K., Hutteman, R., & Back, M. D. (2020). The codevelopment of extraversion and friendships: Bonding and behavioral interaction mechanisms in friendship networks. *Journal of Personality and Social Psychology*, *118*(6), 1269–1290. https://doi.org/10.1037/pspp0000253

VanderWeele, T. J. (2019). Principles of confounder selection. *European Journal of Epidemiology*, *34*(3), 211–219. https://doi.org/10.1007/s10654-019-00494-6

VanderWeele, T. J., Mathur, M. B., & Chen, Y. (2020). Outcome-wide longitudinal designs for causal inference: A new template for empirical studies. *Statistical Science*, *35*(3), 437–466. https://doi.org/10.1214/19-STS728

Vuorre, M., Orben, A., & Przybylski, A. K. (2021). There is no evidence that associations between adolescents' digital technology engagement and mental health problems have increased. *Clinical Psychological Science*, *9*(5), 823–835. https://doi.org/10.1177/2167702621994549

Wagner, J., Becker, M., Lüdtke, O., & Trautwein, U. (2015). The first partnership experience and personality development: A propensity score matching study in young adulthood. *Social Psychological and Personality Science*, *6*(4), 455–463. https://doi.org/10.1177/1948550614566092

Wagner, J., Lüdtke, O., Roberts, B. W., & Trautwein, U. (2014). Who belongs to me? Social relationship and personality characteristics in the transition to young adulthood. *European Journal of Personality*, *28*(6), 586–603. https://doi.org/10.1002/per.1974

Wagner, J., Lüdtke, O., & Robitzsch, A. (2019). Does personality become more stable with age? Disentangling state and trait effects for the big five across the life span using local structural equation modeling. *Journal of Personality and Social Psychology*, *116*(4), 666–680. https://doi.org/10.1037/pspp0000203

Wagner, J., Orth, U., Bleidorn, W., Hopwood, C. J., & Kandler, C. (2020). Toward an integrative model of sources of personality stability and change. *Current Directions in Psychological Science*, *29*(5), 438–444. https://doi.org/10.1177/0963721420924751

Wagner, J., Ram, N., Smith, J., & Gerstorf, D. (2016). Personality trait development at the end of life: Antecedents and correlates of mean-level trajectories. *Journal of Personality and Social Psychology*, *111*(3), 411–429. https://doi.org/10.1037/pspp0000071

Waszczuk, M. A., Hopwood, C. J., Luft, B. J., Morey, L. C., Perlman, G., Ruggero, C. J., Skodol, A. E., & Kotov, R. (2022). The prognostic utility of personality traits versus past psychiatric diagnoses: Predicting future mental health and functioning. *Clinical Psychological Science*, *10*(4), 734–751. https://doi.org/10.1177/21677026211056596

Watson, D., & Clark, L. A. (1999). *The PANAS-X: Manual for the positive and negative affect schedule: Expanded form*. The University of Iowa.

Weber, C., Quintus, M., Egloff, B., Luong, G., Riediger, M., & Wrzus, C. (2020). Same old, same old? Age differences in the diversity of daily life. *Psychology and Aging*, *35*(3), 434–448. https://doi.org/10.1037/pag0000407

Wehner, C., Scheppingen, M. A. van, & Bleidorn, W. (2022). Stability and change in major life goals during the transition to parenthood. *European Journal of Personality*, *36*(1), 61–71. https://doi.org/10.1177/0890207021996894

Wettstein, M., Tauber, B., Kuźma, E., & Wahl, H.-W. (2017). The interplay between personality and cognitive ability across 12 years in middle and late adulthood: Evidence for reciprocal associations. *Psychology and Aging*, *32*, 259–277. https://doi.org/10.1037/pag0000166

Wichers, M., Kasanova, Z., Bakker, J., Thiery, E., Derom, C., Jacobs, N., & Os, J. van. (2015). From affective experience to motivated action: Tracking reward-seeking and punishment-avoidant behaviour in real-life. *PLOS ONE*, *10*(6), e0129722. https://doi.org/10.1371/journal.pone.0129722

Wilt, J., & Revelle, W. (2015). Affect, behaviour, cognition and desire in the Big Five: An analysis of item content and structure. *European Journal of Personality*, *29*(4), 478–497. https://doi.org/10.1002/per.2002

Wright, A. J., & Jackson, J. J. (2022). *Do changes in personality predict life outcomes?* PsyArXiv. https://doi.org/10.31234/osf.io/45yj7

Wright, A. J., & Jackson, J. J. (2023). The associations between life events and person-centered personality consistency. *Journal of Personality*, *Advance online publication*. https://doi.org/10.1111/jopy.12802

Wrzus, C. (2021). Processes of personality development: An update of the TESSERA framework. In J. F. Rauthmann (Ed.), *The Handbook of Personality Dynamics and Processes*. Elsevier.

Wrzus, C., Luong, G., Wagner, G. G., & Riediger, M. (2021). Longitudinal coupling of momentary stress reactivity and trait neuroticism: Specificity of states, traits, and age period. *Journal of Personality and Social Psychology*, *121*(3), 691–706. https://doi.org/10.1037/pspp0000308

Wrzus, C., & Mehl, M. R. (2015). Lab and/or field? Measuring personality processes and their social consequences. *European Journal of Personality*, *29*, 250–271. https://doi.org/10.1002/per.1986

Wrzus, C., & Neubauer, A. B. (2022). Ecological momentary assessment: A meta-analysis on designs, samples, and compliance across research fields. *Assessment*. https://doi.org/10.1177/10731911211067538

Wrzus, C., & Neubauer, A. B. (2023). Ecological momentary assessment: A meta-analysis on designs, samples, and compliance across research fields. *Assessment*, *30*(3), 825–846. https://doi.org/10.1177/10731911211067538

Wrzus, C., & Roberts, B. W. (2017). Processes of personality development in adulthood: The TESSERA framework. *Personality and Social Psychology Review*, *21*(3), 253–277. https://doi.org/10.1177/1088868316652279

Wrzus, C., Roos, Y., Krämer, M. D., & Richter, D. (2023). *Individual differences in social dynamics: Theoretical perspective and empirical development of the social dynamics scale* [Manuscript submitted for publication].

Wrzus, C., Wagner, G. G., & Riediger, M. (2016). Personality-situation transactions from adolescence to old age. *Journal of Personality and Social Psychology*, *110*(5), 782–799. https://doi.org/10.1037/pspp0000054

Wrzus, C., Zimmermann, J., Mund, M., & Neyer, F. J. (2017). Friendships in young and middle adulthood: Normative patterns and personality differences. In M. Hojjat & A. Moyer (Eds.), *The psychology of friendship.* (pp. 21–38). Oxford University Press.

Wünsche, J., Weidmann, R., & Grob, A. (2020). Until death do us part: The codevelopment of life satisfaction in couples preceding the death of one partner. *Journal of Personality and Social Psychology*, *119*(4), 881–900. https://doi.org/10.1037/pspi0000228

Yaremych, H. E., Preacher, K. J., & Hedeker, D. (2021). Centering categorical predictors in multilevel models: Best practices and interpretation. *Psychological Methods*, *Advance online publication*. https://doi.org/10.1037/met0000434

Zettler, I., Schild, C., Lilleholt, L., Kroencke, L., Utesch, T., Moshagen, M., Böhm, R., Back, M. D., & Geukes, K. (2022). The role of personality in COVID-19-related perceptions, evaluations, and behaviors: Findings across five samples, nine traits, and 17 criteria. *Social Psychological and Personality Science*, *13*(1), 299–310. https://doi.org/10.1177/19485506211001680

Zheng, Y., Plomin, R., & von Stumm, S. (2016). Heritability of intraindividual mean and variability of positive and negative affect: Genetic analysis of daily affect ratings over a month. *Psychological Science*, *27*(12), 1611–1619. https://doi.org/10.1177/0956797616669994

Zygar, C., Hagemeyer, B., Pusch, S., & Schönbrodt, F. D. (2018). From motive dispositions to states to outcomes: An intensive experience sampling study on communal motivational dynamics in couples. *European Journal of Personality*, *32*(3), 306–324. https://doi.org/10.1002/per.2145

Appendix A

Supplemental Materials for Study I

Supplemental Material

Model Equations

Mean-Level Changes (RQ1)

Model equation for the basic (i.e., unmoderated) models (ignoring the additional nesting in households applied to the majority of models):

$$\begin{aligned} y_{ti} =& \beta_{0i} + \beta_{1i} before_{ti} + \beta_{2i} after_{ti} + \beta_{3i} shift_{ti} + e_{ti} \\ & \beta_{0i} = \gamma_{00} + \gamma_{01} grandparent_i + \gamma_{02} pscore_i + \upsilon_{0i} \\ & \beta_{1i} = \gamma_{10} + \gamma_{11} grandparent_i \\ & \beta_{2i} = \gamma_{20} + \gamma_{21} grandparent_i \\ & \beta_{3i} = \gamma_{30} + \gamma_{31} grandparent_i \ , \end{aligned} \tag{A1}$$

where at time t for person i $e_{ti} \sim N(0, \sigma_e^2)$ and $\upsilon_{0i} \sim N(0, \tau_{00})$. y_{ti} represented one of the Big Five or life satisfaction. Separate models were computed for LISS and HRS samples, and for parent and nonparent matched controls.

Model equation for the models including the gender interaction (moderator variable $female_i$):

$$\begin{aligned} y_{ti} =& \beta_{0i} + \beta_{1i} before_{ti} + \beta_{2i} after_{ti} + \beta_{3i} shift_{ti} + e_{ti} \\ & \beta_{0i} = \gamma_{00} + \gamma_{01} grandparent_i + \gamma_{02} female_i + \gamma_{03} grandparent_i female_i \\ & \qquad + \gamma_{04} pscore_i + \upsilon_{0i} \\ & \beta_{1i} = \gamma_{10} + \gamma_{11} grandparent_i + \gamma_{12} female_i + \gamma_{13} grandparent_i female_i \\ & \beta_{2i} = \gamma_{20} + \gamma_{21} grandparent_i + \gamma_{22} female_i + \gamma_{23} grandparent_i female_i \\ & \beta_{3i} = \gamma_{30} + \gamma_{31} grandparent_i + \gamma_{32} female_i + \gamma_{33} grandparent_i female_i \ , \end{aligned} \tag{A2}$$

where $e_{ti} \sim N(0, \sigma_e^2)$ and $\upsilon_{0i} \sim N(0, \tau_{00})$. Again, we estimated separate models for each sample (LISS, HRS) and each comparison group (parents, nonparents).

Model equation for the models including the interaction by paid work (moderator variable $working_{ti}$):

$$\begin{aligned}
y_{ti} =& \beta_{0i} + \beta_{1i} working_{ti} + \beta_{2i} before_{ti} + \beta_{3i} before_{ti} working_{ti} + \beta_{4i} after_{ti} \\
& + \beta_{5i} after_{ti} working_{ti} + \beta_{6i} shift_{ti} + \beta_{7i} shift_{ti} working_{ti} + e_{ti} \\
& \beta_{0i} = \gamma_{00} + \gamma_{01} grandparent_i + \gamma_{02} pscore_i + \upsilon_{0i} \\
& \beta_{1i} = \gamma_{10} + \gamma_{11} grandparent_i \\
& \beta_{2i} = \gamma_{20} + \gamma_{21} grandparent_i \\
& \beta_{3i} = \gamma_{30} + \gamma_{31} grandparent_i \\
& \beta_{4i} = \gamma_{40} + \gamma_{41} grandparent_i \\
& \beta_{5i} = \gamma_{50} + \gamma_{51} grandparent_i \\
& \beta_{6i} = \gamma_{60} + \gamma_{61} grandparent_i \\
& \beta_{7i} = \gamma_{70} + \gamma_{71} grandparent_i \ ,
\end{aligned} \tag{A3}$$

where $e_{ti} \sim N(0, \sigma_e^2)$ and $\upsilon_{0i} \sim N(0, \tau_{00})$. We estimated separate models for each comparison group (parents, nonparents) in the HRS.

Model equation for the models including the interaction by grandchild care (moderator variable $caring_{ti}$):

$$\begin{aligned}
y_{ti} =& \beta_{0i} + \beta_{1i} caring_{ti} + \beta_{2i} after_{ti} + \beta_{3i} after_{ti} caring_{ti} + e_{ti} \\
& \beta_{0i} = \gamma_{00} + \gamma_{01} grandparent_i + \gamma_{02} pscore_i + \upsilon_{0i} \\
& \beta_{1i} = \gamma_{10} + \gamma_{11} grandparent_i \\
& \beta_{2i} = \gamma_{20} + \gamma_{21} grandparent_i \\
& \beta_{3i} = \gamma_{30} + \gamma_{31} grandparent_i \ ,
\end{aligned} \tag{A4}$$

where $e_{ti} \sim N(0, \sigma_e^2)$ and $\upsilon_{0i} \sim N(0, \tau_{00})$. Restricted to the HRS post-transition period, we estimated separate models for each comparison group (parents, nonparents).

Interindividual Differences in Change (RQ2)

The equations for the models testing interindividual differences in change differ only in the random effects from those in (A1). For models with a homogeneous (single) random slope (but heterogeneous random intercept variances for the grandparent and the control group, respectively), the random effects are now represented by $e_{ti} \sim N(0, \sigma_e^2)$ and

$$\begin{bmatrix} \upsilon_{0i} \\ \upsilon_{1i} \end{bmatrix} \sim MVN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} T_{00g} & \\ 0 & \tau_{11} \end{bmatrix}\right), \text{ with } T_{00g} = \begin{bmatrix} \tau_{00g=0} & 0 \\ 0 & \tau_{00g=1} \end{bmatrix},$$

where g represents the grouping variable. $\tau_{00g=0}$ refers to the random intercept variance of the control group and $\tau_{00g=1}$ to that of the grandparents. This type of baseline model is compared via likelihood ratio test with one that features both heterogeneous random intercept variances and heterogeneous random slope variances. For models with heterogeneous random slopes for the grandparent and control groups, the random effects are represented by $e_{ti} \sim N(0, \sigma_e^2)$ and $\begin{bmatrix} \upsilon_{0i} \\ \upsilon_{1i} \end{bmatrix} \sim MVN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} T_{00g} & \\ T_{10g} & T_{11g} \end{bmatrix}\right)$, with $T_{00g} = \begin{bmatrix} \tau_{00g=0} & 0 \\ 0 & \tau_{00g=1} \end{bmatrix}$, $T_{11g} = \begin{bmatrix} \tau_{11g=0} & 0 \\ 0 & \tau_{11g=1} \end{bmatrix}$, and $T_{10g} = \begin{bmatrix} \tau_{10g=0} & 0 \\ 0 & \tau_{10g=1} \end{bmatrix}$, where g represents the grouping variable. $\tau_{00g=0}$, $\tau_{11g=0}$ and $\tau_{10g=0}$ refer to the random intercept variance, random slope variance, and random intercept/slope covariance of the control group, respectively, and $\tau_{00g=1}$, $\tau_{11g=1}$, and $\tau_{10g=1}$ to those of the grandparents. In addition to the two random slope variances (instead of one, τ_{11}), the heterogeneous variance models estimate two random intercept/slope covariances. In Tables S64-S69 we report τ_{11}, $\tau_{11g=0}$, and $\tau_{11g=0}$ for each change parameter as well as the results of the likelihood ratio tests. Please note that the notation for heterogeneous models used here is not found in standard multilevel modeling textbooks and is partly based on *this tutorial* by Nilam Ram. See also *this blogpost* by Jonas Lang for syntax examples in *nlme* and *lme4* syntax.

Supplemental Tables

Table S1

Internal Consistency Measures in the Four Analysis Samples at the Time of Matching.

	A	C	E	N	O	LS
LISS: Parent controls						
ω_t	0.88	0.83	0.88	0.91	0.88	0.93
ω_h	0.75	0.57	0.71	0.72	0.63	0.78
α	0.83	0.78	0.84	0.87	0.78	0.91
LISS: Nonparent controls						
ω_t	0.89	0.88	0.93	0.92	0.88	0.89
ω_h	0.73	0.68	0.79	0.79	0.66	0.75
α	0.81	0.79	0.90	0.90	0.79	0.88
HRS: Parent controls						
ω_t	0.78	0.82	0.80	0.76	0.86	0.93
ω_h	0.67	0.48	0.68	0.59	0.61	0.88
α	0.78	0.59	0.75	0.71	0.77	0.90
HRS: Nonparent controls						
ω_t	0.84	0.77	0.81	0.76	0.85	0.92
ω_h	0.64	0.63	0.71	0.62	0.65	0.82
α	0.80	0.57	0.77	0.72	0.79	0.90

Note. A = agreeableness, C = conscientiousness, E = extraversion, N = neuroticism, O = openness, LS = life satisfaction. Omega total, ω_t, is based on 'omega.tot' from the *psych::omega()* function, and omega hierarchical, ω_h, on 'omega_h' (Revelle, 2021). For the LISS, we based the number of lower-order factors specified in 'nfactors' on information supplied in Goldberg (1999). For the HRS, we could not find comparable information and used the default value. α is based on 'raw_alpha' from the *psych::alpha()* function (Revelle, 2021).

Table S2

Standardized Difference in Means for Covariates Used in Propensity Score Matching and the Propensity Score in the LISS.

			Parent control group		Nonparent control group	
Covariate	Description	Raw variables	Before PSM	After PSM	Before PSM	After PSM
pscore	Propensity score	/	1.13	0.02	1.32	0.03
female	Gender (f.=1, m.=0)	geslacht	0.08	0.00	0.07	0.00
age	Age	gebjaar	0.76	0.03	3.86	-0.11
degreehighersec	Higher secondary/preparatory university education	oplmet	0.04	-0.08	-0.08	0.10
degreevocational	Intermediate vocational education	oplmet	-0.20	0.01	0.01	0.06
degreecollege	Higher vocational education	oplmet	0.03	0.05	0.02	-0.02
degreeuniversity	University degree	oplmet	-0.06	0.06	-0.15	-0.03
religion	Member of religion/church	cr*012	0.19	0.01	0.38	0.11
speakdutch	Dutch spoken at home (primarily)	cr*089	-0.01	0.11	-0.01	0.05
divorced	Divorced (marital status)	burgstat	0.01	-0.01	0.29	0.06
widowed	Widowed (marital status)	burgstat	0.09	-0.13	0.14	-0.13
livetogether	Live together with partner	cf*025	-0.03	0.00	1.04	0.05
rooms	Rooms in dwelling	cd*034	0.05	-0.03	0.68	-0.04
logincome	Personal net monthly income in Euros (logarithm)	nettoink	-0.07	-0.03	0.46	-0.09
rental	Live for rent (vs. self-owned dwelling)	woning	-0.10	0.01	-0.48	-0.03
financialsit	Financial situation of household (scale from 1-5)	ci*252	0.01	0.08	-0.05	0.03
jobhours	Average work hours per week	cw*127	0.03	0.08	0.10	0.03
mobility	Mobility problems (walking, staircase, shopping)	ch*023/027/041	0.05	-0.03	0.06	-0.06
dep	Depression items from Mental Health Inventory	ch*011 - ch*015	0.01	0.02	-0.21	-0.09
betterhealth	Poor/moderate health status (ref.: good)	ch*004	-0.03	0.07	-0.28	0.08
worsehealth	Very good/excellent health status (ref.: good)	ch*004	-0.01	0.00	0.05	-0.12
totalchildren	Number living children	cf*455 / cf*036	0.29	0.06	NA	NA
totalresidentkids	Number of living-at-home children in household	aantalki	-0.63	0.01	NA	NA
secondkid	Has two or more children	cf*455 / cf*036	0.23	0.05	NA	NA
thirdkid	Has three or more children	cf*455 / cf*036	0.27	0.06	NA	NA
kid1female	Gender of first child (f.=1, m.=0)	cf*068	0.04	0.02	NA	NA
kid2female	Gender of second child (f.=1, m.=0)	cf*069	0.08	-0.03	NA	NA
kid3female	Gender of third child (f.=1, m.=0)	cf*070	0.14	0.06	NA	NA
kid1age	Age of first child	cf*456 / cf*037	1.58	-0.09	NA	NA
kid2age	Age of second child	cf*457 / cf*038	0.84	0.03	NA	NA
kid3age	Age of third child	cf*458 / cf*039	0.41	0.06	NA	NA
kid1home	First child living at home	cf*083	-1.46	0.00	NA	NA

Table S2 continued

Covariate	Description	Raw variables	Parent control group		Nonparent control group	
			Before PSM	After PSM	Before PSM	After PSM
kid2home	Second child living at home	cf*084	-0.94	0.01	NA	NA
kid3home	Third child living at home	cf*085	-0.03	-0.01	NA	NA
swls	Satisfaction with Life Scale	cp*014 - cp*018	0.06	0.03	0.22	0.02
agree	Agreeableness	cp*021 - cp*066	0.05	0.05	0.12	-0.12
con	Conscientiousness	cp*022 - cp*067	-0.04	0.08	0.14	0.06
extra	Extraversion	cp*020 - cp*065	0.05	0.08	0.04	-0.01
neur	Neuroticism	cp*023 - cp*068	0.05	-0.04	-0.22	-0.06
open	Openness	cp*024 - cp*069	0.03	0.13	-0.16	0.00
participation	Waves participated	/	-0.71	-0.07	-0.18	-0.04
year	Year of assessment	wave	-0.63	-0.02	-0.16	-0.02

Note. PSM = propensity score matching, ref. = reference category, f. = female, m. = male, NA = covariate not used in this sample. The standardized difference in means between the grandparent and the two control groups (parent and nonparent) was computed by $(\bar{x}_{gp} - \bar{x}_c)/(\hat{\sigma}_{gp})$. Rules of thumb say that this measure should ideally be below .25 (Stuart, 2010) or below .10 (Austin, 2011).

Table S3

Standardized Difference in Means for Covariates Used in Propensity Score Matching and the Propensity Score in the HRS.

			Parent control group		Nonparent control group	
Covariate	Description	Raw variables	Before PSM	After PSM	Before PSM	After PSM
pscore	Propensity score	/	0.92	0.01	1.45	0.00
female	Gender (f.=1, m.=0)	RAGENDER	-0.06	0.00	0.01	0.00
age	Age	RABYEAR	-0.46	-0.03	-1.02	0.10
schlyrs	Years of education	RAEDYRS	0.11	0.05	0.24	-0.01
religyear	Religious attendance: yearly	*B082	0.04	0.01	0.13	0.02
religmonth	Religious attendance: monthly	*B082	0.01	-0.03	0.10	0.05
religweek	Religious attendance: weekly	*B082	0.06	0.04	0.04	0.03
religmore	Religious attendance: more	*B082	0.09	-0.04	0.06	-0.06
notusaborn	Not born in the US	*Z230	-0.05	0.02	0.13	0.01
black	Race: black/african american (ref.: white)	RARACEM	-0.12	-0.03	-0.20	0.00
raceother	Race: other (ref.: white)	RARACEM	-0.09	-0.01	0.01	-0.01
divorced	Divorced (marital status)	R*MSTAT	-0.06	-0.02	0.01	0.00
widowed	Widowed (marital status)	R*MSTAT	-0.31	0.01	-0.41	0.04
livetogether	Live together with partner	*A030 / *XF065_R	0.25	0.00	1.05	-0.01
roomslessthree	Number of rooms (in housing unit)	*H147 / *066	-0.15	-0.01	-0.59	-0.06
roomsfourfive	Number of rooms (in housing unit)	*H147 / *066	0.00	0.01	-0.23	-0.02
roomsmoreeight	Number of rooms (in housing unit)	*H147 / *066	0.07	-0.03	0.25	0.03
loghhincome	Household income (logarithm)	*ITOT	0.03	0.00	0.41	0.04
loghhwealth	Household wealth (logarithm)	*ATOTB	0.07	0.00	0.34	0.03
renter	Live for rent (vs. self-owned dwelling)	*H004	-0.09	-0.02	-0.50	-0.08
jobhours	Hours worked/week main job	R*JHOURS	0.25	0.06	0.59	-0.03
paidwork	Working for pay	*J020	0.28	0.08	0.62	-0.04
mobilitydiff	Difficulty in mobility rated from 0-5	R*MOBILA	-0.16	-0.02	-0.52	-0.01
cesd	CESD score (depression)	R*CESD	-0.13	-0.01	-0.26	-0.04
conde	Sum of health conditions	R*CONDE	-0.23	-0.01	-0.51	0.03
healthexcellent	Self-report of health - excellent (ref: good)	R*SHLT	0.06	0.01	0.15	0.00
healthverygood	Self-report of health - very good (ref: good)	R*SHLT	0.23	-0.01	0.31	-0.02
healthfair	Self-report of health - fair (ref: good)	R*SHLT	-0.16	0.00	-0.29	-0.01
healthpoor	Self-report of health - poor (ref: good)	R*SHLT	-0.07	-0.03	-0.24	0.02
totalnonresidentkids	Number of nonresident kids	*A100	0.66	-0.06	NA	NA
totalresidentkids	Number of resident children	*A099	-0.22	0.03	NA	NA
secondkid	Has two or more children	KIDID	0.52	0.01	NA	NA

Table S3 continued

Covariate	Description	Raw variables	Parent control group		Nonparent control group	
			Before PSM	After PSM	Before PSM	After PSM
thirdkid	Has three or more children	KIDID	0.38	-0.02	NA	NA
kid1female	Gender of first child (f.=1, m.=0)	KAGENDERBG	0.11	0.04	NA	NA
kid2female	Gender of second child (f.=1, m.=0)	KAGENDERBG	0.17	0.02	NA	NA
kid3female	Gender of third child (f.=1, m.=0)	KAGENDERBG	0.23	0.05	NA	NA
kid1age	Age of first child	KABYEARBG	-0.35	-0.06	NA	NA
kid2age	Age of second child	KABYEARBG	0.36	-0.01	NA	NA
kid3age	Age of third child	KABYEARBG	0.35	-0.02	NA	NA
kid1educ	Education of first child (years)	KAEDUC	0.30	0.03	NA	NA
kid2educ	Education of second child (years)	KAEDUC	0.57	0.03	NA	NA
kid3educ	Education of third child (years)	KAEDUC	0.40	-0.01	NA	NA
childrenclose	Children live within 10 miles	*E012	0.13	0.00	NA	NA
siblings	Number of living siblings	R*LIVSIB	0.05	-0.02	0.22	0.03
swls	Satisfaction with Life Scale	*LB003*	0.17	0.05	0.30	0.00
agree	Agreeableness	*LB033*	0.06	0.01	0.11	0.02
con	Conscientiousness	*LB033*	0.14	0.03	0.26	-0.03
extra	Extraversion	*LB033*	0.04	0.03	0.18	-0.04
neur	Neuroticism	*LB033*	-0.07	0.01	-0.04	-0.01
open	Openness	*LB033*	0.04	0.07	0.05	-0.05
participation	Waves participated (2006-2018)	/	-0.36	-0.02	-0.26	-0.04
interviewyear	Date of interview - year	*A501	-0.33	-0.04	-0.18	-0.07

Note. PSM = propensity score matching, ref. = reference category, f. = female, m. = male, NA = covariate not used in this sample. The standardized difference in means between the grandparent and the two control groups (parent and nonparent) was computed by $(\bar{x}_{gp} - \bar{x}_c)/(\hat{\sigma}_{gp})$. Rules of thumb say that this measure should ideally be below .25 (Stuart, 2010) or below .10 (Austin, 2011).

Table S4

Means and Standard Deviations of the Big Five and Life Satisfaction over Time in the LISS Panel.

	Pre-transition years						Post-transition years						
	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Agreeableness													
Grandparents	3.84	3.88	3.94	3.84	3.91	3.91	3.85	3.90	3.89	3.96	3.89	3.96	3.98
	(0.50)	(0.50)	(0.45)	(0.50)	(0.53)	(0.48)	(0.51)	(0.55)	(0.52)	(0.49)	(0.51)	(0.51)	(0.40)
Parent controls	3.90	3.87	3.89	3.87	3.85	3.90	3.84	3.86	3.89	3.82	3.84	3.87	3.81
	(0.51)	(0.50)	(0.45)	(0.51)	(0.49)	(0.46)	(0.45)	(0.50)	(0.52)	(0.48)	(0.49)	(0.48)	(0.48)
Nonparent controls	3.89	3.95	3.96	3.97	3.95	3.93	3.90	3.95	3.94	3.94	3.95	3.92	3.90
	(0.53)	(0.53)	(0.49)	(0.49)	(0.49)	(0.48)	(0.46)	(0.44)	(0.46)	(0.48)	(0.44)	(0.43)	(0.42)
Conscientiousness													
Grandparents	3.79	3.85	3.75	3.76	3.77	3.78	3.80	3.80	3.79	3.81	3.81	3.77	3.75
	(0.52)	(0.45)	(0.48)	(0.47)	(0.52)	(0.49)	(0.51)	(0.51)	(0.49)	(0.50)	(0.45)	(0.47)	(0.44)
Parent controls	3.75	3.75	3.73	3.73	3.72	3.76	3.73	3.76	3.74	3.74	3.71	3.76	3.65
	(0.56)	(0.47)	(0.53)	(0.48)	(0.47)	(0.49)	(0.47)	(0.46)	(0.49)	(0.49)	(0.50)	(0.51)	(0.48)
Nonparent controls	3.72	3.76	3.77	3.73	3.76	3.75	3.73	3.74	3.72	3.77	3.74	3.71	3.76
	(0.54)	(0.55)	(0.54)	(0.50)	(0.52)	(0.50)	(0.52)	(0.51)	(0.53)	(0.49)	(0.51)	(0.53)	(0.53)
Extraversion													
Grandparents	3.21	3.18	3.31	3.31	3.29	3.29	3.21	3.21	3.16	3.22	3.26	3.32	3.20
	(0.65)	(0.73)	(0.56)	(0.58)	(0.66)	(0.60)	(0.63)	(0.68)	(0.68)	(0.62)	(0.59)	(0.62)	(0.54)
Parent controls	3.30	3.22	3.22	3.23	3.25	3.23	3.19	3.20	3.24	3.18	3.20	3.17	3.19
	(0.59)	(0.61)	(0.57)	(0.58)	(0.55)	(0.55)	(0.57)	(0.58)	(0.57)	(0.57)	(0.57)	(0.55)	(0.50)
Nonparent controls	3.29	3.28	3.24	3.28	3.29	3.31	3.27	3.24	3.30	3.22	3.27	3.25	3.26
	(0.72)	(0.70)	(0.78)	(0.74)	(0.68)	(0.66)	(0.70)	(0.68)	(0.71)	(0.73)	(0.72)	(0.66)	(0.71)
Neuroticism													
Grandparents	2.39	2.33	2.32	2.41	2.48	2.42	2.32	2.38	2.28	2.35	2.29	2.45	2.41
	(0.70)	(0.64)	(0.59)	(0.63)	(0.64)	(0.70)	(0.67)	(0.78)	(0.68)	(0.65)	(0.64)	(0.79)	(0.68)
Parent controls	2.50	2.44	2.47	2.42	2.46	2.43	2.40	2.41	2.34	2.36	2.37	2.33	2.40
	(0.58)	(0.60)	(0.62)	(0.55)	(0.58)	(0.60)	(0.60)	(0.60)	(0.62)	(0.60)	(0.61)	(0.64)	(0.59)
Nonparent controls	2.51	2.47	2.51	2.45	2.46	2.41	2.44	2.42	2.49	2.50	2.48	2.52	2.49
	(0.58)	(0.61)	(0.68)	(0.64)	(0.66)	(0.65)	(0.69)	(0.71)	(0.76)	(0.74)	(0.77)	(0.80)	(0.83)

Table S4 continued

	Pre-transition years						Post-transition years						
	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Openness													
Grandparents	3.48	3.48	3.48	3.51	3.47	3.47	3.46	3.49	3.50	3.48	3.47	3.46	3.39
	(0.52)	(0.51)	(0.51)	(0.45)	(0.53)	(0.52)	(0.50)	(0.54)	(0.44)	(0.46)	(0.47)	(0.53)	(0.53)
Parent controls	3.47	3.41	3.42	3.44	3.41	3.38	3.41	3.40	3.37	3.37	3.38	3.36	3.36
	(0.58)	(0.50)	(0.51)	(0.52)	(0.49)	(0.49)	(0.52)	(0.50)	(0.49)	(0.48)	(0.48)	(0.45)	(0.48)
Nonparent controls	3.54	3.52	3.50	3.50	3.51	3.46	3.49	3.48	3.52	3.52	3.51	3.48	3.49
	(0.48)	(0.53)	(0.51)	(0.53)	(0.53)	(0.53)	(0.52)	(0.52)	(0.52)	(0.53)	(0.51)	(0.49)	(0.52)
Life satisfaction													
Grandparents	5.17	5.24	5.21	5.14	5.29	5.28	5.34	5.23	5.36	5.44	5.39	5.27	5.32
	(1.07)	(0.91)	(1.11)	(0.98)	(0.92)	(1.08)	(0.91)	(0.99)	(1.06)	(0.88)	(1.10)	(1.10)	(1.08)
Parent controls	5.10	5.14	5.17	5.21	5.20	5.31	5.27	5.26	5.26	5.30	5.21	5.30	5.18
	(1.29)	(1.11)	(1.17)	(1.01)	(1.06)	(1.12)	(1.10)	(1.12)	(1.10)	(1.09)	(1.12)	(1.17)	(1.12)
Nonparent controls	5.06	5.17	5.07	5.10	5.21	5.22	5.12	5.00	5.02	4.96	5.04	5.05	5.02
	(0.92)	(0.85)	(0.92)	(0.92)	(0.88)	(0.88)	(0.96)	(1.00)	(1.15)	(1.21)	(1.13)	(1.16)	(1.14)

Note. Standard deviations shown in parentheses; $time = 0$ marks the first year where the transition to grandparenthood was reported.

Table S5

Means and Standard Deviations of the Big Five and Life Satisfaction over Time in the HRS.

	Pre-transition years						Post-transition years						
	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Agreeableness													
Grandparents	3.46		3.51		3.51		3.51		3.52		3.50		3.56
	(0.47)		(0.48)		(0.49)		(0.49)		(0.48)		(0.53)		(0.44)
Parent controls	3.47		3.51		3.51		3.51		3.50		3.50		3.48
	(0.50)		(0.46)		(0.47)		(0.48)		(0.49)		(0.50)		(0.52)
Nonparent controls	3.53		3.48		3.51		3.48		3.52		3.44		3.47
	(0.48)		(0.51)		(0.49)		(0.51)		(0.49)		(0.54)		(0.54)
Conscientiousness													
Grandparents	3.47		3.47		3.47		3.46		3.45		3.44		3.49
	(0.46)		(0.45)		(0.44)		(0.45)		(0.44)		(0.43)		(0.44)
Parent controls	3.45		3.44		3.46		3.46		3.46		3.44		3.46
	(0.44)		(0.45)		(0.45)		(0.45)		(0.47)		(0.48)		(0.50)
Nonparent controls	3.50		3.47		3.49		3.49		3.50		3.47		3.49
	(0.43)		(0.45)		(0.43)		(0.44)		(0.44)		(0.45)		(0.44)
Extraversion													
Grandparents	3.15		3.22		3.20		3.21		3.19		3.22		3.22
	(0.56)		(0.56)		(0.54)		(0.56)		(0.58)		(0.59)		(0.58)
Parent controls	3.18		3.19		3.19		3.22		3.21		3.22		3.22
	(0.54)		(0.54)		(0.55)		(0.54)		(0.56)		(0.52)		(0.54)
Nonparent controls	3.23		3.21		3.24		3.22		3.25		3.24		3.27
	(0.54)		(0.54)		(0.55)		(0.53)		(0.52)		(0.56)		(0.55)
Neuroticism													
Grandparents	2.00		1.98		2.06		1.91		1.96		1.91		1.91
	(0.56)		(0.63)		(0.62)		(0.60)		(0.58)		(0.59)		(0.61)
Parent controls	2.07		2.02		2.02		1.98		1.99		1.96		1.95
	(0.59)		(0.59)		(0.60)		(0.61)		(0.62)		(0.59)		(0.59)
Nonparent controls	2.08		2.04		2.03		1.96		1.97		1.88		1.93
	(0.59)		(0.61)		(0.60)		(0.60)		(0.60)		(0.56)		(0.58)

Table S5 continued

	Pre-transition years						Post-transition years						
	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Openness													
Grandparents	3.00		3.02		3.04		3.01		3.00		2.96		3.04
	(0.51)		(0.53)		(0.51)		(0.52)		(0.52)		(0.59)		(0.51)
Parent controls	3.01		2.99		2.99		3.00		2.99		2.97		2.96
	(0.51)		(0.54)		(0.54)		(0.53)		(0.53)		(0.56)		(0.56)
Nonparent controls	3.08		3.04		3.07		3.04		3.06		3.02		3.04
	(0.56)		(0.53)		(0.54)		(0.53)		(0.55)		(0.55)		(0.57)
Life satisfaction													
Grandparents	5.14		5.08		5.15		5.17		5.16		5.29		5.28
	(1.44)		(1.45)		(1.46)		(1.40)		(1.44)		(1.38)		(1.50)
Parent controls	5.08		5.03		5.05		5.16		5.13		5.17		5.18
	(1.60)		(1.56)		(1.58)		(1.50)		(1.52)		(1.46)		(1.49)
Nonparent controls	5.16		5.07		5.15		5.21		5.26		5.34		5.46
	(1.45)		(1.54)		(1.47)		(1.44)		(1.43)		(1.37)		(1.31)

Note. Standard deviations shown in parentheses; $time = 0$ marks the first year where the transition to grandparenthood was reported. To aid comparability with the LISS panel measures, we reverse scored all Big Five items so that higher values corresponded to higher trait levels.

Table S6

Intra-Class Correlations of Grandparents and Matched Controls in the Four Analysis Samples.

	A	C	E	N	O	LS
LISS: Parent controls						
ICC_{pid}	0.76	0.76	0.83	0.67	0.76	0.28
ICC_{hid}	0.04	0.02	0.01	0.10	0.03	0.40
$ICC_{pid/hid}$	0.80	0.78	0.84	0.78	0.79	0.68
LISS: Nonparent controls						
ICC_{pid}	0.75	0.74	0.85	0.65	0.80	0.31
ICC_{hid}	0.00	0.01	0.00	0.10	0.01	0.34
$ICC_{pid/hid}$	0.75	0.75	0.85	0.74	0.81	0.65
HRS: Parent controls						
ICC_{pid}	0.75	0.73	0.76	0.71	0.58	0.28
ICC_{hid}	0.01	0.03	0.02	0.03	0.20	0.38
$ICC_{pid/hid}$	0.76	0.76	0.79	0.74	0.78	0.66
HRS: Nonparent controls						
ICC_{pid}	0.69	0.74	0.75	0.74	0.60	0.33
ICC_{hid}	0.08	0.05	0.04	0.01	0.22	0.37
$ICC_{pid/hid}$	0.77	0.79	0.80	0.75	0.83	0.70

Note. A = agreeableness, C = conscientiousness, E = extraversion, N = neuroticism, O = openness, LS = life satisfaction. Intra-class correlations are the proportion of total variation that is explained by the respective nesting factor. ICC_{pid} is the proportion of total variance explained by nesting in respondents which corresponds to the correlation between two randomly selected observations from the same respondent. ICC_{hid} is the proportion of total variance explained by nesting in households which corresponds to the correlation between two randomly selected observations from the same household. $ICC_{pid/hid}$ is the proportion of total variance explained by nesting in respondents and in households which corresponds to the correlation between two randomly selected observations from the same respondent and the same household.

Table S7

Fixed Effects of Agreeableness Over the Transition to Grandparenthood.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.86	[3.80, 3.91]	135.36	$<$ .001	3.90	[3.83, 3.96]	116.54	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.06	[0.01, 0.12]	2.18	.029	0.02	[-0.04, 0.08]	0.71	.478
Before-slope, $\hat{\gamma}_{10}$	0.00	[-0.01, 0.00]	-0.90	.368	0.00	[-0.01, 0.00]	-1.52	.130
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.01, -0.01]	-4.30	$<$ .001	0.00	[0.00, 0.01]	0.88	.377
Shift, $\hat{\gamma}_{30}$	0.01	[-0.01, 0.03]	1.05	.292	0.00	[-0.03, 0.02]	-0.10	.924
Grandparent, $\hat{\gamma}_{01}$	0.04	[-0.04, 0.12]	0.93	.351	0.01	[-0.08, 0.10]	0.27	.788
Before-slope * Grandparent, $\hat{\gamma}_{11}$	-0.01	[-0.02, 0.01]	-1.07	.283	0.00	[-0.02, 0.01]	-0.57	.568
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[0.00, 0.02]	2.17	.030	0.00	[-0.01, 0.01]	-0.07	.943
Shift * Grandparent, $\hat{\gamma}_{31}$	0.00	[-0.04, 0.05]	0.19	.847	0.02	[-0.04, 0.07]	0.60	.551
HRS								
Intercept, $\hat{\gamma}_{00}$	3.47	[3.44, 3.51]	198.85	$<$ .001	3.49	[3.45, 3.54]	167.64	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.08	[0.02, 0.14]	2.51	.012	0.07	[0.01, 0.14]	2.23	.026
Before-slope, $\hat{\gamma}_{10}$	0.00	[-0.01, 0.01]	-0.21	.833	-0.01	[-0.02, 0.00]	-2.77	.006
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.02, 0.00]	-2.50	.012	-0.01	[-0.02, 0.00]	-3.16	.002
Shift, $\hat{\gamma}_{30}$	0.01	[-0.01, 0.03]	0.67	.506	0.02	[0.00, 0.04]	2.39	.017
Grandparent, $\hat{\gamma}_{01}$	0.01	[-0.04, 0.07]	0.49	.627	-0.01	[-0.07, 0.05]	-0.38	.706
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.03, 0.02]	-0.19	.852	0.01	[-0.01, 0.03]	0.89	.375
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[0.00, 0.03]	1.57	.116	0.01	[0.00, 0.03]	1.91	.057
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.01	[-0.05, 0.04]	-0.36	.717	-0.03	[-0.07, 0.02]	-1.15	.251

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S8

Linear Contrasts for Agreeableness.

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.00	0.07	.792	0.00	0.01	.932
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.02	0.90	.343	0.02	0.63	.428
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.02	0.52	.471	0.02	0.44	.506
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10} + \hat{\gamma}_{11}$)	-0.01	2.75	.097	-0.01	2.02	.155
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{21}$)	0.00	0.10	.748	0.00	0.12	.726
HRS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.00	0.06	.806	0.01	2.86	.091
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.00	0.02	.890	0.00	0.02	.896
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.00	0.05	.815	-0.01	0.42	.517
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10} + \hat{\gamma}_{11}$)	0.00	0.09	.759	0.00	0.10	.746
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{21}$)	0.00	0.27	.607	0.00	0.30	.581

Note. The linear contrasts are needed in cases where estimates of interest are represented by multiple fixed-effects coefficients and are computed using the *linearHypothesis* function from the *car* R package (Fox & Weisberg, 2019a) based on the models from Table S7. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S9

Linear Contrasts for Agreeableness (Moderated by Gender).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.01	0.20	.657	0.01	0.67	.413
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.00	0.00	.959	-0.01	0.34	.559
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.00	0.02	.901	0.00	0.01	.939
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.03	1.69	.194	0.03	1.30	.255
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.00	0.01	.924	-0.01	0.09	.762
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	-0.01	1.10	.295	0.00	0.19	.659
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.00	0.01	.927	-0.01	1.23	.267
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.03	1.38	.239	0.04	1.64	.201
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.01	0.13	.716	-0.02	0.99	.319
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.00	0.01	.932	0.00	0.01	.921
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	-0.01	1.13	.288	-0.01	0.90	.342
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.03	0.61	.434	0.03	0.50	.478
HRS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.03	5.09	.024	0.00	0.00	.959
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.02	5.24	.022	0.02	4.44	.035
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.01	0.05	.819	0.01	0.05	.828
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.00	0.00	.971	0.00	0.00	.976
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.02	0.67	.413	0.00	0.03	.865
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.02	1.37	.242	0.01	0.79	.374
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.00	0.07	.791	0.01	0.84	.358
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.03	1.13	.288	-0.02	0.84	.359
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.05	10.29	.001	0.02	1.80	.180
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.02	1.17	.280	0.02	1.19	.276
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	-0.02	1.87	.171	-0.02	2.01	.157
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.00	0.02	.884	0.00	0.02	.887

Note. The linear contrasts are based on the models from Table 2. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S10

Fixed Effects of Agreeableness Over the Transition to Grandparenthood Moderated by Performing Paid Work.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.51	[3.47, 3.56]	161.90	$<$ .001	3.51	[3.46, 3.55]	142.65	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.09	[0.03, 0.15]	2.82	.005	0.06	[-0.01, 0.12]	1.69	.090
Before-slope, $\hat{\gamma}_{20}$	-0.01	[-0.02, 0.01]	-0.57	.567	-0.02	[-0.04, 0.00]	-1.95	.051
After-slope, $\hat{\gamma}_{40}$	-0.02	[-0.03, -0.01]	-3.42	.001	-0.02	[-0.03, -0.01]	-2.94	.003
Shift, $\hat{\gamma}_{60}$	-0.01	[-0.04, 0.02]	-0.56	.578	0.03	[-0.01, 0.06]	1.58	.114
Grandparent, $\hat{\gamma}_{01}$	-0.12	[-0.21, -0.03]	-2.65	.008	-0.11	[-0.20, -0.02]	-2.31	.021
Working, $\hat{\gamma}_{10}$	-0.06	[-0.10, -0.02]	-3.06	.002	-0.01	[-0.05, 0.03]	-0.37	.710
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.05	[0.00, 0.10]	2.14	.033	0.07	[0.02, 0.12]	2.76	.006
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.02	[0.00, 0.04]	1.63	.103	0.02	[0.00, 0.04]	1.54	.124
Shift * Grandparent, $\hat{\gamma}_{61}$	0.00	[-0.08, 0.07]	-0.06	.949	-0.04	[-0.11, 0.03]	-1.06	.288
Before-slope * Working, $\hat{\gamma}_{30}$	0.01	[-0.02, 0.03]	0.52	.604	0.01	[-0.01, 0.03]	0.70	.482
After-slope * Working, $\hat{\gamma}_{50}$	0.02	[0.00, 0.03]	2.46	.014	0.01	[0.00, 0.03]	1.66	.096
Shift * Working, $\hat{\gamma}_{70}$	0.02	[-0.03, 0.06]	0.71	.480	-0.01	[-0.05, 0.03]	-0.37	.712
Grandparent * Working, $\hat{\gamma}_{11}$	0.18	[0.09, 0.28]	3.79	$<$ .001	0.13	[0.04, 0.22]	2.76	.006
Before-slope * Grandparent * Working, $\hat{\gamma}_{31}$	-0.07	[-0.13, -0.02]	-2.49	.013	-0.08	[-0.13, -0.02]	-2.63	.009
After-slope * Grandparent * Working, $\hat{\gamma}_{51}$	-0.01	[-0.04, 0.02]	-0.75	.453	-0.01	[-0.04, 0.03]	-0.40	.692
Shift * Grandparent * Working, $\hat{\gamma}_{71}$	-0.01	[-0.10, 0.09]	-0.11	.914	0.02	[-0.08, 0.11]	0.36	.719

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *working* = 1 indicates being employed in paid work.

Table S11

Linear Contrasts for Agreeableness (Moderated by Paid Work; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of not-working controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60}$)	-0.03	4.00	.045	0.01	0.68	.411
Shift of working controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{50} + \hat{\gamma}_{70}$)	0.01	0.40	.528	0.02	2.65	.103
Shift of not-working grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.01	0.14	.712	-0.01	0.15	.700
Shift of working grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.01	0.07	.795	0.00	0.06	.812
Shift of not-working controls vs. not-working grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61}$)	0.02	0.29	.589	-0.02	0.53	.466
Before-slope of working controls vs. working grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.02	1.75	.186	-0.01	0.28	.597
After-slope of working controls vs. working grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{51}$)	0.01	0.32	.571	0.01	1.05	.305
Shift of working controls vs. working grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.00	0.00	.958	-0.01	0.24	.621
Shift of not-working controls vs. working controls ($\hat{\gamma}_{50} + \hat{\gamma}_{70}$)	0.03	3.81	.051	0.00	0.05	.825
Before-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{30} + \hat{\gamma}_{31}$)	-0.07	6.16	.013	-0.07	6.59	.010
After-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{51}$)	0.01	0.14	.710	0.01	0.15	.694
Shift of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.02	0.20	.658	0.01	0.20	.659

Note. The linear contrasts are based on the models from Table S10. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S12

Fixed Effects of Agreeableness Over the Transition to Grandparenthood Moderated by Grandchild Care.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.47	[3.43, 3.52]	158.38	$<$ .001	3.44	[3.39, 3.49]	128.70	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.17	[0.09, 0.24]	4.36	$<$ .001	0.22	[0.14, 0.30]	5.14	$<$ .001
After-slope, $\hat{\gamma}_{20}$	-0.02	[-0.03, -0.01]	-3.73	$<$ .001	-0.02	[-0.03, -0.01]	-3.02	.003
Grandparent, $\hat{\gamma}_{01}$	-0.04	[-0.11, 0.02]	-1.29	.197	-0.04	[-0.12, 0.03]	-1.25	.212
Caring, $\hat{\gamma}_{10}$	-0.01	[-0.04, 0.03]	-0.42	.672	0.00	[-0.04, 0.03]	-0.18	.854
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.02	[0.00, 0.04]	2.01	.044	0.02	[0.00, 0.04]	1.71	.088
After-slope * Caring, $\hat{\gamma}_{30}$	0.01	[-0.01, 0.02]	0.76	.446	0.00	[-0.01, 0.02]	0.34	.732
Grandparent * Caring, $\hat{\gamma}_{11}$	0.02	[-0.06, 0.11]	0.55	.584	0.01	[-0.08, 0.10]	0.29	.773
After-slope * Grandparent * Caring, $\hat{\gamma}_{31}$	0.01	[-0.03, 0.04]	0.35	.726	0.01	[-0.02, 0.04]	0.59	.556

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *caring* = 1 indicates more than 100 hours of grandchild care since the last assessment.

Table S13

Linear Contrasts for Agreeableness (Moderated by Grandchild Care; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
After-slope of caring controls vs. caring grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.03	4.66	.031	0.03	4.93	.026
After-slope of not-caring grandparents vs. caring grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	0.01	0.61	.434	0.01	0.70	.404

Note. The linear contrasts are based on the models from Table S12. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S14

Fixed Effects of Agreeableness Over the Transition to Grandparenthood Moderated by Ethnicity.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.49	[3.46, 3.53]	185.58	< .001	3.48	[3.44, 3.53]	152.86	< .001
Propensity score, $\hat{\gamma}_{02}$	0.08	[0.02, 0.14]	2.62	.009	0.06	[0.00, 0.13]	1.87	.061
Before-slope, $\hat{\gamma}_{20}$	-0.01	[-0.02, 0.00]	-2.08	.037	-0.01	[-0.02, 0.00]	-1.87	.062
After-slope, $\hat{\gamma}_{40}$	0.00	[-0.01, 0.01]	-0.56	.574	-0.01	[-0.02, 0.00]	-2.44	.015
Shift, $\hat{\gamma}_{60}$	0.01	[-0.01, 0.03]	0.90	.368	0.03	[0.01, 0.05]	2.65	.008
Grandparent, $\hat{\gamma}_{01}$	-0.01	[-0.07, 0.05]	-0.27	.790	0.00	[-0.06, 0.07]	0.15	.884
Black, $\hat{\gamma}_{10}$	-0.07	[-0.18, 0.04]	-1.27	.203	0.13	[0.01, 0.24]	2.16	.031
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[-0.02, 0.03]	0.42	.674	0.00	[-0.02, 0.03]	0.31	.755
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.00	[-0.01, 0.02]	0.39	.695	0.01	[-0.01, 0.03]	1.25	.211
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.01	[-0.05, 0.04]	-0.27	.788	-0.03	[-0.07, 0.02]	-1.07	.286
Before-slope * Black, $\hat{\gamma}_{30}$	0.05	[0.01, 0.10]	2.55	.011	-0.04	[-0.08, 0.00]	-1.98	.047
After-slope * Black, $\hat{\gamma}_{50}$	-0.06	[-0.08, -0.03]	-4.67	< .001	-0.04	[-0.08, -0.01]	-2.88	.004
Shift * Black, $\hat{\gamma}_{70}$	-0.02	[-0.09, 0.06]	-0.41	.679	0.01	[-0.07, 0.09]	0.18	.856
Grandparent * Black, $\hat{\gamma}_{11}$	0.07	[-0.14, 0.27]	0.63	.532	-0.13	[-0.35, 0.08]	-1.24	.214
Before-slope * Grandparent * Black, $\hat{\gamma}_{31}$	-0.02	[-0.12, 0.09]	-0.28	.781	0.08	[-0.02, 0.18]	1.51	.130
After-slope * Grandparent * Black, $\hat{\gamma}_{51}$	0.07	[0.01, 0.13]	2.12	.034	0.06	[-0.01, 0.12]	1.67	.095
Shift * Grandparent * Black, $\hat{\gamma}_{71}$	0.01	[-0.16, 0.19]	0.14	.891	-0.01	[-0.19, 0.17]	-0.13	.893

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *black* = 0 indicates White/Caucasian ethnicity, *black* = 1 indicates Black/African American ethnicity.

Table S15

Linear Contrasts for Agreeableness (Moderated by Ethnicity; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of White controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$)	0.01	0.85	.358	0.02	5.58	.018
Shift of Black controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	-0.07	5.38	.020	-0.02	0.34	.559
Shift of White grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	0.00	0.07	.791	0.00	0.06	.806
Shift of Black grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.01	0.04	.840	0.01	0.03	.854
Shift of White controls vs. White grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	0.00	0.03	.858	-0.02	0.71	.400
Before-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.01	0.03	.854	0.08	2.68	.102
After-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{51}$)	0.07	5.26	.022	0.07	4.17	.041
Shift of Black controls vs. Black grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.08	1.43	.232	0.03	0.19	.665
Shift of White controls vs. Black controls ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	-0.07	6.18	.013	-0.04	1.41	.235
Before-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	0.04	0.64	.424	0.04	0.69	.406
After-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{51}$)	0.01	0.14	.713	0.01	0.14	.705
Shift of White grandparents vs. Black grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.01	0.02	.903	0.01	0.01	.912

Note. The linear contrasts are based on the models from Table S14. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S16

Fixed Effects of Conscientiousness Over the Transition to Grandparenthood.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.77	[3.71, 3.82]	134.94	$<$ .001	3.83	[3.76, 3.90]	114.22	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.08	[0.02, 0.13]	2.59	.009	-0.01	[-0.07, 0.05]	-0.45	.652
Before-slope, $\hat{\gamma}_{10}$	-0.01	[-0.01, 0.00]	-2.43	.015	-0.01	[-0.01, 0.00]	-2.09	.037
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.01, 0.00]	-2.96	.003	0.01	[0.00, 0.01]	2.22	.026
Shift, $\hat{\gamma}_{30}$	0.01	[-0.01, 0.04]	1.21	.225	0.00	[-0.02, 0.03]	0.35	.724
Grandparent, $\hat{\gamma}_{01}$	-0.02	[-0.10, 0.06]	-0.46	.644	-0.05	[-0.14, 0.04]	-1.14	.255
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.01	[0.00, 0.02]	1.38	.168	0.01	[0.00, 0.02]	1.21	.226
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.01, 0.01]	0.46	.646	-0.01	[-0.02, 0.00]	-1.72	.085
Shift * Grandparent, $\hat{\gamma}_{31}$	0.00	[-0.05, 0.05]	0.14	.887	0.01	[-0.04, 0.07]	0.48	.634
HRS								
Intercept, $\hat{\gamma}_{00}$	3.39	[3.36, 3.42]	208.49	$<$ .001	3.35	[3.32, 3.39]	174.84	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.08	[0.02, 0.13]	2.75	.006	0.15	[0.09, 0.21]	5.01	$<$ .001
Before-slope, $\hat{\gamma}_{10}$	0.01	[0.00, 0.02]	2.35	.019	0.00	[-0.01, 0.01]	0.86	.388
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.01, 0.00]	-1.53	.125	-0.01	[-0.01, 0.00]	-2.31	.021
Shift, $\hat{\gamma}_{30}$	-0.01	[-0.03, 0.01]	-1.17	.242	0.00	[-0.02, 0.02]	-0.19	.846
Grandparent, $\hat{\gamma}_{01}$	0.03	[-0.02, 0.09]	1.34	.181	0.03	[-0.02, 0.08]	1.17	.241
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.03, 0.02]	-0.32	.752	0.00	[-0.02, 0.03]	0.39	.696
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[0.00, 0.03]	1.90	.058	0.02	[0.00, 0.03]	2.34	.019
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.02	[-0.06, 0.02]	-0.97	.333	-0.03	[-0.07, 0.01]	-1.51	.130

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S17

Linear Contrasts for Conscientiousness.

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	0.01	0.54	.461	0.01	0.80	.371
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.01	0.47	.493	0.01	0.39	.532
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.01	0.07	.789	0.00	0.02	.884
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.00	0.10	.751	0.00	0.08	.773
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	0.00	0.86	.353	0.00	0.69	.406
HRS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	-0.02	4.85	.028	-0.01	1.62	.202
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.02	2.50	.114	-0.02	2.87	.091
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.01	0.17	.678	-0.01	0.87	.351
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.01	0.59	.441	0.01	0.70	.403
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	0.01	1.85	.174	0.01	2.16	.142

Note. The linear contrasts are needed in cases where estimates of interest are represented by multiple fixed-effects coefficients and are computed using the *linearHypothesis* function from the *car* R package (Fox & Weisberg, 2019a) based on the models from Table S16. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S18

Fixed Effects of Conscientiousness Over the Transition to Grandparenthood Moderated by Gender.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.72	[3.64, 3.80]	89.52	$<$ .001	3.77	[3.67, 3.87]	75.55	$<$ .001
Propensity score, $\hat{\gamma}_{04}$	0.08	[0.02, 0.13]	2.61	.009	-0.01	[-0.07, 0.05]	-0.33	.745
Before-slope, $\hat{\gamma}_{10}$	-0.01	[-0.02, 0.00]	-2.08	.037	-0.01	[-0.02, 0.00]	-2.26	.024
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.01, 0.00]	-1.96	.050	0.00	[-0.01, 0.00]	-0.56	.577
Shift, $\hat{\gamma}_{30}$	0.02	[-0.01, 0.06]	1.44	.150	0.00	[-0.03, 0.04]	0.08	.936
Grandparent, $\hat{\gamma}_{01}$	-0.01	[-0.14, 0.11]	-0.23	.820	-0.04	[-0.17, 0.10]	-0.56	.575
Female, $\hat{\gamma}_{02}$	0.09	[-0.02, 0.20]	1.60	.110	0.10	[-0.03, 0.23]	1.48	.139
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.01	[-0.01, 0.03]	1.00	.318	0.01	[-0.01, 0.03]	1.06	.291
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[-0.01, 0.02]	1.12	.261	0.00	[-0.01, 0.02]	0.48	.634
Shift * Grandparent, $\hat{\gamma}_{31}$	0.00	[-0.08, 0.07]	-0.08	.936	0.02	[-0.06, 0.10]	0.51	.613
Before-slope * Female, $\hat{\gamma}_{12}$	0.00	[-0.01, 0.01]	0.62	.537	0.01	[0.00, 0.02]	1.29	.198
After-slope * Female, $\hat{\gamma}_{22}$	0.00	[-0.01, 0.01]	-0.02	.986	0.01	[0.00, 0.02]	2.90	.004
Shift * Female, $\hat{\gamma}_{32}$	-0.02	[-0.07, 0.03]	-0.84	.401	0.00	[-0.05, 0.05]	0.11	.912
Grandparent * Female, $\hat{\gamma}_{03}$	-0.01	[-0.17, 0.16]	-0.08	.939	-0.02	[-0.20, 0.16]	-0.20	.841
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.00	[-0.02, 0.02]	-0.17	.867	-0.01	[-0.03, 0.02]	-0.49	.623
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	-0.01	[-0.03, 0.01]	-1.06	.290	-0.03	[-0.05, 0.00]	-2.22	.026
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.01	[-0.09, 0.11]	0.26	.792	-0.01	[-0.12, 0.10]	-0.17	.866
HRS								
Intercept, $\hat{\gamma}_{00}$	3.31	[3.27, 3.36]	142.75	$<$ .001	3.27	[3.22, 3.32]	126.71	$<$ .001
Propensity score, $\hat{\gamma}_{04}$	0.08	[0.03, 0.14]	2.97	.003	0.14	[0.09, 0.20]	4.83	$<$ .001
Before-slope, $\hat{\gamma}_{10}$	0.03	[0.01, 0.04]	3.61	$<$ .001	0.00	[-0.01, 0.02]	0.71	.477
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.01]	-0.92	.360	0.00	[-0.01, 0.00]	-0.98	.328
Shift, $\hat{\gamma}_{30}$	-0.02	[-0.05, 0.01]	-1.46	.143	0.02	[-0.01, 0.05]	1.51	.131
Grandparent, $\hat{\gamma}_{01}$	0.01	[-0.07, 0.08]	0.15	.879	0.01	[-0.06, 0.09]	0.38	.707
Female, $\hat{\gamma}_{02}$	0.14	[0.08, 0.20]	4.73	$<$ .001	0.16	[0.10, 0.22]	4.88	$<$ .001
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.04, 0.03]	-0.24	.807	0.02	[-0.01, 0.05]	1.06	.287
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.02	[0.00, 0.04]	1.96	.050	0.02	[0.00, 0.04]	2.13	.033
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.04	[-0.11, 0.02]	-1.39	.164	-0.09	[-0.15, -0.03]	-2.90	.004
Before-slope * Female, $\hat{\gamma}_{12}$	-0.03	[-0.05, -0.01]	-2.78	.006	0.00	[-0.02, 0.02]	-0.17	.861
After-slope * Female, $\hat{\gamma}_{22}$	0.00	[-0.01, 0.01]	-0.16	.874	0.00	[-0.02, 0.01]	-0.53	.593
Shift * Female, $\hat{\gamma}_{32}$	0.02	[-0.02, 0.06]	0.94	.346	-0.04	[-0.08, -0.01]	-2.27	.023

Table S18 continued

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Grandparent * Female, $\hat{\gamma}_{03}$	0.05	[-0.05, 0.15]	1.00	.318	0.03	[-0.07, 0.13]	0.53	.595
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.00	[-0.04, 0.05]	0.12	.903	-0.02	[-0.07, 0.02]	-1.07	.283
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	-0.01	[-0.04, 0.02]	-0.92	.356	-0.01	[-0.04, 0.02]	-0.84	.401
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.04	[-0.04, 0.13]	1.00	.315	0.10	[0.02, 0.18]	2.55	.011

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S19

Linear Contrasts for Conscientiousness (Moderated by Gender).

Linear Contrast	Parent controls $\hat{\gamma}_c$	Parent controls χ^2	Parent controls p	Nonparent controls $\hat{\gamma}_c$	Nonparent controls χ^2	Nonparent controls p
LISS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.02	1.46	.226	0.00	0.00	.976
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.00	0.01	.923	0.02	1.18	.277
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.02	0.67	.413	0.02	0.57	.452
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.01	0.06	.800	0.01	0.05	.816
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.01	0.03	.867	0.02	0.47	.494
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.01	0.72	.395	0.00	0.17	.677
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.00	0.11	.737	-0.02	7.66	.006
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.01	0.07	.787	-0.01	0.09	.766
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.02	0.93	.335	0.02	0.59	.444
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.00	0.02	.901	0.00	0.01	.915
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	-0.01	1.40	.236	-0.01	1.13	.287
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.02	0.19	.664	-0.02	0.16	.689
HRS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	-0.03	5.34	.021	0.02	2.33	.127
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.01	0.74	.388	-0.03	9.62	.002
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.05	5.02	.025	-0.05	5.82	.016
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.00	0.01	.923	0.00	0.01	.912
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.02	0.89	.345	-0.07	8.09	.004
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.00	0.01	.926	-0.01	0.17	.680
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.01	0.61	.436	0.01	1.23	.266
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.01	0.09	.764	0.03	1.65	.199
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.02	1.33	.248	-0.05	10.13	.001
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	-0.02	1.38	.240	-0.03	1.60	.205
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	-0.01	1.23	.268	-0.02	1.46	.227
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.05	2.55	.110	0.05	2.95	.086

Note. The linear contrasts are based on the models from Table S18. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S20

Linear Contrasts for Conscientiousness (Moderated by Paid Work; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of not-working controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60}$)	-0.01	0.25	.620	-0.07	26.57	$<$ .001
Shift of working controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{50} + \hat{\gamma}_{70}$)	-0.02	3.07	.080	0.02	4.47	.035
Shift of not-working grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.06	5.21	.022	-0.06	6.00	.014
Shift of working grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	-0.01	0.08	.778	-0.01	0.13	.718
Shift of not-working controls vs. not-working grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.05	3.38	.066	0.01	0.08	.778
Before-slope of working controls vs. working grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.03	5.06	.024	-0.01	1.02	.313
After-slope of working controls vs. working grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{51}$)	0.01	1.32	.250	0.01	1.11	.293
Shift of working controls vs. working grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.01	0.29	.590	-0.02	1.55	.213
Shift of not-working controls vs. working controls ($\hat{\gamma}_{50} + \hat{\gamma}_{70}$)	-0.01	0.47	.495	0.08	29.16	$<$ .001
Before-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{30} + \hat{\gamma}_{31}$)	-0.08	9.33	.002	-0.08	10.57	.001
After-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{51}$)	0.00	0.01	.930	0.00	0.02	.885
Shift of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.05	2.65	.103	0.05	2.93	.087

Note. The linear contrasts are based on the models from Table 3. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S21

Linear Contrasts for Conscientiousness (Moderated by Grandchild Care; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
After-slope of caring controls vs. caring grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.04	11.65	.001	0.04	11.81	.001
After-slope of not-caring grandparents vs. caring grandparents ($\hat{\gamma}_{30} + \hat{\gamma}_{31}$)	0.03	4.75	.029	0.03	5.45	.020

Note. The linear contrasts are based on the models from Table 4. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S22

Fixed Effects of Conscientiousness Over the Transition to Grandparenthood Moderated by Ethnicity.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.42	[3.38, 3.45]	194.05	< .001	3.36	[3.32, 3.40]	160.53	< .001
Propensity score, $\hat{\gamma}_{02}$	0.07	[0.01, 0.13]	2.38	.017	0.15	[0.09, 0.21]	4.83	< .001
Before-slope, $\hat{\gamma}_{20}$	0.01	[0.00, 0.02]	1.42	.155	0.01	[0.00, 0.02]	1.59	.111
After-slope, $\hat{\gamma}_{40}$	0.00	[-0.01, 0.01]	-0.35	.727	-0.01	[-0.01, 0.00]	-1.77	.076
Shift, $\hat{\gamma}_{60}$	0.00	[-0.02, 0.02]	-0.37	.714	0.00	[-0.02, 0.01]	-0.43	.664
Grandparent, $\hat{\gamma}_{01}$	0.01	[-0.05, 0.06]	0.24	.812	0.02	[-0.04, 0.08]	0.70	.483
Black, $\hat{\gamma}_{10}$	-0.21	[-0.31, -0.11]	-4.05	< .001	0.00	[-0.10, 0.11]	0.02	.983
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[-0.02, 0.03]	0.47	.639	0.01	[-0.02, 0.03]	0.50	.619
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.01	[0.00, 0.03]	1.53	.126	0.02	[0.00, 0.03]	2.27	.023
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.03	[-0.08, 0.01]	-1.52	.128	-0.04	[-0.08, 0.01]	-1.62	.105
Before-slope * Black, $\hat{\gamma}_{30}$	0.09	[0.05, 0.13]	4.31	< .001	-0.04	[-0.07, 0.00]	-2.15	.032
After-slope * Black, $\hat{\gamma}_{50}$	-0.02	[-0.04, 0.00]	-1.78	.076	-0.02	[-0.05, 0.00]	-1.78	.076
Shift * Black, $\hat{\gamma}_{70}$	-0.13	[-0.20, -0.06]	-3.50	< .001	0.04	[-0.04, 0.11]	0.99	.322
Grandparent * Black, $\hat{\gamma}_{11}$	0.29	[0.10, 0.49]	2.96	.003	0.09	[-0.10, 0.28]	0.94	.349
Before-slope * Grandparent * Black, $\hat{\gamma}_{31}$	-0.12	[-0.22, -0.02]	-2.29	.022	0.01	[-0.09, 0.10]	0.15	.883
After-slope * Grandparent * Black, $\hat{\gamma}_{51}$	0.04	[-0.02, 0.10]	1.38	.169	0.05	[-0.01, 0.10]	1.51	.132
Shift * Grandparent * Black, $\hat{\gamma}_{71}$	0.08	[-0.09, 0.24]	0.91	.360	-0.08	[-0.24, 0.08]	-1.02	.310

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. $black = 0$ indicates White/Caucasian ethnicity, $black = 1$ indicates Black/African American ethnicity.

Table S23

Linear Contrasts for Conscientiousness (Moderated by Ethnicity; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of White controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60}$)	0.00	0.40	.529	-0.01	1.78	.182
Shift of Black controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{50} + \hat{\gamma}_{70}$)	-0.15	32.53	$< .001$	0.00	0.01	.923
Shift of White grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.03	3.20	.074	-0.03	3.69	.055
Shift of Black grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	-0.05	0.98	.321	-0.05	1.06	.304
Shift of White controls vs. White grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.02	1.72	.189	-0.02	1.25	.264
Before-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.11	5.04	.025	0.01	0.08	.783
After-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{51}$)	0.05	3.35	.067	0.06	4.52	.033
Shift of Black controls vs. Black grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.10	2.51	.113	-0.06	0.91	.339
Shift of White controls vs. Black controls ($\hat{\gamma}_{50} + \hat{\gamma}_{70}$)	-0.15	27.97	$< .001$	0.01	0.20	.656
Before-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{30} + \hat{\gamma}_{31}$)	-0.03	0.40	.527	-0.03	0.48	.489
After-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{51}$)	0.02	0.58	.445	0.02	0.60	.439
Shift of White grandparents vs. Black grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	-0.03	0.22	.641	-0.03	0.22	.642

Note. The linear contrasts are based on the models from Table S22. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S24

Fixed Effects of Extraversion Over the Transition to Grandparenthood.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.25	[3.17, 3.32]	89.33	$<$ .001	3.29	[3.20, 3.38]	73.28	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.08	[0.01, 0.14]	2.32	.021	0.03	[-0.03, 0.09]	0.89	.375
Before-slope, $\hat{\gamma}_{10}$	0.00	[-0.01, 0.00]	-1.59	.113	0.00	[-0.01, 0.00]	-0.91	.365
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.00]	-1.75	.080	-0.01	[-0.02, -0.01]	-4.79	$<$ .001
Shift, $\hat{\gamma}_{30}$	-0.02	[-0.04, 0.01]	-1.41	.160	0.00	[-0.02, 0.03]	0.37	.712
Grandparent, $\hat{\gamma}_{01}$	0.04	[-0.07, 0.14]	0.66	.508	0.00	[-0.12, 0.12]	0.04	.971
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.02, 0.01]	-0.70	.483	-0.01	[-0.02, 0.01]	-1.00	.318
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.01, 0.01]	0.41	.682	0.01	[0.00, 0.02]	1.74	.083
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.01	[-0.06, 0.05]	-0.34	.731	-0.03	[-0.09, 0.02]	-1.15	.248
HRS								
Intercept, $\hat{\gamma}_{00}$	3.19	[3.15, 3.22]	160.27	$<$ .001	3.14	[3.10, 3.19]	136.03	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.05	[-0.01, 0.12]	1.53	.126	0.05	[-0.02, 0.12]	1.50	.134
Before-slope, $\hat{\gamma}_{10}$	-0.01	[-0.02, 0.01]	-1.03	.303	0.01	[0.00, 0.02]	1.40	.162
After-slope, $\hat{\gamma}_{20}$	0.01	[0.00, 0.01]	1.57	.117	0.00	[-0.01, 0.01]	0.45	.654
Shift, $\hat{\gamma}_{30}$	0.00	[-0.02, 0.03]	0.34	.738	0.00	[-0.02, 0.02]	-0.34	.736
Grandparent, $\hat{\gamma}_{01}$	0.00	[-0.06, 0.06]	0.07	.944	0.04	[-0.03, 0.10]	1.17	.243
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.01	[-0.02, 0.03]	0.51	.609	-0.01	[-0.03, 0.02]	-0.51	.607
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.01, 0.02]	0.45	.651	0.01	[-0.01, 0.02]	1.00	.316
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.02	[-0.07, 0.03]	-0.92	.357	-0.02	[-0.06, 0.03]	-0.66	.508

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S25

Linear Contrasts for Extraversion.

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	-0.02	3.95	.047	-0.01	0.40	.527
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.03	1.87	.172	-0.03	1.85	.174
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.01	0.09	.765	-0.02	0.84	.358
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	-0.01	2.51	.113	-0.01	2.52	.112
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	0.00	0.16	.692	0.00	0.16	.693
HRS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	0.01	1.28	.259	0.00	0.06	.812
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.01	0.31	.576	-0.01	0.35	.556
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.02	1.02	.313	-0.01	0.17	.676
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.00	0.01	.939	0.00	0.01	.931
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	0.01	1.63	.202	0.01	1.80	.180

Note. The linear contrasts are needed in cases where estimates of interest are represented by multiple fixed-effects coefficients and are computed using the *linearHypothesis* function from the *car* R package (Fox & Weisberg, 2019a) based on the models from Table S24. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S26

Fixed Effects of Extraversion Over the Transition to Grandparenthood Moderated by Gender.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.21	[3.11, 3.32]	59.28	$<$ .001	3.23	[3.09, 3.36]	47.76	$<$ .001
Propensity score, $\hat{\gamma}_{04}$	0.08	[0.01, 0.14]	2.35	.019	0.03	[-0.03, 0.09]	0.99	.322
Before-slope, $\hat{\gamma}_{10}$	0.00	[-0.01, 0.00]	-0.91	.363	0.01	[0.00, 0.02]	1.77	.077
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.01]	-0.05	.964	-0.01	[-0.02, -0.01]	-3.61	$<$ .001
Shift, $\hat{\gamma}_{30}$	-0.08	[-0.12, -0.05]	-4.40	$<$ .001	-0.01	[-0.04, 0.03]	-0.29	.773
Grandparent, $\hat{\gamma}_{01}$	0.06	[-0.10, 0.22]	0.76	.449	0.06	[-0.12, 0.23]	0.65	.517
Female, $\hat{\gamma}_{02}$	0.06	[-0.08, 0.20]	0.80	.426	0.12	[-0.05, 0.30]	1.36	.174
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.02, 0.01]	-0.40	.690	-0.02	[-0.03, 0.00]	-1.61	.108
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.02, 0.01]	-0.38	.700	0.01	[-0.01, 0.03]	1.15	.252
Shift * Grandparent, $\hat{\gamma}_{31}$	0.05	[-0.03, 0.13]	1.18	.236	-0.03	[-0.11, 0.05]	-0.72	.474
Before-slope * Female, $\hat{\gamma}_{12}$	0.00	[-0.01, 0.01]	-0.14	.889	-0.02	[-0.03, -0.01]	-3.39	.001
After-slope * Female, $\hat{\gamma}_{22}$	-0.01	[-0.02, 0.00]	-1.59	.112	0.00	[-0.01, 0.01]	0.42	.673
Shift * Female, $\hat{\gamma}_{32}$	0.12	[0.07, 0.17]	4.70	$<$ .001	0.02	[-0.03, 0.07]	0.77	.441
Grandparent * Female, $\hat{\gamma}_{03}$	-0.04	[-0.25, 0.17]	-0.40	.687	-0.11	[-0.34, 0.13]	-0.89	.376
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.00	[-0.03, 0.02]	-0.10	.917	0.02	[-0.01, 0.04]	1.38	.167
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	0.01	[-0.01, 0.03]	0.89	.371	0.00	[-0.02, 0.02]	0.01	.989
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	-0.11	[-0.22, 0.00]	-1.92	.055	-0.01	[-0.12, 0.10]	-0.11	.909
HRS								
Intercept, $\hat{\gamma}_{00}$	3.13	[3.08, 3.19]	109.26	$<$ .001	3.12	[3.06, 3.19]	98.59	$<$ .001
Propensity score, $\hat{\gamma}_{04}$	0.06	[-0.01, 0.12]	1.69	.091	0.05	[-0.02, 0.12]	1.32	.188
Before-slope, $\hat{\gamma}_{10}$	0.01	[0.00, 0.03]	1.43	.152	-0.01	[-0.02, 0.01]	-1.01	.314
After-slope, $\hat{\gamma}_{20}$	0.01	[0.00, 0.03]	2.51	.012	0.01	[-0.01, 0.02]	1.04	.299
Shift, $\hat{\gamma}_{30}$	-0.02	[-0.05, 0.02]	-1.05	.293	0.00	[-0.03, 0.03]	0.06	.953
Grandparent, $\hat{\gamma}_{01}$	-0.01	[-0.10, 0.08]	-0.15	.879	0.00	[-0.09, 0.09]	0.02	.980
Female, $\hat{\gamma}_{02}$	0.10	[0.02, 0.17]	2.64	.008	0.05	[-0.04, 0.13]	1.10	.270
Before-slope * Grandparent, $\hat{\gamma}_{11}$	-0.02	[-0.06, 0.02]	-1.15	.249	0.00	[-0.04, 0.04]	-0.14	.891
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.02, 0.03]	0.12	.901	0.01	[-0.01, 0.03]	0.83	.409
Shift * Grandparent, $\hat{\gamma}_{31}$	0.00	[-0.07, 0.08]	0.13	.895	-0.01	[-0.09, 0.06]	-0.39	.694
Before-slope * Female, $\hat{\gamma}_{12}$	-0.03	[-0.06, -0.01]	-2.98	.003	0.03	[0.01, 0.05]	2.60	.009
After-slope * Female, $\hat{\gamma}_{22}$	-0.02	[-0.03, 0.00]	-1.97	.049	-0.01	[-0.02, 0.01]	-0.95	.340
Shift * Female, $\hat{\gamma}_{32}$	0.04	[-0.01, 0.08]	1.72	.086	-0.01	[-0.05, 0.03]	-0.41	.681

Table S26 continued

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Grandparent * Female, $\hat{\gamma}_{03}$	0.02	[-0.11, 0.14]	0.24	.808	0.07	[-0.06, 0.19]	1.02	.307
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.06	[0.00, 0.11]	2.07	.039	-0.01	[-0.06, 0.04]	-0.27	.785
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	0.00	[-0.03, 0.04]	0.20	.844	0.00	[-0.04, 0.03]	-0.27	.784
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	-0.05	[-0.15, 0.05]	-0.98	.328	0.00	[-0.10, 0.09]	-0.03	.976

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S27

Linear Contrasts for Extraversion (Moderated by Gender).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	-0.08	25.26	$<$ .001	-0.02	1.25	.264
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.03	3.67	.055	0.00	0.05	.819
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.04	1.43	.231	-0.04	1.40	.236
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.02	0.60	.438	-0.02	0.60	.440
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.05	1.58	.209	-0.02	0.30	.582
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	-0.01	0.35	.552	0.00	0.09	.767
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.01	0.82	.365	0.01	1.60	.206
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.05	2.46	.117	-0.03	0.62	.429
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.11	25.15	$<$ .001	0.02	0.95	.331
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.00	0.04	.851	0.00	0.03	.857
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	0.00	0.05	.825	0.00	0.05	.826
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.02	0.13	.716	0.02	0.13	.721
HRS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.00	0.06	.802	0.01	0.30	.584
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.02	3.12	.077	-0.01	0.69	.406
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.00	0.02	.897	0.00	0.01	.904
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.02	0.69	.405	-0.02	0.76	.384
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.01	0.05	.819	0.00	0.02	.884
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.03	3.30	.069	-0.01	0.33	.568
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.01	0.18	.668	0.01	0.26	.613
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.04	2.36	.124	-0.01	0.17	.683
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.02	1.85	.173	-0.02	0.92	.338
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.02	0.78	.377	0.02	0.83	.363
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	-0.01	0.57	.452	-0.01	0.62	.432
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.02	0.43	.513	-0.02	0.45	.502

Note. The linear contrasts are based on the models from Table S26. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S28

Fixed Effects of Extraversion Over the Transition to Grandparenthood Moderated by Performing Paid Work.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.19	[3.14, 3.24]	131.67	< .001	3.16	[3.11, 3.21]	117.06	< .001
Propensity score, $\hat{\gamma}_{02}$	0.04	[-0.02, 0.11]	1.28	.201	0.02	[-0.05, 0.09]	0.46	.645
Before-slope, $\hat{\gamma}_{20}$	0.00	[-0.02, 0.02]	-0.34	.734	0.00	[-0.02, 0.02]	-0.22	.825
After-slope, $\hat{\gamma}_{40}$	0.01	[0.00, 0.02]	1.45	.148	0.00	[-0.01, 0.01]	-0.55	.583
Shift, $\hat{\gamma}_{60}$	-0.03	[-0.07, 0.00]	-1.89	.059	-0.01	[-0.04, 0.03]	-0.43	.668
Grandparent, $\hat{\gamma}_{01}$	-0.08	[-0.18, 0.02]	-1.62	.105	-0.04	[-0.14, 0.05]	-0.88	.379
Working, $\hat{\gamma}_{10}$	0.00	[-0.05, 0.04]	-0.21	.836	0.00	[-0.04, 0.04]	-0.10	.922
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.04	[-0.01, 0.09]	1.50	.134	0.04	[-0.01, 0.09]	1.51	.132
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.01	[-0.01, 0.04]	1.05	.292	0.02	[0.00, 0.05]	1.99	.047
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.03	[-0.11, 0.05]	-0.73	.467	-0.06	[-0.13, 0.02]	-1.38	.168
Before-slope * Working, $\hat{\gamma}_{30}$	0.00	[-0.03, 0.02]	-0.27	.785	0.02	[-0.01, 0.04]	1.18	.238
After-slope * Working, $\hat{\gamma}_{50}$	0.00	[-0.01, 0.02]	0.10	.923	0.02	[0.00, 0.03]	1.98	.047
Shift * Working, $\hat{\gamma}_{70}$	0.06	[0.01, 0.10]	2.43	.015	0.00	[-0.04, 0.05]	0.13	.900
Grandparent * Working, $\hat{\gamma}_{11}$	0.11	[0.01, 0.21]	2.10	.036	0.11	[0.01, 0.21]	2.13	.033
Before-slope * Grandparent * Working, $\hat{\gamma}_{31}$	-0.04	[-0.10, 0.02]	-1.28	.200	-0.06	[-0.12, 0.00]	-1.92	.055
After-slope * Grandparent * Working, $\hat{\gamma}_{51}$	-0.02	[-0.05, 0.02]	-0.92	.355	-0.03	[-0.06, 0.00]	-1.79	.074
Shift * Grandparent * Working, $\hat{\gamma}_{71}$	0.02	[-0.09, 0.12]	0.29	.774	0.07	[-0.03, 0.17]	1.32	.186

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *working* = 1 indicates being employed in paid work.

Table S29

Linear Contrasts for Extraversion (Moderated by Paid Work; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of not-working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$)	-0.03	3.19	.074	-0.01	0.53	.465
Shift of working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	0.03	8.11	.004	0.01	0.44	.505
Shift of not-working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.04	2.00	.157	-0.04	2.17	.141
Shift of working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.01	0.42	.518	0.01	0.43	.514
Shift of not-working controls vs. not-working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.02	0.25	.618	-0.03	0.91	.341
Before-slope of working controls vs. working grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.00	0.00	.998	-0.02	1.62	.204
After-slope of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{51}$)	0.00	0.07	.793	-0.01	0.29	.592
Shift of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.02	0.50	.479	0.01	0.09	.766
Shift of not-working controls vs. working controls ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	0.06	9.85	.002	0.02	0.94	.333
Before-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	-0.04	2.27	.131	-0.04	2.47	.116
After-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{51}$)	-0.02	0.96	.326	-0.02	1.03	.311
Shift of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.06	2.22	.136	0.06	2.37	.124

Note. The linear contrasts are based on the models from Table S28. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S30

Fixed Effects of Extraversion Over the Transition to Grandparenthood Moderated by Grandchild Care.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.18	[3.13, 3.23]	127.99	$<$ .001	3.16	[3.10, 3.22]	107.75	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.07	[-0.01, 0.16]	1.72	.086	0.07	[-0.02, 0.16]	1.45	.148
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.01]	0.54	.590	0.00	[-0.01, 0.01]	0.61	.539
Grandparent, $\hat{\gamma}_{01}$	-0.01	[-0.08, 0.06]	-0.26	.795	0.01	[-0.07, 0.09]	0.27	.790
Caring, $\hat{\gamma}_{10}$	0.03	[-0.01, 0.07]	1.63	.104	0.00	[-0.04, 0.03]	-0.09	.932
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.03, 0.02]	-0.20	.840	0.00	[-0.02, 0.02]	-0.25	.802
After-slope * Caring, $\hat{\gamma}_{30}$	-0.01	[-0.03, 0.01]	-1.04	.300	0.00	[-0.02, 0.01]	-0.23	.818
Grandparent * Caring, $\hat{\gamma}_{11}$	-0.06	[-0.16, 0.03]	-1.30	.194	-0.04	[-0.13, 0.06]	-0.81	.421
After-slope * Grandparent * Caring, $\hat{\gamma}_{31}$	0.04	[0.00, 0.07]	1.99	.047	0.03	[0.00, 0.07]	1.79	.074

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *caring* = 1 indicates more than 100 hours of grandchild care since the last assessment.

Table S31

Linear Contrasts for Extraversion (Moderated by Grandchild Care; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
After-slope of caring controls vs. caring grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.03	6.30	.012	0.03	4.85	.028
After-slope of not-caring grandparents vs. caring grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	0.03	2.91	.088	0.03	3.56	.059

Note. The linear contrasts are based on the models from Table S30. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S32

Fixed Effects of Extraversion Over the Transition to Grandparenthood Moderated by Ethnicity.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.20	[3.16, 3.24]	148.85	< .001	3.13	[3.08, 3.18]	123.56	< .001
Propensity score, $\hat{\gamma}_{02}$	0.03	[-0.03, 0.10]	1.00	.320	0.05	[-0.03, 0.12]	1.28	.201
Before-slope, $\hat{\gamma}_{20}$	-0.01	[-0.03, 0.00]	-2.24	.025	0.01	[0.00, 0.02]	1.97	.049
After-slope, $\hat{\gamma}_{40}$	0.01	[0.00, 0.01]	1.77	.077	0.00	[0.00, 0.01]	1.13	.258
Shift, $\hat{\gamma}_{60}$	0.01	[-0.01, 0.04]	1.25	.212	0.00	[-0.03, 0.02]	-0.23	.818
Grandparent, $\hat{\gamma}_{01}$	-0.03	[-0.09, 0.04]	-0.78	.437	0.04	[-0.03, 0.11]	1.03	.304
Black, $\hat{\gamma}_{10}$	-0.07	[-0.19, 0.06]	-1.04	.299	0.15	[0.02, 0.28]	2.32	.020
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.02	[-0.01, 0.04]	1.20	.232	-0.01	[-0.04, 0.02]	-0.62	.538
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.00	[-0.02, 0.02]	0.27	.790	0.01	[-0.01, 0.02]	0.58	.563
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.03	[-0.08, 0.02]	-1.12	.264	-0.01	[-0.06, 0.04]	-0.47	.635
Before-slope * Black, $\hat{\gamma}_{30}$	0.08	[0.03, 0.12]	3.35	.001	-0.04	[-0.09, 0.00]	-2.12	.034
After-slope * Black, $\hat{\gamma}_{50}$	-0.01	[-0.04, 0.01]	-1.03	.304	-0.06	[-0.09, -0.02]	-3.32	.001
Shift * Black, $\hat{\gamma}_{70}$	-0.05	[-0.13, 0.03]	-1.19	.233	0.06	[-0.03, 0.15]	1.30	.193
Grandparent * Black, $\hat{\gamma}_{11}$	0.28	[0.05, 0.52]	2.38	.017	0.07	[-0.16, 0.30]	0.58	.565
Before-slope * Grandparent * Black, $\hat{\gamma}_{31}$	-0.10	[-0.22, 0.01]	-1.73	.084	0.02	[-0.09, 0.13]	0.37	.710
After-slope * Grandparent * Black, $\hat{\gamma}_{51}$	0.02	[-0.05, 0.09]	0.50	.618	0.06	[-0.01, 0.13]	1.64	.101
Shift * Grandparent * Black, $\hat{\gamma}_{71}$	0.02	[-0.17, 0.21]	0.19	.852	-0.09	[-0.28, 0.10]	-0.91	.362

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. $black = 0$ indicates White/Caucasian ethnicity, $black = 1$ indicates Black/African American ethnicity.

Table S33

Linear Contrasts for Extraversion (Moderated by Ethnicity; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of White controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$)	0.02	5.77	.016	0.00	0.04	.843
Shift of Black controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	-0.04	1.83	.176	0.00	0.02	.879
Shift of White grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.01	0.09	.765	-0.01	0.10	.758
Shift of Black grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.03	0.26	.608	-0.03	0.27	.603
Shift of White controls vs. White grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.03	1.82	.177	-0.01	0.13	.716
Before-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.08	2.20	.138	0.01	0.05	.818
After-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{51}$)	0.02	0.34	.557	0.06	3.38	.066
Shift of Black controls vs. Black grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.01	0.02	.902	-0.04	0.28	.595
Shift of White controls vs. Black controls ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	-0.06	3.93	.047	0.00	0.01	.925
Before-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	-0.02	0.19	.664	-0.02	0.19	.662
After-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{51}$)	0.00	0.01	.905	0.00	0.01	.904
Shift of White grandparents vs. Black grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.03	0.17	.680	-0.03	0.17	.677

Note. The linear contrasts are based on the models from Table S32. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S34

Fixed Effects of Neuroticism Over the Transition to Grandparenthood.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	2.48	[2.41, 2.56]	67.36	$<$ .001	2.43	[2.34, 2.52]	53.46	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.06	[-0.01, 0.14]	1.66	.096	0.17	[0.09, 0.25]	4.15	$<$ .001
Before-slope, $\hat{\gamma}_{10}$	-0.01	[-0.01, 0.00]	-1.73	.084	-0.02	[-0.02, -0.01]	-4.27	$<$ .001
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.01, 0.00]	-2.66	.008	0.01	[0.00, 0.02]	2.79	.005
Shift, $\hat{\gamma}_{30}$	0.00	[-0.03, 0.03]	-0.21	.831	-0.01	[-0.04, 0.03]	-0.38	.703
Grandparent, $\hat{\gamma}_{01}$	-0.09	[-0.20, 0.02]	-1.63	.103	-0.08	[-0.20, 0.05]	-1.24	.217
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.01, 0.02]	0.61	.541	0.02	[0.00, 0.03]	1.82	.069
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[-0.01, 0.02]	0.97	.334	-0.01	[-0.03, 0.00]	-1.40	.163
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.05	[-0.11, 0.02]	-1.41	.158	-0.05	[-0.12, 0.03]	-1.21	.227
HRS								
Intercept, $\hat{\gamma}_{00}$	2.07	[2.03, 2.12]	94.88	$<$ .001	2.07	[2.02, 2.12]	79.40	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	-0.02	[-0.09, 0.06]	-0.46	.649	0.13	[0.05, 0.21]	3.07	.002
Before-slope, $\hat{\gamma}_{10}$	-0.02	[-0.04, -0.01]	-3.16	.002	-0.04	[-0.05, -0.02]	-5.33	$<$ .001
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.01]	-0.07	.947	-0.01	[-0.02, 0.00]	-3.02	.003
Shift, $\hat{\gamma}_{30}$	-0.01	[-0.04, 0.01]	-0.96	.337	-0.02	[-0.05, 0.01]	-1.45	.146
Grandparent, $\hat{\gamma}_{01}$	-0.05	[-0.12, 0.02]	-1.47	.141	-0.11	[-0.18, -0.04]	-2.99	.003
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.03	[0.00, 0.06]	1.82	.069	0.04	[0.01, 0.07]	2.67	.008
After-slope * Grandparent, $\hat{\gamma}_{21}$	-0.02	[-0.04, 0.00]	-2.00	.045	-0.01	[-0.03, 0.01]	-0.78	.437
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.05	[-0.10, 0.01]	-1.54	.125	-0.04	[-0.10, 0.02]	-1.28	.200

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S35

Linear Contrasts for Neuroticism.

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	-0.01	0.68	.410	0.00	0.03	.859
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.05	3.97	.046	-0.05	3.33	.068
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.04	1.93	.165	-0.06	2.90	.088
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.00	0.03	.853	0.00	0.02	.885
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	0.00	0.05	.828	0.00	0.04	.843
HRS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	-0.01	1.64	.201	-0.03	10.46	.001
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.08	15.39	$< .001$	-0.08	15.42	$< .001$
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.07	8.55	.003	-0.05	4.15	.042
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.01	0.25	.615	0.01	0.19	.661
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	-0.02	5.12	.024	-0.02	5.64	.018

Note. The linear contrasts are needed in cases where estimates of interest are represented by multiple fixed-effects coefficients and are computed using the *linearHypothesis* function from the *car* R package (Fox & Weisberg, 2019a) based on the models from Table S34. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S36

Fixed Effects of Neuroticism Over the Transition to Grandparenthood Moderated by Gender.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	2.41	[2.31, 2.52]	45.01	< .001	2.29	[2.16, 2.42]	34.73	< .001
Propensity score, $\hat{\gamma}_{04}$	0.07	[-0.01, 0.14]	1.74	.082	0.18	[0.10, 0.26]	4.42	< .001
Before-slope, $\hat{\gamma}_{10}$	-0.01	[-0.02, 0.00]	-1.31	.190	-0.01	[-0.02, 0.00]	-2.42	.016
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.01]	-0.29	.770	0.02	[0.01, 0.03]	4.98	< .001
Shift, $\hat{\gamma}_{30}$	-0.02	[-0.07, 0.02]	-1.01	.315	-0.04	[-0.09, 0.01]	-1.52	.129
Grandparent, $\hat{\gamma}_{01}$	-0.15	[-0.30, 0.01]	-1.85	.065	-0.08	[-0.25, 0.10]	-0.85	.394
Female, $\hat{\gamma}_{02}$	0.12	[-0.02, 0.26]	1.72	.086	0.24	[0.07, 0.41]	2.80	.005
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.00	[-0.02, 0.03]	0.38	.703	0.01	[-0.01, 0.04]	0.87	.382
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.02, 0.02]	0.08	.939	-0.02	[-0.05, 0.00]	-2.17	.030
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.05	[-0.15, 0.04]	-1.10	.271	-0.04	[-0.15, 0.07]	-0.74	.456
Before-slope * Female, $\hat{\gamma}_{12}$	0.00	[-0.01, 0.02]	0.21	.836	-0.01	[-0.02, 0.01]	-0.89	.376
After-slope * Female, $\hat{\gamma}_{22}$	-0.01	[-0.02, 0.00]	-2.01	.045	-0.03	[-0.04, -0.01]	-4.22	< .001
Shift * Female, $\hat{\gamma}_{32}$	0.04	[-0.02, 0.10]	1.17	.241	0.06	[-0.01, 0.13]	1.81	.070
Grandparent * Female, $\hat{\gamma}_{03}$	0.10	[-0.11, 0.31]	0.96	.337	0.00	[-0.24, 0.23]	-0.03	.972
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.00	[-0.03, 0.03]	0.09	.925	0.01	[-0.02, 0.04]	0.60	.548
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	0.01	[-0.02, 0.04]	0.70	.487	0.03	[0.00, 0.05]	1.66	.097
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.02	[-0.12, 0.15]	0.25	.800	-0.01	[-0.15, 0.14]	-0.11	.913
HRS								
Intercept, $\hat{\gamma}_{00}$	1.98	[1.92, 2.04]	63.31	< .001	2.02	[1.95, 2.09]	56.79	< .001
Propensity score, $\hat{\gamma}_{04}$	-0.01	[-0.09, 0.06]	-0.31	.759	0.13	[0.04, 0.21]	2.96	.003
Before-slope, $\hat{\gamma}_{10}$	-0.03	[-0.05, -0.01]	-3.13	.002	-0.02	[-0.04, 0.00]	-2.29	.022
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.02, 0.00]	-1.54	.124	-0.02	[-0.04, -0.01]	-3.03	.002
Shift, $\hat{\gamma}_{30}$	0.06	[0.03, 0.10]	3.23	.001	-0.02	[-0.06, 0.02]	-0.85	.396
Grandparent, $\hat{\gamma}_{01}$	-0.05	[-0.15, 0.05]	-1.01	.311	-0.15	[-0.26, -0.04]	-2.77	.006
Female, $\hat{\gamma}_{02}$	0.17	[0.09, 0.25]	4.20	< .001	0.09	[0.00, 0.18]	2.05	.041
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.06	[0.02, 0.11]	2.68	.007	0.06	[0.01, 0.10]	2.31	.021
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.03, 0.03]	-0.08	.939	0.01	[-0.02, 0.04]	0.59	.557
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.15	[-0.23, -0.06]	-3.25	.001	-0.06	[-0.15, 0.03]	-1.38	.167
Before-slope * Female, $\hat{\gamma}_{12}$	0.02	[-0.01, 0.04]	1.15	.250	-0.02	[-0.05, 0.00]	-1.64	.102
After-slope * Female, $\hat{\gamma}_{22}$	0.02	[0.00, 0.04]	2.04	.041	0.01	[-0.01, 0.03]	1.41	.157
Shift * Female, $\hat{\gamma}_{32}$	-0.14	[-0.19, -0.09]	-5.18	< .001	0.00	[-0.06, 0.05]	-0.11	.909

Table S36 continued

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Grandparent * Female, $\hat{\gamma}_{03}$	0.00	[-0.13, 0.14]	0.01	.996	0.07	[-0.07, 0.21]	0.97	.331
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	-0.06	[-0.12, 0.00]	-1.90	.057	-0.02	[-0.09, 0.04]	-0.74	.461
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	-0.04	[-0.08, 0.01]	-1.71	.087	-0.03	[-0.07, 0.01]	-1.45	.148
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.18	[0.06, 0.29]	2.95	.003	0.04	[-0.08, 0.16]	0.69	.491

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S37

Linear Contrasts for Neuroticism (Moderated by Gender).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	-0.02	1.47	.226	-0.01	0.41	.520
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.00	0.00	.998	0.02	0.95	.328
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.08	4.09	.043	-0.08	3.37	.066
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.03	0.60	.439	-0.03	0.51	.474
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.05	1.53	.217	-0.07	1.81	.178
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.01	0.31	.577	0.02	3.32	.068
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.01	1.24	.265	0.00	0.01	.927
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.03	0.47	.491	-0.05	1.18	.278
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.02	0.81	.368	0.03	1.29	.255
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.00	0.04	.833	0.00	0.05	.825
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	0.00	0.04	.840	0.00	0.04	.840
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.05	0.95	.331	0.05	0.76	.382
HRS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.05	12.37	$<$ .001	-0.04	6.17	.013
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.07	23.28	$<$ .001	-0.03	4.52	.033
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.09	9.16	.002	-0.09	9.17	.002
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.07	6.71	.010	-0.07	6.70	.010
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.15	18.41	$<$ .001	-0.05	2.40	.122
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.00	0.03	.873	0.03	2.33	.127
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	-0.04	6.89	.009	-0.02	2.28	.131
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.00	0.02	.888	-0.04	1.86	.173
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.12	34.07	$<$ .001	0.01	0.23	.629
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	-0.05	2.44	.118	-0.05	2.49	.115
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	-0.02	0.81	.369	-0.02	0.83	.364
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.02	0.28	.599	0.02	0.28	.597

Note. The linear contrasts are based on the models from Table S36. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S38

Fixed Effects of Neuroticism Over the Transition to Grandparenthood Moderated by Performing Paid Work.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	2.02	[1.96, 2.07]	73.54	< .001	2.09	[2.03, 2.15]	67.21	< .001
Propensity score, $\hat{\gamma}_{02}$	-0.02	[-0.10, 0.06]	-0.47	.636	0.15	[0.07, 0.24]	3.52	< .001
Before-slope, $\hat{\gamma}_{20}$	0.01	[-0.02, 0.03]	0.62	.535	-0.05	[-0.08, -0.02]	-3.81	< .001
After-slope, $\hat{\gamma}_{40}$	-0.01	[-0.02, 0.00]	-1.48	.140	0.00	[-0.02, 0.01]	-0.15	.877
Shift, $\hat{\gamma}_{60}$	0.02	[-0.02, 0.06]	0.95	.343	-0.03	[-0.08, 0.01]	-1.34	.179
Grandparent, $\hat{\gamma}_{01}$	0.15	[0.03, 0.26]	2.48	.013	0.00	[-0.11, 0.12]	0.07	.948
Working, $\hat{\gamma}_{10}$	0.09	[0.04, 0.14]	3.45	.001	-0.04	[-0.09, 0.01]	-1.65	.098
Before-slope * Grandparent, $\hat{\gamma}_{21}$	-0.07	[-0.14, -0.01]	-2.20	.028	-0.02	[-0.08, 0.05]	-0.48	.634
After-slope * Grandparent, $\hat{\gamma}_{41}$	-0.02	[-0.05, 0.01]	-1.26	.209	-0.03	[-0.06, 0.00]	-1.91	.056
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.03	[-0.12, 0.07]	-0.60	.548	0.02	[-0.07, 0.12]	0.47	.636
Before-slope * Working, $\hat{\gamma}_{30}$	-0.04	[-0.07, -0.01]	-2.86	.004	0.02	[-0.01, 0.05]	1.25	.210
After-slope * Working, $\hat{\gamma}_{50}$	0.02	[0.00, 0.04]	1.87	.062	-0.02	[-0.04, -0.01]	-2.66	.008
Shift * Working, $\hat{\gamma}_{70}$	-0.06	[-0.11, 0.00]	-2.13	.033	0.03	[-0.03, 0.08]	0.98	.325
Grandparent * Working, $\hat{\gamma}_{11}$	-0.26	[-0.39, -0.14]	-4.25	< .001	-0.14	[-0.26, -0.02]	-2.33	.020
Before-slope * Grandparent * Working, $\hat{\gamma}_{31}$	0.13	[0.06, 0.21]	3.50	< .001	0.07	[0.00, 0.15]	1.90	.057
After-slope * Grandparent * Working, $\hat{\gamma}_{51}$	-0.01	[-0.05, 0.03]	-0.40	.688	0.03	[-0.01, 0.08]	1.64	.101
Shift * Grandparent * Working, $\hat{\gamma}_{71}$	-0.02	[-0.14, 0.11]	-0.26	.794	-0.10	[-0.23, 0.02]	-1.63	.103

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *working* = 1 indicates being employed in paid work.

Table S39

Linear Contrasts for Neuroticism (Moderated by Paid Work; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of not-working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$)	0.01	0.37	.543	-0.03	2.93	.087
Shift of working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	-0.03	5.61	.018	-0.03	5.27	.022
Shift of not-working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.04	1.12	.290	-0.04	1.17	.280
Shift of working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.10	15.73	$<$ .001	-0.10	15.86	$<$ .001
Shift of not-working controls vs. not-working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.05	1.48	.223	-0.01	0.02	.888
Before-slope of working controls vs. working grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.06	10.60	.001	0.06	9.30	.002
After-slope of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{51}$)	-0.03	3.38	.066	0.01	0.16	.694
Shift of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.07	6.11	.013	-0.07	6.69	.010
Shift of not-working controls vs. working controls ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	-0.04	3.70	.054	0.00	0.02	.886
Before-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	0.09	6.67	.010	0.09	7.01	.008
After-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{51}$)	0.01	0.22	.639	0.01	0.25	.618
Shift of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.07	2.21	.137	-0.07	2.19	.139

Note. The linear contrasts are based on the models from Table S38. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S40

Fixed Effects of Neuroticism Over the Transition to Grandparenthood Moderated by Grandchild Care.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	2.00	[1.95, 2.05]	73.94	< .001	1.97	[1.90, 2.03]	59.60	< .001
Propensity score, $\hat{\gamma}_{02}$	0.03	[-0.06, 0.13]	0.70	.486	0.02	[-0.09, 0.12]	0.29	.775
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.02, 0.01]	-1.03	.304	-0.01	[-0.02, 0.00]	-1.49	.136
Grandparent, $\hat{\gamma}_{01}$	-0.08	[-0.16, 0.00]	-2.01	.045	-0.05	[-0.13, 0.04]	-1.05	.293
Caring, $\hat{\gamma}_{10}$	0.02	[-0.02, 0.06]	0.86	.392	0.05	[0.00, 0.09]	2.12	.034
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.02, 0.03]	0.27	.784	0.01	[-0.02, 0.03]	0.54	.591
After-slope * Caring, $\hat{\gamma}_{30}$	-0.01	[-0.03, 0.01]	-1.21	.224	-0.02	[-0.04, 0.00]	-2.05	.040
Grandparent * Caring, $\hat{\gamma}_{11}$	0.08	[-0.03, 0.18]	1.36	.175	0.04	[-0.07, 0.16]	0.73	.463
After-slope * Grandparent * Caring, $\hat{\gamma}_{31}$	-0.03	[-0.07, 0.01]	-1.25	.213	-0.02	[-0.06, 0.03]	-0.73	.464

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *caring* = 1 indicates more than 100 hours of grandchild care since the last assessment.

Table S41

Linear Contrasts for Neuroticism (Moderated by Grandchild Care; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
After-slope of caring controls vs. caring grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.02	2.09	.148	-0.01	0.28	.595
After-slope of not-caring grandparents vs. caring grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	-0.04	4.06	.044	-0.04	3.52	.061

Note. The linear contrasts are based on the models from Table S40. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S42

Fixed Effects of Neuroticism Over the Transition to Grandparenthood Moderated by Ethnicity.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	2.08	[2.04, 2.13]	88.55	< .001	2.07	[2.01, 2.13]	72.73	< .001
Propensity score, $\hat{\gamma}_{02}$	-0.02	[-0.09, 0.06]	-0.40	.686	0.13	[0.04, 0.21]	2.96	.003
Before-slope, $\hat{\gamma}_{20}$	-0.02	[-0.03, -0.01]	-2.79	.005	-0.03	[-0.05, -0.02]	-4.44	< .001
After-slope, $\hat{\gamma}_{40}$	0.00	[-0.01, 0.01]	-0.24	.808	-0.02	[-0.03, -0.01]	-3.53	< .001
Shift, $\hat{\gamma}_{60}$	-0.03	[-0.06, 0.00]	-2.21	.027	-0.01	[-0.04, 0.01]	-1.03	.305
Grandparent, $\hat{\gamma}_{01}$	-0.02	[-0.09, 0.06]	-0.45	.650	-0.07	[-0.15, 0.01]	-1.81	.070
Black, $\hat{\gamma}_{10}$	-0.01	[-0.15, 0.13]	-0.15	.881	-0.09	[-0.23, 0.05]	-1.24	.213
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.02	[-0.02, 0.05]	0.99	.322	0.03	[0.00, 0.06]	1.67	.094
After-slope * Grandparent, $\hat{\gamma}_{41}$	-0.02	[-0.04, 0.00]	-2.23	.026	-0.01	[-0.03, 0.01]	-0.73	.464
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.02	[-0.08, 0.04]	-0.78	.436	-0.04	[-0.10, 0.02]	-1.24	.215
Before-slope * Black, $\hat{\gamma}_{30}$	-0.09	[-0.15, -0.04]	-3.41	.001	-0.04	[-0.09, 0.01]	-1.56	.118
After-slope * Black, $\hat{\gamma}_{50}$	0.04	[0.01, 0.07]	2.55	.011	0.05	[0.01, 0.09]	2.65	.008
Shift * Black, $\hat{\gamma}_{70}$	0.12	[0.02, 0.21]	2.42	.015	-0.02	[-0.12, 0.09]	-0.28	.778
Grandparent * Black, $\hat{\gamma}_{11}$	-0.29	[-0.55, -0.03]	-2.21	.027	-0.20	[-0.47, 0.07]	-1.44	.151
Before-slope * Grandparent * Black, $\hat{\gamma}_{31}$	0.11	[-0.02, 0.24]	1.62	.106	0.06	[-0.08, 0.19]	0.83	.405
After-slope * Grandparent * Black, $\hat{\gamma}_{51}$	-0.01	[-0.09, 0.07]	-0.32	.750	-0.03	[-0.11, 0.06]	-0.63	.530
Shift * Grandparent * Black, $\hat{\gamma}_{71}$	-0.08	[-0.30, 0.14]	-0.72	.469	0.05	[-0.18, 0.28]	0.43	.670

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *black* = 0 indicates White/Caucasian ethnicity, *black* = 1 indicates Black/African American ethnicity.

Table S43

Linear Contrasts for Neuroticism (Moderated by Ethnicity; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of White controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60}$)	-0.03	8.87	.003	-0.03	8.31	.004
Shift of Black controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{50} + \hat{\gamma}_{70}$)	0.12	12.30	$<$ .001	0.01	0.03	.858
Shift of White grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.08	14.19	$<$ .001	-0.08	13.24	$<$ .001
Shift of Black grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	-0.02	0.06	.812	-0.02	0.05	.824
Shift of White controls vs. White grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.05	4.10	.043	-0.05	3.82	.051
Before-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.13	3.64	.056	0.09	1.62	.203
After-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{51}$)	-0.04	0.85	.355	-0.04	0.70	.404
Shift of Black controls vs. Black grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	-0.14	3.04	.081	-0.02	0.08	.780
Shift of White controls vs. Black controls ($\hat{\gamma}_{50} + \hat{\gamma}_{70}$)	0.16	17.71	$<$ .001	0.04	0.87	.350
Before-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{30} + \hat{\gamma}_{31}$)	0.02	0.08	.774	0.02	0.07	.789
After-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{51}$)	0.03	0.49	.485	0.03	0.46	.499
Shift of White grandparents vs. Black grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.06	0.64	.423	0.06	0.61	.435

Note. The linear contrasts are based on the models from Table S42. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S44

Fixed Effects of Openness Over the Transition to Grandparenthood.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.48	[3.42, 3.53]	121.02	$<$ .001	3.52	[3.46, 3.59]	104.78	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.04	[-0.02, 0.10]	1.40	.161	0.01	[-0.04, 0.06]	0.47	.637
Before-slope, $\hat{\gamma}_{10}$	-0.01	[-0.01, 0.00]	-3.00	.003	0.00	[-0.01, 0.00]	-1.98	.048
After-slope, $\hat{\gamma}_{20}$	0.00	[-0.01, 0.00]	-1.82	.070	0.00	[0.00, 0.01]	0.78	.433
Shift, $\hat{\gamma}_{30}$	-0.01	[-0.03, 0.01]	-0.72	.469	0.01	[-0.01, 0.03]	1.25	.212
Grandparent, $\hat{\gamma}_{01}$	-0.01	[-0.10, 0.07]	-0.31	.753	-0.05	[-0.14, 0.04]	-1.10	.271
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.01	[0.00, 0.02]	1.53	.127	0.01	[0.00, 0.02]	1.11	.269
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.00	[-0.01, 0.01]	-0.23	.822	-0.01	[-0.02, 0.00]	-1.42	.154
Shift * Grandparent, $\hat{\gamma}_{31}$	0.00	[-0.05, 0.05]	0.16	.872	-0.02	[-0.06, 0.03]	-0.77	.444
HRS								
Intercept, $\hat{\gamma}_{00}$	3.05	[3.01, 3.09]	152.61	$<$ .001	3.04	[2.99, 3.09]	131.12	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.04	[-0.02, 0.11]	1.28	.199	-0.01	[-0.08, 0.06]	-0.31	.759
Before-slope, $\hat{\gamma}_{10}$	-0.02	[-0.03, -0.01]	-3.90	$<$ .001	0.00	[-0.01, 0.01]	-0.54	.591
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.02, -0.01]	-3.38	.001	-0.01	[-0.02, 0.00]	-2.76	.006
Shift, $\hat{\gamma}_{30}$	0.03	[0.01, 0.05]	2.62	.009	0.01	[-0.01, 0.02]	0.56	.574
Grandparent, $\hat{\gamma}_{01}$	-0.03	[-0.09, 0.03]	-1.01	.312	0.00	[-0.06, 0.07]	0.08	.936
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.02	[0.00, 0.05]	1.60	.109	0.00	[-0.02, 0.02]	0.12	.906
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[-0.01, 0.03]	1.12	.262	0.01	[-0.01, 0.02]	0.80	.424
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.04	[-0.09, 0.00]	-1.81	.070	-0.02	[-0.06, 0.02]	-0.95	.343

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S45

Linear Contrasts for Openness.

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	-0.01	1.50	.221	0.02	2.55	.110
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.01	0.24	.627	-0.01	0.28	.595
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.00	0.02	.895	-0.02	1.45	.229
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.00	0.04	.842	0.00	0.05	.820
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	-0.01	1.28	.257	-0.01	1.45	.229
HRS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	0.02	3.66	.056	0.00	0.25	.621
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.02	1.29	.256	-0.02	1.55	.214
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.04	3.52	.061	-0.01	0.78	.376
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.00	0.01	.935	0.00	0.01	.903
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	0.00	0.17	.679	0.00	0.22	.638

Note. The linear contrasts are needed in cases where estimates of interest are represented by multiple fixed-effects coefficients and are computed using the *linearHypothesis* function from the *car* R package (Fox & Weisberg, 2019a) based on the models from Table S44. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S46

Fixed Effects of Openness Over the Transition to Grandparenthood Moderated by Gender.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	3.55	[3.46, 3.63]	83.49	$<$ .001	3.58	[3.48, 3.67]	71.70	$<$ .001
Propensity score, $\hat{\gamma}_{04}$	0.04	[-0.02, 0.10]	1.37	.170	0.01	[-0.04, 0.06]	0.32	.751
Before-slope, $\hat{\gamma}_{10}$	-0.01	[-0.02, 0.00]	-2.26	.024	0.00	[-0.01, 0.01]	-0.38	.706
After-slope, $\hat{\gamma}_{20}$	0.00	[0.00, 0.01]	1.28	.200	0.00	[-0.01, 0.01]	0.30	.763
Shift, $\hat{\gamma}_{30}$	-0.05	[-0.08, -0.02]	-2.92	.004	0.01	[-0.02, 0.04]	0.86	.392
Grandparent, $\hat{\gamma}_{01}$	0.03	[-0.09, 0.15]	0.48	.634	0.01	[-0.12, 0.14]	0.13	.893
Female, $\hat{\gamma}_{02}$	-0.12	[-0.23, -0.01]	-2.16	.031	-0.09	[-0.22, 0.04]	-1.38	.168
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.01	[-0.01, 0.02]	0.77	.441	0.00	[-0.02, 0.01]	-0.10	.918
After-slope * Grandparent, $\hat{\gamma}_{21}$	-0.01	[-0.03, 0.00]	-1.62	.105	-0.01	[-0.02, 0.00]	-1.26	.208
Shift * Grandparent, $\hat{\gamma}_{31}$	0.04	[-0.03, 0.12]	1.12	.263	-0.02	[-0.09, 0.05]	-0.64	.522
Before-slope * Female, $\hat{\gamma}_{12}$	0.00	[-0.01, 0.01]	0.36	.720	-0.01	[-0.02, 0.00]	-1.43	.153
After-slope * Female, $\hat{\gamma}_{22}$	-0.02	[-0.02, -0.01]	-3.38	.001	0.00	[-0.01, 0.01]	0.33	.744
Shift * Female, $\hat{\gamma}_{32}$	0.08	[0.03, 0.12]	3.31	.001	0.00	[-0.04, 0.04]	0.02	.987
Grandparent * Female, $\hat{\gamma}_{03}$	-0.08	[-0.25, 0.08]	-1.00	.318	-0.12	[-0.29, 0.06]	-1.29	.199
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.01	[-0.02, 0.03]	0.44	.659	0.01	[-0.01, 0.04]	1.29	.195
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	0.02	[0.00, 0.04]	1.94	.052	0.00	[-0.02, 0.02]	0.35	.725
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	-0.07	[-0.17, 0.03]	-1.39	.166	0.01	[-0.09, 0.10]	0.14	.889
HRS								
Intercept, $\hat{\gamma}_{00}$	3.07	[3.01, 3.12]	110.76	$<$ .001	3.05	[2.99, 3.11]	98.96	$<$ .001
Propensity score, $\hat{\gamma}_{04}$	0.04	[-0.02, 0.11]	1.33	.183	-0.02	[-0.08, 0.05]	-0.45	.653
Before-slope, $\hat{\gamma}_{10}$	-0.02	[-0.04, 0.00]	-2.49	.013	-0.02	[-0.03, 0.00]	-2.46	.014
After-slope, $\hat{\gamma}_{20}$	-0.02	[-0.03, -0.01]	-3.51	$<$ .001	-0.01	[-0.02, 0.00]	-1.99	.046
Shift, $\hat{\gamma}_{30}$	0.07	[0.03, 0.10]	4.03	$<$ .001	0.00	[-0.03, 0.03]	0.12	.903
Grandparent, $\hat{\gamma}_{01}$	-0.04	[-0.13, 0.05]	-0.92	.358	0.00	[-0.09, 0.09]	0.02	.981
Female, $\hat{\gamma}_{02}$	-0.02	[-0.09, 0.04]	-0.68	.498	-0.01	[-0.09, 0.06]	-0.32	.752
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.01	[-0.03, 0.05]	0.37	.708	0.00	[-0.03, 0.04]	0.26	.798
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.02	[0.00, 0.04]	1.62	.106	0.01	[-0.01, 0.03]	0.92	.357
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.11	[-0.18, -0.03]	-2.89	.004	-0.04	[-0.10, 0.03]	-1.19	.233
Before-slope * Female, $\hat{\gamma}_{12}$	0.00	[-0.03, 0.02]	-0.33	.740	0.03	[0.01, 0.05]	2.83	.005
After-slope * Female, $\hat{\gamma}_{22}$	0.01	[0.00, 0.03]	1.72	.085	0.00	[-0.01, 0.02]	0.25	.801
Shift * Female, $\hat{\gamma}_{32}$	-0.07	[-0.11, -0.02]	-3.05	.002	0.01	[-0.03, 0.05]	0.35	.726

Table S46 continued

Parameter	Parent controls $\hat{\gamma}$	95% CI	t	p	Nonparent controls $\hat{\gamma}$	95% CI	t	p
Grandparent * Female, $\hat{\gamma}_{03}$	0.01	[-0.10, 0.13]	0.25	.804	0.00	[-0.11, 0.12]	0.05	.961
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.03	[-0.03, 0.08]	0.95	.341	-0.01	[-0.05, 0.04]	-0.26	.798
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	-0.02	[-0.05, 0.01]	-1.17	.240	-0.01	[-0.04, 0.02]	-0.51	.608
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.11	[0.01, 0.21]	2.26	.024	0.03	[-0.05, 0.12]	0.78	.435

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S47

Linear Contrasts for Openness (Moderated by Gender).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	-0.05	9.28	.002	0.01	1.08	.298
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.02	1.34	.247	0.02	1.55	.213
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.02	0.32	.569	-0.02	0.38	.539
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.00	0.03	.853	-0.01	0.04	.839
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	0.03	0.81	.368	-0.03	1.04	.308
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.01	2.27	.132	0.01	3.22	.073
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.01	1.23	.268	-0.01	0.72	.396
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	-0.02	0.48	.487	-0.02	0.57	.450
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	0.06	9.22	.002	0.00	0.01	.928
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.01	0.46	.499	0.01	0.52	.469
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	0.00	0.27	.605	0.00	0.30	.583
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.01	0.09	.766	0.01	0.10	.751
HRS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30}$)	0.05	13.53	$< .001$	-0.01	0.56	.455
Shift of female controls vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.01	0.48	.489	0.00	0.00	.998
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.04	2.45	.118	-0.04	2.84	.092
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20} + \hat{\gamma}_{30} + \hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.00	0.01	.939	0.00	0.01	.915
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.09	9.39	.002	-0.03	1.33	.249
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11} + \hat{\gamma}_{13}$)	0.03	3.45	.063	0.00	0.01	.923
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{23}$)	0.00	0.00	.973	0.00	0.07	.796
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21} + \hat{\gamma}_{31} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.01	0.06	.808	0.00	0.01	.923
Shift of male vs. female controls ($\hat{\gamma}_{22} + \hat{\gamma}_{32}$)	-0.05	10.30	.001	0.01	0.32	.571
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12} + \hat{\gamma}_{13}$)	0.02	0.80	.370	0.02	1.08	.299
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{23}$)	-0.01	0.21	.646	-0.01	0.20	.654
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22} + \hat{\gamma}_{32} + \hat{\gamma}_{23} + \hat{\gamma}_{33}$)	0.04	1.23	.266	0.04	1.40	.237

Note. The linear contrasts are based on the models from Table S46. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S48

Fixed Effects of Openness Over the Transition to Grandparenthood Moderated by Performing Paid Work.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.04	[2.99, 3.09]	126.17	< .001	3.07	[3.02, 3.12]	116.43	< .001
Propensity score, $\hat{\gamma}_{02}$	0.03	[-0.03, 0.10]	0.92	.357	-0.03	[-0.09, 0.04]	-0.81	.420
Before-slope, $\hat{\gamma}_{20}$	-0.02	[-0.04, 0.00]	-1.85	.064	-0.01	[-0.03, 0.01]	-1.18	.238
After-slope, $\hat{\gamma}_{40}$	-0.02	[-0.03, -0.01]	-4.08	< .001	-0.01	[-0.02, 0.00]	-1.67	.095
Shift, $\hat{\gamma}_{60}$	0.04	[0.00, 0.07]	2.12	.034	-0.02	[-0.06, 0.01]	-1.45	.148
Grandparent, $\hat{\gamma}_{01}$	-0.09	[-0.19, 0.01]	-1.73	.084	-0.09	[-0.19, 0.00]	-1.94	.053
Working, $\hat{\gamma}_{10}$	0.02	[-0.02, 0.06]	1.05	.292	-0.04	[-0.07, 0.00]	-1.91	.056
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.04	[-0.01, 0.10]	1.61	.107	0.04	[-0.01, 0.08]	1.48	.139
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.04	[0.02, 0.06]	3.31	.001	0.03	[0.01, 0.05]	2.44	.015
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.12	[-0.19, -0.04]	-2.91	.004	-0.05	[-0.12, 0.02]	-1.44	.149
Before-slope * Working, $\hat{\gamma}_{30}$	0.00	[-0.03, 0.02]	-0.36	.720	0.01	[-0.01, 0.04]	1.11	.269
After-slope * Working, $\hat{\gamma}_{50}$	0.02	[0.01, 0.04]	3.01	.003	0.00	[-0.01, 0.02]	0.38	.702
Shift * Working, $\hat{\gamma}_{70}$	-0.02	[-0.07, 0.02]	-0.99	.324	0.04	[0.00, 0.08]	2.01	.044
Grandparent * Working, $\hat{\gamma}_{11}$	0.07	[-0.03, 0.17]	1.34	.180	0.13	[0.04, 0.22]	2.79	.005
Before-slope * Grandparent * Working, $\hat{\gamma}_{31}$	-0.02	[-0.09, 0.04]	-0.77	.439	-0.04	[-0.10, 0.01]	-1.47	.141
After-slope * Grandparent * Working, $\hat{\gamma}_{51}$	-0.06	[-0.10, -0.03]	-3.53	< .001	-0.04	[-0.07, -0.01]	-2.61	.009
Shift * Grandparent * Working, $\hat{\gamma}_{71}$	0.14	[0.04, 0.24]	2.66	.008	0.07	[-0.02, 0.16]	1.51	.130

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *working* = 1 indicates being employed in paid work.

Table S49

Linear Contrasts for Openness (Moderated by Paid Work; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of not-working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$)	0.01	1.13	.288	-0.03	5.76	.016
Shift of working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	0.02	1.97	.160	0.01	1.68	.194
Shift of not-working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.06	4.32	.038	-0.06	5.11	.024
Shift of working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.02	0.68	.408	0.02	0.81	.367
Shift of not-working controls vs. not-working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.07	5.45	.020	-0.03	0.73	.392
Before-slope of working controls vs. working grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.02	1.47	.226	-0.01	0.17	.684
After-slope of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{51}$)	-0.02	2.93	.087	-0.01	1.57	.210
Shift of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.00	0.01	.916	0.01	0.06	.804
Shift of not-working controls vs. working controls ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	0.00	0.00	.980	0.05	7.22	.007
Before-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	-0.03	0.99	.320	-0.03	1.25	.263
After-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{51}$)	-0.04	6.04	.014	-0.04	7.42	.006
Shift of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	0.08	4.49	.034	0.08	5.31	.021

Note. The linear contrasts are based on the models from Table S48. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S50

Fixed Effects of Openness Over the Transition to Grandparenthood Moderated by Grandchild Care.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.04	[2.99, 3.09]	122.72	$<$ .001	2.97	[2.91, 3.03]	101.44	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.05	[-0.03, 0.14]	1.26	.207	0.23	[0.14, 0.32]	5.21	$<$ .001
After-slope, $\hat{\gamma}_{20}$	-0.02	[-0.03, -0.01]	-4.38	$<$ .001	-0.02	[-0.03, -0.01]	-3.16	.002
Grandparent, $\hat{\gamma}_{01}$	-0.03	[-0.11, 0.04]	-0.92	.358	-0.05	[-0.12, 0.03]	-1.15	.248
Caring, $\hat{\gamma}_{10}$	0.01	[-0.03, 0.05]	0.62	.536	0.00	[-0.04, 0.03]	-0.26	.794
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.01	[-0.01, 0.03]	0.87	.385	0.00	[-0.02, 0.02]	0.05	.960
After-slope * Caring, $\hat{\gamma}_{30}$	0.00	[-0.02, 0.02]	-0.09	.929	0.00	[-0.01, 0.02]	0.30	.762
Grandparent * Caring, $\hat{\gamma}_{11}$	-0.04	[-0.13, 0.06]	-0.75	.454	-0.03	[-0.12, 0.06]	-0.67	.505
After-slope * Grandparent * Caring, $\hat{\gamma}_{31}$	0.03	[-0.01, 0.06]	1.55	.122	0.03	[-0.01, 0.06]	1.63	.103

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *caring* = 1 indicates more than 100 hours of grandchild care since the last assessment.

Table S51

Linear Contrasts for Openness (Moderated by Grandchild Care; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
After-slope of caring controls vs. caring grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.04	7.93	.005	0.03	5.03	.025
After-slope of not-caring grandparents vs. caring grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	0.03	2.84	.092	0.03	3.87	.049

Note. The linear contrasts are based on the models from Table S50. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S52

Fixed Effects of Openness Over the Transition to Grandparenthood Moderated by Ethnicity.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	3.06	[3.02, 3.10]	142.11	< .001	3.04	[2.99, 3.08]	120.08	< .001
Propensity score, $\hat{\gamma}_{02}$	0.05	[-0.01, 0.12]	1.57	.116	-0.03	[-0.09, 0.04]	-0.80	.426
Before-slope, $\hat{\gamma}_{20}$	-0.02	[-0.03, -0.01]	-3.53	< .001	0.00	[-0.01, 0.01]	0.35	.729
After-slope, $\hat{\gamma}_{40}$	-0.01	[-0.02, -0.01]	-3.55	< .001	-0.01	[-0.02, 0.00]	-3.06	.002
Shift, $\hat{\gamma}_{60}$	0.02	[0.00, 0.04]	1.82	.069	0.01	[-0.01, 0.03]	1.28	.200
Grandparent, $\hat{\gamma}_{01}$	-0.04	[-0.11, 0.02]	-1.31	.190	0.01	[-0.06, 0.08]	0.39	.697
Black, $\hat{\gamma}_{10}$	-0.04	[-0.16, 0.08]	-0.65	.517	0.06	[-0.06, 0.19]	0.96	.336
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.02	[0.00, 0.05]	1.65	.099	0.00	[-0.02, 0.02]	-0.03	.978
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.01	[-0.01, 0.03]	1.14	.253	0.01	[-0.01, 0.02]	0.86	.387
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.04	[-0.09, 0.01]	-1.55	.121	-0.03	[-0.08, 0.01]	-1.39	.166
Before-slope * Black, $\hat{\gamma}_{30}$	0.02	[-0.03, 0.06]	0.69	.490	-0.03	[-0.06, 0.01]	-1.46	.144
After-slope * Black, $\hat{\gamma}_{50}$	0.01	[-0.02, 0.04]	0.79	.429	0.03	[0.00, 0.06]	1.93	.054
Shift * Black, $\hat{\gamma}_{70}$	0.09	[0.01, 0.17]	2.19	.028	-0.07	[-0.15, 0.01]	-1.64	.102
Grandparent * Black, $\hat{\gamma}_{11}$	0.12	[-0.11, 0.35]	1.01	.311	0.01	[-0.22, 0.23]	0.05	.960
Before-slope * Grandparent * Black, $\hat{\gamma}_{31}$	-0.05	[-0.16, 0.07]	-0.80	.425	0.00	[-0.10, 0.10]	-0.01	.993
After-slope * Grandparent * Black, $\hat{\gamma}_{51}$	0.02	[-0.05, 0.09]	0.55	.582	0.00	[-0.06, 0.06]	0.04	.970
Shift * Grandparent * Black, $\hat{\gamma}_{71}$	-0.08	[-0.26, 0.11]	-0.80	.422	0.08	[-0.10, 0.25]	0.85	.393

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *black* = 0 indicates White/Caucasian ethnicity, *black* = 1 indicates Black/African American ethnicity.

Table S53

Linear Contrasts for Openness (Moderated by Ethnicity; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of White controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60}$)	0.01	0.62	.431	0.00	0.10	.750
Shift of Black controls vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{50} + \hat{\gamma}_{70}$)	0.11	12.63	$<$ .001	-0.03	1.43	.231
Shift of White grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.02	1.72	.190	-0.02	2.09	.148
Shift of Black grandparents vs. 0 ($\hat{\gamma}_{40} + \hat{\gamma}_{60} + \hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.02	0.08	.773	0.02	0.09	.770
Shift of White controls vs. White grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61}$)	-0.03	2.33	.127	-0.03	2.06	.151
Before-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{21} + \hat{\gamma}_{31}$)	-0.02	0.17	.678	0.00	0.00	.987
After-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{51}$)	0.03	0.76	.383	0.01	0.07	.797
Shift of Black controls vs. Black grandparents ($\hat{\gamma}_{41} + \hat{\gamma}_{61} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	-0.09	1.63	.201	0.05	0.66	.418
Shift of White controls vs. Black controls ($\hat{\gamma}_{50} + \hat{\gamma}_{70}$)	0.10	10.12	.001	-0.04	1.53	.216
Before-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{30} + \hat{\gamma}_{31}$)	-0.03	0.33	.568	-0.03	0.34	.558
After-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{51}$)	0.03	0.84	.360	0.03	1.09	.297
Shift of White grandparents vs. Black grandparents ($\hat{\gamma}_{50} + \hat{\gamma}_{70} + \hat{\gamma}_{51} + \hat{\gamma}_{71}$)	0.04	0.40	.526	0.04	0.46	.500

Note. The linear contrasts are based on the models from Table S52. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S54

Fixed Effects of Life Satisfaction Over the Transition to Grandparenthood.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	5.04	[4.93, 5.15]	90.40	$<$ .001	5.15	[5.02, 5.28]	78.22	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	-0.08	[-0.22, 0.05]	-1.18	.239	0.01	[-0.12, 0.15]	0.20	.843
Before-slope, $\hat{\gamma}_{10}$	0.03	[0.02, 0.04]	5.02	$<$ .001	0.01	[0.00, 0.03]	2.03	.042
After-slope, $\hat{\gamma}_{20}$	0.01	[0.00, 0.02]	2.10	.036	-0.01	[-0.02, 0.00]	-1.53	.126
Shift, $\hat{\gamma}_{30}$	-0.03	[-0.09, 0.02]	-1.20	.230	-0.11	[-0.16, -0.05]	-3.64	$<$ .001
Grandparent, $\hat{\gamma}_{01}$	0.14	[-0.03, 0.30]	1.58	.115	0.00	[-0.18, 0.18]	0.01	.995
Before-slope * Grandparent, $\hat{\gamma}_{11}$	-0.01	[-0.04, 0.02]	-0.55	.583	0.01	[-0.02, 0.04]	0.68	.494
After-slope * Grandparent, $\hat{\gamma}_{21}$	-0.02	[-0.04, 0.01]	-1.53	.125	0.00	[-0.02, 0.03]	0.09	.928
Shift * Grandparent, $\hat{\gamma}_{31}$	0.08	[-0.04, 0.20]	1.24	.215	0.15	[0.02, 0.28]	2.34	.019
HRS								
Intercept, $\hat{\gamma}_{00}$	4.79	[4.67, 4.90]	81.69	$<$ .001	4.58	[4.45, 4.72]	67.28	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.42	[0.21, 0.63]	3.87	$<$ .001	0.43	[0.21, 0.65]	3.87	$<$ .001
Before-slope, $\hat{\gamma}_{10}$	0.01	[-0.03, 0.04]	0.27	.790	0.04	[0.00, 0.07]	1.95	.051
After-slope, $\hat{\gamma}_{20}$	0.01	[-0.01, 0.04]	0.91	.361	0.03	[0.01, 0.05]	2.37	.018
Shift, $\hat{\gamma}_{30}$	0.01	[-0.06, 0.09]	0.28	.783	-0.01	[-0.09, 0.06]	-0.40	.690
Grandparent, $\hat{\gamma}_{01}$	-0.01	[-0.20, 0.18]	-0.11	.911	0.15	[-0.04, 0.35]	1.51	.130
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.08	[-0.01, 0.17]	1.76	.079	0.06	[-0.03, 0.14]	1.26	.207
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.03	[-0.02, 0.09]	1.11	.266	0.02	[-0.04, 0.07]	0.61	.539
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.07	[-0.24, 0.10]	-0.78	.436	-0.05	[-0.21, 0.11]	-0.59	.553

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S55

Linear Contrasts for Life Satisfaction.

Linear Contrast	Parent controls $\hat{\gamma}_c$	χ^2	p	Nonparent controls $\hat{\gamma}_c$	χ^2	p
LISS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	-0.02	0.83	.363	-0.12	20.17	$<$ .001
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.03	0.53	.468	0.04	0.51	.476
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.06	1.13	.288	0.15	7.24	.007
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.02	3.68	.055	0.02	3.28	.070
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	-0.01	0.46	.496	-0.01	0.42	.519
HRS						
Shift of the controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	0.02	0.58	.445	0.01	0.28	.595
Shift of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.01	0.04	.844	-0.02	0.09	.771
Shift of the controls vs. shift of the grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.03	0.27	.602	-0.03	0.25	.616
Before-slope of the grandparents vs. 0 ($\hat{\gamma}_{10}$ + $\hat{\gamma}_{11}$)	0.09	4.29	.038	0.09	5.35	.021
After-slope of the grandparents vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{21}$)	0.04	2.88	.090	0.05	3.50	.061

Note. The linear contrasts are needed in cases where estimates of interest are represented by multiple fixed-effects coefficients and are computed using the *linearHypothesis* function from the *car* R package (Fox & Weisberg, 2019a) based on the models from Table S54. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S56

Fixed Effects of Life Satisfaction Over the Transition to Grandparenthood Moderated by Gender.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
LISS								
Intercept, $\hat{\gamma}_{00}$	4.96	[4.81, 5.11]	63.49	< .001	5.12	[4.94, 5.30]	55.20	< .001
Propensity score, $\hat{\gamma}_{04}$	-0.08	[-0.21, 0.05]	-1.17	.241	0.01	[-0.12, 0.14]	0.15	.878
Before-slope, $\hat{\gamma}_{10}$	0.05	[0.03, 0.06]	4.76	< .001	0.02	[0.00, 0.03]	1.57	.116
After-slope, $\hat{\gamma}_{20}$	0.02	[0.00, 0.03]	1.91	.056	-0.02	[-0.04, 0.00]	-2.50	.012
Shift, $\hat{\gamma}_{30}$	-0.08	[-0.17, 0.00]	-2.00	.045	-0.04	[-0.12, 0.04]	-0.93	.352
Grandparent, $\hat{\gamma}_{01}$	0.27	[0.04, 0.51]	2.29	.022	0.09	[-0.17, 0.34]	0.67	.505
Female, $\hat{\gamma}_{02}$	0.14	[-0.05, 0.33]	1.43	.152	0.05	[-0.17, 0.28]	0.47	.637
Before-slope * Grandparent, $\hat{\gamma}_{11}$	-0.02	[-0.07, 0.02]	-1.19	.235	0.01	[-0.04, 0.05]	0.24	.808
After-slope * Grandparent, $\hat{\gamma}_{21}$	-0.03	[-0.07, 0.00]	-1.73	.084	0.00	[-0.03, 0.04]	0.23	.817
Shift * Grandparent, $\hat{\gamma}_{31}$	0.13	[-0.05, 0.30]	1.38	.166	0.08	[-0.10, 0.27]	0.86	.387
Before-slope * Female, $\hat{\gamma}_{12}$	-0.02	[-0.05, 0.00]	-1.90	.058	0.00	[-0.03, 0.02]	-0.26	.791
After-slope * Female, $\hat{\gamma}_{22}$	-0.01	[-0.03, 0.01]	-0.69	.491	0.02	[0.00, 0.04]	2.00	.046
Shift * Female, $\hat{\gamma}_{32}$	0.09	[-0.02, 0.20]	1.60	.110	-0.13	[-0.24, -0.01]	-2.13	.033
Grandparent * Female, $\hat{\gamma}_{03}$	-0.26	[-0.56, 0.04]	-1.67	.095	-0.16	[-0.49, 0.17]	-0.97	.331
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.03	[-0.02, 0.09]	1.15	.251	0.01	[-0.05, 0.07]	0.38	.704
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	0.02	[-0.03, 0.07]	0.91	.365	-0.01	[-0.06, 0.04]	-0.30	.768
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	-0.09	[-0.33, 0.15]	-0.73	.467	0.13	[-0.12, 0.38]	0.99	.322
HRS								
Intercept, $\hat{\gamma}_{00}$	4.68	[4.53, 4.82]	61.35	< .001	4.49	[4.32, 4.66]	51.99	< .001
Propensity score, $\hat{\gamma}_{04}$	0.43	[0.22, 0.64]	3.95	< .001	0.40	[0.18, 0.62]	3.61	< .001
Before-slope, $\hat{\gamma}_{10}$	0.01	[-0.05, 0.07]	0.28	.777	0.06	[0.01, 0.12]	2.27	.023
After-slope, $\hat{\gamma}_{20}$	-0.01	[-0.05, 0.03]	-0.55	.584	0.06	[0.02, 0.10]	3.05	.002
Shift, $\hat{\gamma}_{30}$	0.18	[0.07, 0.29]	3.13	.002	-0.21	[-0.32, -0.10]	-3.75	< .001
Grandparent, $\hat{\gamma}_{01}$	0.09	[-0.17, 0.35]	0.71	.480	0.25	[-0.01, 0.52]	1.85	.064
Female, $\hat{\gamma}_{02}$	0.20	[0.03, 0.37]	2.36	.019	0.18	[-0.01, 0.38]	1.88	.060
Before-slope * Grandparent, $\hat{\gamma}_{11}$	0.01	[-0.13, 0.14]	0.10	.917	-0.04	[-0.17, 0.09]	-0.62	.536
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.06	[-0.03, 0.14]	1.32	.186	-0.01	[-0.09, 0.07]	-0.23	.816
Shift * Grandparent, $\hat{\gamma}_{31}$	-0.19	[-0.44, 0.06]	-1.51	.131	0.19	[-0.05, 0.43]	1.57	.117
Before-slope * Female, $\hat{\gamma}_{12}$	-0.01	[-0.09, 0.07]	-0.27	.788	-0.05	[-0.12, 0.03]	-1.23	.218
After-slope * Female, $\hat{\gamma}_{22}$	0.04	[-0.01, 0.09]	1.58	.114	-0.05	[-0.10, 0.00]	-2.07	.039
Shift * Female, $\hat{\gamma}_{32}$	-0.31	[-0.46, -0.15]	-3.95	< .001	0.34	[0.20, 0.48]	4.63	< .001

Table S56 continued

Parameter	Parent controls $\hat{\gamma}$	Parent controls 95% CI	Parent controls t	Parent controls p	Nonparent controls $\hat{\gamma}$	Nonparent controls 95% CI	Nonparent controls t	Nonparent controls p
Grandparent * Female, $\hat{\gamma}_{03}$	-0.19	[-0.51, 0.13]	-1.19	.234	-0.17	[-0.50, 0.15]	-1.04	.298
Before-slope * Grandparent * Female, $\hat{\gamma}_{13}$	0.14	[-0.04, 0.32]	1.48	.139	0.17	[0.00, 0.34]	1.91	.056
After-slope * Grandparent * Female, $\hat{\gamma}_{23}$	-0.05	[-0.16, 0.07]	-0.79	.432	0.05	[-0.06, 0.15]	0.82	.412
Shift * Grandparent * Female, $\hat{\gamma}_{33}$	0.23	[-0.11, 0.56]	1.34	.180	-0.41	[-0.73, -0.10]	-2.55	.011

Note. Two models were computed for each of the two samples (LISS, HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval.

Table S57

Linear Contrasts for Life Satisfaction (Moderated by Gender).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
LISS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	-0.07	3.48	.062	-0.06	2.59	.108
Shift of female controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$)	0.01	0.19	.663	-0.16	21.48	< .001
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.03	0.13	.723	0.03	0.12	.730
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$ + $\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$ + $\hat{\gamma}_{23}$ + $\hat{\gamma}_{33}$)	0.04	0.41	.524	0.04	0.40	.529
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.09	1.38	.239	0.09	1.07	.300
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11}$ + $\hat{\gamma}_{13}$)	0.01	0.16	.690	0.02	0.67	.413
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{23}$)	-0.01	0.30	.583	0.00	0.03	.853
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$ + $\hat{\gamma}_{23}$ + $\hat{\gamma}_{33}$)	0.03	0.13	.714	0.21	7.28	.007
Shift of male vs. female controls ($\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$)	0.08	2.81	.094	-0.10	3.97	.046
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12}$ + $\hat{\gamma}_{13}$)	0.01	0.11	.746	0.01	0.09	.770
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22}$ + $\hat{\gamma}_{23}$)	0.02	0.45	.502	0.02	0.41	.520
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$ + $\hat{\gamma}_{23}$ + $\hat{\gamma}_{33}$)	0.02	0.03	.866	0.02	0.03	.865
HRS						
Shift of male controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$)	0.17	14.63	< .001	-0.15	12.35	< .001
Shift of female controls vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$)	-0.09	5.59	.018	0.14	13.77	< .001
Shift of grandfathers vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.04	0.17	.682	0.03	0.12	.727
Shift of grandmothers vs. 0 ($\hat{\gamma}_{20}$ + $\hat{\gamma}_{30}$ + $\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$ + $\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$ + $\hat{\gamma}_{23}$ + $\hat{\gamma}_{33}$)	-0.05	0.35	.553	-0.05	0.45	.504
Shift of male controls vs. grandfathers ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.13	1.92	.166	0.18	3.79	.052
Before-slope of female controls vs. grandmothers ($\hat{\gamma}_{11}$ + $\hat{\gamma}_{13}$)	0.14	5.47	.019	0.13	4.79	.029
After-slope of female controls vs. grandmothers ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{23}$)	0.01	0.09	.769	0.04	0.92	.337
Shift of female controls vs. grandmothers ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$ + $\hat{\gamma}_{23}$ + $\hat{\gamma}_{33}$)	0.05	0.29	.587	-0.19	5.13	.024
Shift of male vs. female controls ($\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$)	-0.26	19.63	< .001	0.29	25.88	< .001
Before-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{12}$ + $\hat{\gamma}_{13}$)	0.13	2.28	.131	0.12	2.36	.125
After-slope of grandfathers vs. grandmothers ($\hat{\gamma}_{22}$ + $\hat{\gamma}_{23}$)	0.00	0.01	.937	-0.01	0.02	.889
Shift of grandfathers vs. grandmothers ($\hat{\gamma}_{22}$ + $\hat{\gamma}_{32}$ + $\hat{\gamma}_{23}$ + $\hat{\gamma}_{33}$)	-0.08	0.50	.480	-0.08	0.50	.477

Note. The linear contrasts are based on the models from Table S56. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S58

Fixed Effects of Life Satisfaction Over the Transition to Grandparenthood Moderated by Performing Paid Work.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	4.78	[4.63, 4.93]	63.55	< .001	4.62	[4.46, 4.78]	56.07	< .001
Propensity score, $\hat{\gamma}_{02}$	0.40	[0.18, 0.61]	3.64	< .001	0.37	[0.15, 0.59]	3.26	.001
Before-slope, $\hat{\gamma}_{20}$	0.00	[-0.07, 0.07]	0.11	.912	-0.08	[-0.16, -0.01]	-2.31	.021
After-slope, $\hat{\gamma}_{40}$	0.00	[-0.04, 0.03]	-0.25	.800	0.05	[0.01, 0.09]	2.74	.006
Shift, $\hat{\gamma}_{60}$	-0.02	[-0.14, 0.10]	-0.30	.761	0.18	[0.06, 0.30]	2.90	.004
Grandparent, $\hat{\gamma}_{01}$	-0.04	[-0.36, 0.29]	-0.22	.826	0.11	[-0.20, 0.43]	0.70	.484
Working, $\hat{\gamma}_{10}$	0.02	[-0.12, 0.16]	0.27	.787	0.02	[-0.12, 0.15]	0.25	.799
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.07	[-0.11, 0.25]	0.74	.458	0.16	[-0.01, 0.33]	1.83	.067
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.04	[-0.05, 0.12]	0.87	.385	-0.02	[-0.10, 0.06]	-0.49	.622
Shift * Grandparent, $\hat{\gamma}_{61}$	0.11	[-0.16, 0.38]	0.77	.440	-0.10	[-0.36, 0.16]	-0.74	.459
Before-slope * Working, $\hat{\gamma}_{30}$	0.00	[-0.08, 0.09]	0.06	.950	0.16	[0.08, 0.25]	3.86	< .001
After-slope * Working, $\hat{\gamma}_{50}$	0.05	[0.00, 0.10]	1.88	.060	-0.04	[-0.09, 0.01]	-1.59	.112
Shift * Working, $\hat{\gamma}_{70}$	0.02	[-0.13, 0.18]	0.28	.778	-0.26	[-0.41, -0.11]	-3.35	.001
Grandparent * Working, $\hat{\gamma}_{11}$	0.03	[-0.31, 0.38]	0.19	.848	0.03	[-0.30, 0.35]	0.15	.880
Before-slope * Grandparent * Working, $\hat{\gamma}_{31}$	0.02	[-0.19, 0.23]	0.19	.853	-0.14	[-0.34, 0.06]	-1.38	.167
After-slope * Grandparent * Working, $\hat{\gamma}_{51}$	-0.03	[-0.15, 0.09]	-0.51	.611	0.06	[-0.05, 0.17]	1.07	.286
Shift * Grandparent * Working, $\hat{\gamma}_{71}$	-0.25	[-0.61, 0.10]	-1.41	.160	0.03	[-0.31, 0.36]	0.15	.881

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *working* = 1 indicates being employed in paid work.

Table S59

Linear Contrasts for Life Satisfaction (Moderated by Paid Work; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of not-working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$)	-0.02	0.22	.636	0.23	21.09	$<$ .001
Shift of working controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	0.05	1.67	.197	-0.07	3.91	.048
Shift of not-working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	0.12	1.43	.232	0.12	1.55	.213
Shift of working grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.09	1.49	.223	-0.10	1.99	.159
Shift of not-working controls vs. not-working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	0.14	1.65	.200	-0.12	1.21	.272
Before-slope of working controls vs. working grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.09	2.65	.104	0.02	0.15	.697
After-slope of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{51}$)	0.01	0.02	.886	0.04	1.06	.303
Shift of working controls vs. working grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.14	2.80	.094	-0.03	0.16	.689
Shift of not-working controls vs. working controls ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	0.07	1.35	.246	-0.30	23.66	$<$ .001
Before-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	0.02	0.05	.819	0.02	0.05	.823
After-slope of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{51}$)	0.02	0.13	.716	0.02	0.16	.693
Shift of not-working grandparents vs. working grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.21	2.77	.096	-0.22	3.28	.070

Note. The linear contrasts are based on the models from Table S58. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S60

Fixed Effects of Life Satisfaction Over the Transition to Grandparenthood Moderated by Grandchild Care.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	4.99	[4.85, 5.13]	69.26	$<$ .001	4.82	[4.66, 4.99]	57.30	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	-0.05	[-0.30, 0.21]	-0.37	.712	0.24	[-0.02, 0.51]	1.79	.074
After-slope, $\hat{\gamma}_{20}$	0.02	[-0.01, 0.06]	1.43	.153	0.02	[-0.02, 0.05]	1.05	.293
Grandparent, $\hat{\gamma}_{01}$	-0.02	[-0.24, 0.20]	-0.17	.863	0.02	[-0.21, 0.25]	0.15	.879
Caring, $\hat{\gamma}_{10}$	-0.02	[-0.14, 0.10]	-0.33	.739	-0.12	[-0.24, 0.00]	-2.01	.045
After-slope * Grandparent, $\hat{\gamma}_{21}$	0.04	[-0.03, 0.12]	1.25	.212	0.05	[-0.02, 0.12]	1.42	.155
After-slope * Caring, $\hat{\gamma}_{30}$	-0.01	[-0.06, 0.04]	-0.30	.762	0.05	[0.00, 0.10]	1.78	.075
Grandparent * Caring, $\hat{\gamma}_{11}$	0.23	[-0.06, 0.53]	1.54	.124	0.34	[0.05, 0.64]	2.29	.022
After-slope * Grandparent * Caring, $\hat{\gamma}_{31}$	-0.03	[-0.14, 0.08]	-0.50	.620	-0.08	[-0.19, 0.03]	-1.48	.140

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *caring* = 1 indicates more than 100 hours of grandchild care since the last assessment.

Table S61

Linear Contrasts for Life Satisfaction (Moderated by Grandchild Care; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
After-slope of caring controls vs. caring grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	0.02	0.15	.702	-0.03	0.63	.429
After-slope of not-caring grandparents vs. caring grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	-0.04	0.51	.476	-0.04	0.56	.454

Note. The linear contrasts are based on the models from Table S60. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S62

Fixed Effects of Life Satisfaction Over the Transition to Grandparenthood Moderated by Ethnicity.

	Parent controls				Nonparent controls			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Intercept, $\hat{\gamma}_{00}$	4.91	[4.79, 5.04]	78.04	$<$ .001	4.62	[4.48, 4.77]	62.14	$<$ .001
Propensity score, $\hat{\gamma}_{02}$	0.40	[0.19, 0.62]	3.65	$<$ .001	0.35	[0.13, 0.58]	3.06	.002
Before-slope, $\hat{\gamma}_{20}$	-0.01	[-0.05, 0.04]	-0.24	.809	0.05	[0.01, 0.09]	2.34	.020
After-slope, $\hat{\gamma}_{40}$	0.01	[-0.01, 0.04]	1.00	.319	0.03	[0.01, 0.06]	2.41	.016
Shift, $\hat{\gamma}_{60}$	-0.02	[-0.10, 0.06]	-0.47	.637	0.00	[-0.08, 0.08]	0.00	.997
Grandparent, $\hat{\gamma}_{01}$	-0.06	[-0.26, 0.14]	-0.59	.556	0.22	[0.01, 0.43]	2.01	.045
Black, $\hat{\gamma}_{10}$	-0.89	[-1.25, -0.53]	-4.86	$<$ .001	0.10	[-0.26, 0.47]	0.56	.577
Before-slope * Grandparent, $\hat{\gamma}_{21}$	0.10	[0.00, 0.19]	2.04	.042	0.05	[-0.04, 0.14]	1.11	.269
After-slope * Grandparent, $\hat{\gamma}_{41}$	0.02	[-0.04, 0.08]	0.69	.488	0.01	[-0.05, 0.06]	0.19	.849
Shift * Grandparent, $\hat{\gamma}_{61}$	-0.04	[-0.22, 0.14]	-0.43	.667	-0.06	[-0.23, 0.11]	-0.74	.460
Before-slope * Black, $\hat{\gamma}_{30}$	0.09	[-0.06, 0.25]	1.15	.249	-0.18	[-0.31, -0.04]	-2.52	.012
After-slope * Black, $\hat{\gamma}_{50}$	0.02	[-0.06, 0.11]	0.55	.584	-0.08	[-0.19, 0.03]	-1.37	.170
Shift * Black, $\hat{\gamma}_{70}$	-0.03	[-0.31, 0.25]	-0.20	.840	0.06	[-0.24, 0.35]	0.37	.709
Grandparent * Black, $\hat{\gamma}_{11}$	0.42	[-0.30, 1.13]	1.15	.251	-0.57	[-1.28, 0.14]	-1.57	.116
Before-slope * Grandparent * Black, $\hat{\gamma}_{31}$	-0.23	[-0.62, 0.16]	-1.17	.241	0.03	[-0.34, 0.40]	0.17	.862
After-slope * Grandparent * Black, $\hat{\gamma}_{51}$	0.26	[0.03, 0.49]	2.20	.027	0.36	[0.13, 0.59]	3.07	.002
Shift * Grandparent * Black, $\hat{\gamma}_{71}$	-0.34	[-0.98, 0.31]	-1.02	.308	-0.43	[-1.06, 0.21]	-1.32	.187

Note. Two models were computed (only HRS): grandparents matched with parent controls and with nonparent controls. CI = confidence interval. *black* = 0 indicates White/Caucasian ethnicity, *black* = 1 indicates Black/African American ethnicity.

Table S63

Linear Contrasts for Life Satisfaction (Moderated by Ethnicity; only HRS).

	Parent controls			Nonparent controls		
Linear Contrast	$\hat{\gamma}_c$	χ^2	p	$\hat{\gamma}_c$	χ^2	p
Shift of White controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$)	-0.01	0.03	.864	0.03	1.09	.296
Shift of Black controls vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	-0.01	0.01	.930	0.01	0.01	.923
Shift of White grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.02	0.14	.709	-0.03	0.21	.644
Shift of Black grandparents vs. 0 ($\hat{\gamma}_{40}$ + $\hat{\gamma}_{60}$ + $\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.10	0.24	.625	-0.11	0.30	.583
Shift of White controls vs. White grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$)	-0.02	0.06	.799	-0.06	0.78	.376
Before-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{21}$ + $\hat{\gamma}_{31}$)	-0.14	0.49	.482	0.08	0.21	.648
After-slope of Black controls vs. Black grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{51}$)	0.28	6.12	.013	0.37	10.37	.001
Shift of Black controls vs. Black grandparents ($\hat{\gamma}_{41}$ + $\hat{\gamma}_{61}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.10	0.16	.689	-0.12	0.28	.596
Shift of White controls vs. Black controls ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$)	0.00	0.00	.971	-0.02	0.03	.854
Before-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{30}$ + $\hat{\gamma}_{31}$)	-0.14	0.60	.437	-0.14	0.66	.418
After-slope of White grandparents vs. Black grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{51}$)	0.28	6.90	.009	0.29	7.56	.006
Shift of White grandparents vs. Black grandparents ($\hat{\gamma}_{50}$ + $\hat{\gamma}_{70}$ + $\hat{\gamma}_{51}$ + $\hat{\gamma}_{71}$)	-0.08	0.14	.713	-0.09	0.16	.689

Note. The linear contrasts are based on the models from Table S62. $\hat{\gamma}_c$ = combined fixed-effects estimate.

Table S64

Tests of Heterogeneous Random Slope Variance Models for Agreeableness Against Comparison Models With a Uniform Random Slope Variance.

	Parent controls					Nonparent controls				
	Var.	*SD*	*LR*	*p*	GP greater	*Var.*	*SD*	*LR*	*p*	GP greater
LISS										
Before-slope: uniform	0.00	0.04				0.00	0.04			
Before-slope: heterogeneous (controls)	0.00	0.05				0.00	0.05			
Before-slope: heterogeneous (grandparents)	0.00	0.04	15.22	.002	no	0.00	0.03	37.53	< .001	no
After-slope: uniform	0.00	0.03				0.00	0.03			
After-slope: heterogeneous (controls)	0.00	0.04				0.00	0.04			
After-slope: heterogeneous (grandparents)	0.00	0.03	4.88	.181	no	0.00	0.02	14.49	.002	no
Shift: uniform	0.02	0.15				0.02	0.15			
Shift: heterogeneous (controls)	0.02	0.15				0.03	0.16			
Shift: heterogeneous (grandparents)	0.02	0.13	1.57	.666	no	0.01	0.10	15.97	.001	no
HRS										
Before-slope: uniform	0.01	0.11				0.01	0.12			
Before-slope: heterogeneous (controls)	0.02	0.14				0.02	0.15			
Before-slope: heterogeneous (grandparents)	0.01	0.12	57.65	< .001	no	0.02	0.13	81.45	< .001	no
After-slope: uniform	0.01	0.09				0.01	0.11			
After-slope: heterogeneous (controls)	0.01	0.10				0.01	0.12			
After-slope: heterogeneous (grandparents)	0.01	0.08	35.76	< .001	no	0.01	0.09	68.22	< .001	no
Shift: uniform	0.06	0.25				0.07	0.26			
Shift: heterogeneous (controls)	0.08	0.28				0.09	0.30			
Shift: heterogeneous (grandparents)	0.05	0.22	68.90	< .001	no	0.06	0.24	92.11	< .001	no

Note. The heterogeneous variance models (df = 16) differ only in the random effects from the comparison models (df = 13). In addition to two random slope variances (instead of one), the heterogeneous variance models estimate two additional random intercept/slope covariances. Both models estimate heterogeneous random intercept variances for the grandparent and control groups. *Var.* = random slope variance; *SD* = standard deviation; *LR* = likelihood ratio; p = p-value (of the LR test); *GP greater* = indicating if the random slope variance of the grandparents is larger than that of either control group.

Table S65

Tests of Heterogeneous Random Slope Variance Models for Conscientiousness Against Comparison Models With a Uniform Random Slope Variance.

	Parent controls					Nonparent controls				
	Var.	*SD*	*LR*	*p*	GP greater	*Var.*	*SD*	*LR*	*p*	GP greater
LISS										
Before-slope: uniform	0.00	0.04				0.00	0.04			
Before-slope: heterogeneous (controls)	0.00	0.05				0.00	0.04			
Before-slope: heterogeneous (grandparents)	0.00	0.03	16.78	< .001	no	0.00	0.01	31.44	< .001	no
After-slope: uniform	0.00	0.04				0.00	0.04			
After-slope: heterogeneous (controls)	0.00	0.04				0.00	0.04			
After-slope: heterogeneous (grandparents)	0.00	0.03	8.02	.046	no	0.00	0.03	17.47	< .001	no
Shift: uniform	0.02	0.14				0.02	0.14			
Shift: heterogeneous (controls)	0.02	0.15				0.02	0.16			
Shift: heterogeneous (grandparents)	0.01	0.12	2.58	.461	no	0.01	0.08	14.58	.002	no
HRS										
Before-slope: uniform	0.01	0.11				0.01	0.11			
Before-slope: heterogeneous (controls)	0.02	0.14				0.02	0.14			
Before-slope: heterogeneous (grandparents)	0.01	0.11	79.31	< .001	no	0.02	0.13	105.76	< .001	no
After-slope: uniform	0.01	0.09				0.01	0.10			
After-slope: heterogeneous (controls)	0.01	0.11				0.01	0.11			
After-slope: heterogeneous (grandparents)	0.01	0.08	57.77	< .001	no	0.01	0.09	59.64	< .001	no
Shift: uniform	0.06	0.24				0.06	0.25			
Shift: heterogeneous (controls)	0.07	0.27				0.08	0.27			
Shift: heterogeneous (grandparents)	0.05	0.23	83.80	< .001	no	0.06	0.25	91.50	< .001	no

Note. The heterogeneous variance models ($df = 16$) differ only in the random effects from the comparison models ($df = 13$). In addition to two random slope variances (instead of one), the heterogeneous variance models estimate two additional random intercept/slope covariances. Both models estimate heterogeneous random intercept variances for the grandparent and control groups. *Var.* = random slope variance; *SD* = standard deviation; *LR* = likelihood ratio; *p* = *p*-value (of the LR test); *GP greater* = indicating if the random slope variance of the grandparents is larger than that of either control group.

Table S66

Tests of Heterogeneous Random Slope Variance Models for Extraversion Against Comparison Models With a Uniform Random Slope Variance.

	Parent controls					Nonparent controls				
	Var.	*SD*	*LR*	*p*	GP greater	*Var.*	*SD*	*LR*	*p*	GP greater
LISS										
Before-slope: uniform	0.00	0.05				0.00	0.05			
Before-slope: heterogeneous (controls)	0.00	0.06				0.00	0.06			
Before-slope: heterogeneous (grandparents)	0.00	0.05	25.93	< .001	no	0.00	0.05	16.88	< .001	no
After-slope: uniform	0.00	0.04				0.00	0.04			
After-slope: heterogeneous (controls)	0.00	0.04				0.00	0.05			
After-slope: heterogeneous (grandparents)	0.00	0.03	4.61	.203	no	0.00	0.03	8.97	.030	no
Shift: uniform	0.03	0.17				0.03	0.18			
Shift: heterogeneous (controls)	0.03	0.18				0.04	0.20			
Shift: heterogeneous (grandparents)	0.02	0.13	6.66	.084	no	0.02	0.13	8.05	.045	no
HRS										
Before-slope: uniform	0.01	0.12				0.02	0.13			
Before-slope: heterogeneous (controls)	0.02	0.14				0.03	0.16			
Before-slope: heterogeneous (grandparents)	0.01	0.11	50.21	< .001	no	0.02	0.13	88.69	< .001	no
After-slope: uniform	0.01	0.10				0.01	0.11			
After-slope: heterogeneous (controls)	0.01	0.11				0.02	0.12			
After-slope: heterogeneous (grandparents)	0.01	0.09	40.23	< .001	no	0.01	0.10	48.76	< .001	no
Shift: uniform	0.07	0.27				0.08	0.28			
Shift: heterogeneous (controls)	0.09	0.29				0.09	0.31			
Shift: heterogeneous (grandparents)	0.06	0.25	60.29	< .001	no	0.07	0.26	67.55	< .001	no

Note. The heterogeneous variance models (df = 16) differ only in the random effects from the comparison models (df = 13). In addition to two random slope variances (instead of one), the heterogeneous variance models estimate two additional random intercept/slope covariances. Both models estimate heterogeneous random intercept variances for the grandparent and control groups. *Var.* = random slope variance; *SD* = standard deviation; *LR* = likelihood ratio; p = p-value (of the LR test); *GP greater* = indicating if the random slope variance of the grandparents is larger than that of either control group.

Table S67

Tests of Heterogeneous Random Slope Variance Models for Neuroticism Against Comparison Models With a Uniform Random Slope Variance.

	Parent controls					Nonparent controls				
	Var.	*SD*	*LR*	*p*	GP greater	*Var.*	*SD*	*LR*	*p*	GP greater
LISS										
Before-slope: uniform	0.00	0.06				0.01	0.07			
Before-slope: heterogeneous (controls)	0.00	0.07				0.01	0.09			
Before-slope: heterogeneous (grandparents)	0.00	0.06	13.44	.004	no	0.00	0.06	27.16	< .001	no
After-slope: uniform	0.00	0.05				0.00	0.06			
After-slope: heterogeneous (controls)	0.00	0.05				0.00	0.06			
After-slope: heterogeneous (grandparents)	0.00	0.04	4.07	.254	no	0.00	0.04	12.76	.005	no
Shift: uniform	0.04	0.21				0.06	0.25			
Shift: heterogeneous (controls)	0.04	0.21				0.08	0.29			
Shift: heterogeneous (grandparents)	0.04	0.20	1.74	.628	no	0.03	0.18	13.84	.003	no
HRS										
Before-slope: uniform	0.02	0.15				0.02	0.15			
Before-slope: heterogeneous (controls)	0.04	0.19				0.04	0.20			
Before-slope: heterogeneous (grandparents)	0.03	0.17	83.87	< .001	no	0.03	0.18	96.92	< .001	no
After-slope: uniform	0.01	0.12				0.01	0.12			
After-slope: heterogeneous (controls)	0.02	0.14				0.02	0.14			
After-slope: heterogeneous (grandparents)	0.01	0.10	73.89	< .001	no	0.01	0.10	87.94	< .001	no
Shift: uniform	0.10	0.32				0.09	0.30			
Shift: heterogeneous (controls)	0.13	0.36				0.12	0.34			
Shift: heterogeneous (grandparents)	0.09	0.30	103.35	< .001	no	0.08	0.29	99.32	< .001	no

Note. The heterogeneous variance models (df = 16) differ only in the random effects from the comparison models (df = 13). In addition to two random slope variances (instead of one), the heterogeneous variance models estimate two additional random intercept/slope covariances. Both models estimate heterogeneous random intercept variances for the grandparent and control groups. *Var.* = random slope variance; *SD* = standard deviation; *LR* = likelihood ratio; p = p-value (of the LR test); *GP greater* = indicating if the random slope variance of the grandparents is larger than that of either control group.

Table S68

Tests of Heterogeneous Random Slope Variance Models for Openness Against Comparison Models With a Uniform Random Slope Variance.

	Parent controls					Nonparent controls				
	Var.	*SD*	*LR*	*p*	GP greater	*Var.*	*SD*	*LR*	*p*	GP greater
LISS										
Before-slope: uniform	0.00	0.04				0.00	0.04			
Before-slope: heterogeneous (controls)	0.00	0.05				0.00	0.04			
Before-slope: heterogeneous (grandparents)	0.00	0.04	32.73	< .001	no	0.00	0.04	20.42	< .001	no
After-slope: uniform	0.00	0.03				0.00	0.03			
After-slope: heterogeneous (controls)	0.00	0.04				0.00	0.03			
After-slope: heterogeneous (grandparents)	0.00	0.02	20.08	< .001	no	0.00	0.02	9.55	.023	no
Shift: uniform	0.02	0.14				0.02	0.13			
Shift: heterogeneous (controls)	0.02	0.16				0.02	0.13			
Shift: heterogeneous (grandparents)	0.01	0.10	16.70	< .001	no	0.01	0.12	8.33	.040	no
HRS										
Before-slope: uniform	0.01	0.12				0.01	0.12			
Before-slope: heterogeneous (controls)	0.02	0.15				0.02	0.14			
Before-slope: heterogeneous (grandparents)	0.01	0.10	66.09	< .001	no	0.02	0.14	57.57	< .001	yes
After-slope: uniform	0.01	0.10				0.01	0.10			
After-slope: heterogeneous (controls)	0.01	0.11				0.01	0.11			
After-slope: heterogeneous (grandparents)	0.01	0.09	31.95	< .001	no	0.01	0.10	31.36	< .001	no
Shift: uniform	0.07	0.26				0.07	0.26			
Shift: heterogeneous (controls)	0.08	0.28				0.08	0.28			
Shift: heterogeneous (grandparents)	0.06	0.24	61.83	< .001	no	0.07	0.26	52.06	< .001	no

Note. The heterogeneous variance models (df = 16) differ only in the random effects from the comparison models (df = 13). In addition to two random slope variances (instead of one), the heterogeneous variance models estimate two additional random intercept/slope covariances. Both models estimate heterogeneous random intercept variances for the grandparent and control groups. *Var.* = random slope variance; *SD* = standard deviation; *LR* = likelihood ratio; p = p-value (of the LR test); *GP greater* = indicating if the random slope variance of the grandparents is larger than that of either control group.

Table S69

Tests of Heterogeneous Random Slope Variance Models for Life Satisfaction Against Comparison Models With a Uniform Random Slope Variance.

	Parent controls					Nonparent controls				
	Var.	*SD*	*LR*	*p*	GP greater	*Var.*	*SD*	*LR*	*p*	GP greater
LISS										
Before-slope: uniform	0.01	0.11				0.01	0.11			
Before-slope: heterogeneous (controls)	0.02	0.14				0.02	0.14			
Before-slope: heterogeneous (grandparents)	0.02	0.13	56.24	< .001	no	0.01	0.12	34.59	< .001	no
After-slope: uniform	0.01	0.10				0.01	0.10			
After-slope: heterogeneous (controls)	0.01	0.09				0.01	0.10			
After-slope: heterogeneous (grandparents)	0.02	0.12	11.91	.008	yes	0.01	0.12	10.88	.012	yes
Shift: uniform	0.20	0.45				0.19	0.44			
Shift: heterogeneous (controls)	0.21	0.45				0.19	0.44			
Shift: heterogeneous (grandparents)	0.23	0.48	8.96	.030	yes	0.21	0.46	8.43	.038	yes
HRS										
Before-slope: uniform	0.12	0.34				0.14	0.38			
Before-slope: heterogeneous (controls)	0.22	0.47				0.22	0.47			
Before-slope: heterogeneous (grandparents)	0.22	0.47	116.02	< .001	no	0.32	0.57	115.87	< .001	yes
After-slope: uniform	0.10	0.32				0.11	0.33			
After-slope: heterogeneous (controls)	0.14	0.38				0.15	0.39			
After-slope: heterogeneous (grandparents)	0.07	0.27	96.08	< .001	no	0.09	0.30	80.01	< .001	no
Shift: uniform	0.84	0.91				0.78	0.88			
Shift: heterogeneous (controls)	1.11	1.05				1.00	1.00			
Shift: heterogeneous (grandparents)	0.76	0.87	171.58	< .001	no	0.85	0.92	125.52	< .001	no

Note. The heterogeneous variance models (df = 16) differ only in the random effects from the comparison models (df = 13). In addition to two random slope variances (instead of one), the heterogeneous variance models estimate two additional random intercept/slope covariances. Both models estimate heterogeneous random intercept variances for the grandparent and control groups. *Var.* = random slope variance; *SD* = standard deviation; *LR* = likelihood ratio; p = p-value (of the LR test); *GP greater* = indicating if the random slope variance of the grandparents is larger than that of either control group.

Table S70

Rank-Order Stability With Maximal Retest Interval.

	Parent controls				Nonparent controls			
Outcome	Cor_{all}	Cor_{GP}	Cor_{con}	p	Cor_{all}	Cor_{GP}	Cor_{con}	p
LISS								
Agreeableness	0.74	0.77	0.74	.236	0.67	0.77	0.64	$< .001$
Conscientiousness	0.68	0.77	0.66	.028	0.69	0.77	0.67	.002
Extraversion	0.74	0.82	0.71	.001	0.80	0.82	0.80	.903
Neuroticism	0.70	0.76	0.68	.089	0.68	0.76	0.65	.684
Openness	0.74	0.79	0.73	.162	0.78	0.79	0.78	.887
Life Satisfaction	0.67	0.54	0.70	.087	0.51	0.54	0.51	.247
HRS								
Agreeableness	0.67	0.68	0.67	.361	0.69	0.68	0.69	.913
Conscientiousness	0.66	0.68	0.66	.041	0.65	0.68	0.64	.765
Extraversion	0.70	0.73	0.69	.050	0.69	0.73	0.68	.003
Neuroticism	0.64	0.67	0.64	.281	0.63	0.67	0.62	.187
Openness	0.70	0.71	0.70	.464	0.76	0.71	0.77	.001
Life Satisfaction	0.51	0.54	0.50	.396	0.48	0.54	0.46	.072

Note. Test-retest correlations as indicators of rank-order stability, and p-values indicating significant group differences therein between grandparents and each control group. The average retest intervals in years are 8.45 (SD = 2.24) for the LISS parent sample, 8.31 (SD = 2.28) for the LISS nonparent sample, 6.91 (SD = 2.21) for the HRS parent sample, and 6.96 (SD = 2.27) for the HRS nonparent sample. Cor = correlation; GP = grandparents; con = controls.

Table S71

Rank-Order Stability Excluding Duplicate Control Observations.

	Parent controls				Nonparent controls			
Outcome	Cor_{all}	Cor_{GP}	Cor_{con}	p	Cor_{all}	Cor_{GP}	Cor_{con}	p
LISS								
Agreeableness	0.79	0.81	0.77	.410	0.77	0.81	0.71	.007
Conscientiousness	0.80	0.80	0.79	.428	0.78	0.80	0.75	.395
Extraversion	0.86	0.87	0.85	.751	0.86	0.87	0.86	.709
Neuroticism	0.77	0.77	0.78	.925	0.76	0.77	0.75	.545
Openness	0.76	0.80	0.72	.111	0.81	0.80	0.82	.826
Life Satisfaction	0.65	0.66	0.63	.853	0.64	0.66	0.63	.252
HRS								
Agreeableness	0.69	0.70	0.68	.990	0.70	0.70	0.70	.943
Conscientiousness	0.70	0.69	0.70	.219	0.69	0.69	0.70	.513
Extraversion	0.74	0.75	0.73	.228	0.75	0.75	0.74	.159
Neuroticism	0.68	0.71	0.66	.599	0.72	0.71	0.74	.028
Openness	0.73	0.73	0.74	.887	0.74	0.73	0.76	.639
Life Satisfaction	0.56	0.55	0.57	.515	0.58	0.55	0.62	.031

Note. Test-retest correlations as indicators of rank-order stability, and p-values indicating significant group differences therein between grandparents and each control group. The average retest intervals in years are 2.90 (SD = 0.90) for the LISS parent sample, 2.90 (SD = 0.92) for the LISS nonparent sample, 3.91 (SD = 0.96) for the HRS parent sample, and 3.89 (SD = 0.94) for the HRS nonparent sample. Cor = correlation; GP = grandparents; con = controls.

Supplemental Figures

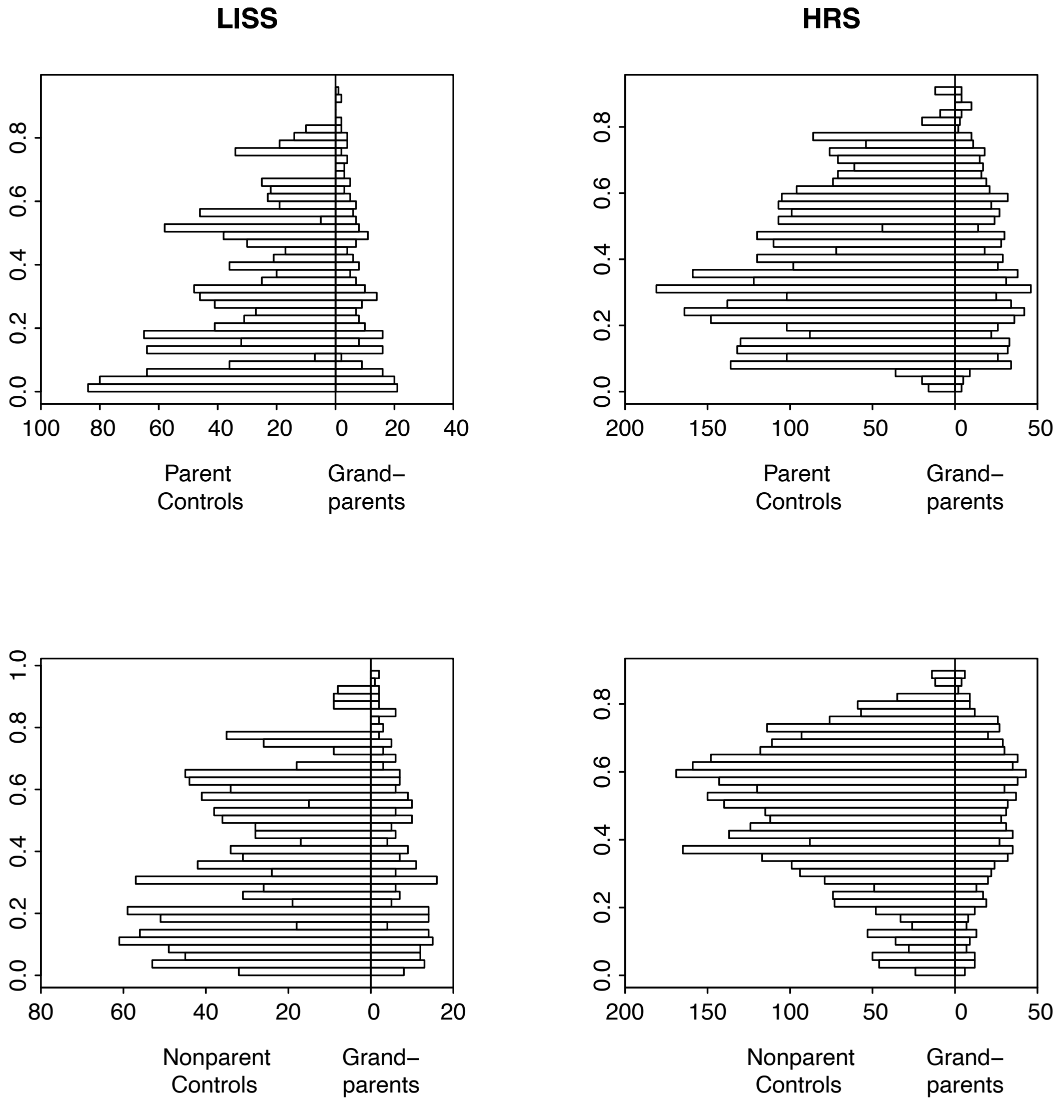

Figure S1

Distributional Overlap of the Propensity Score in the Four Analysis Samples at the Time of Matching.

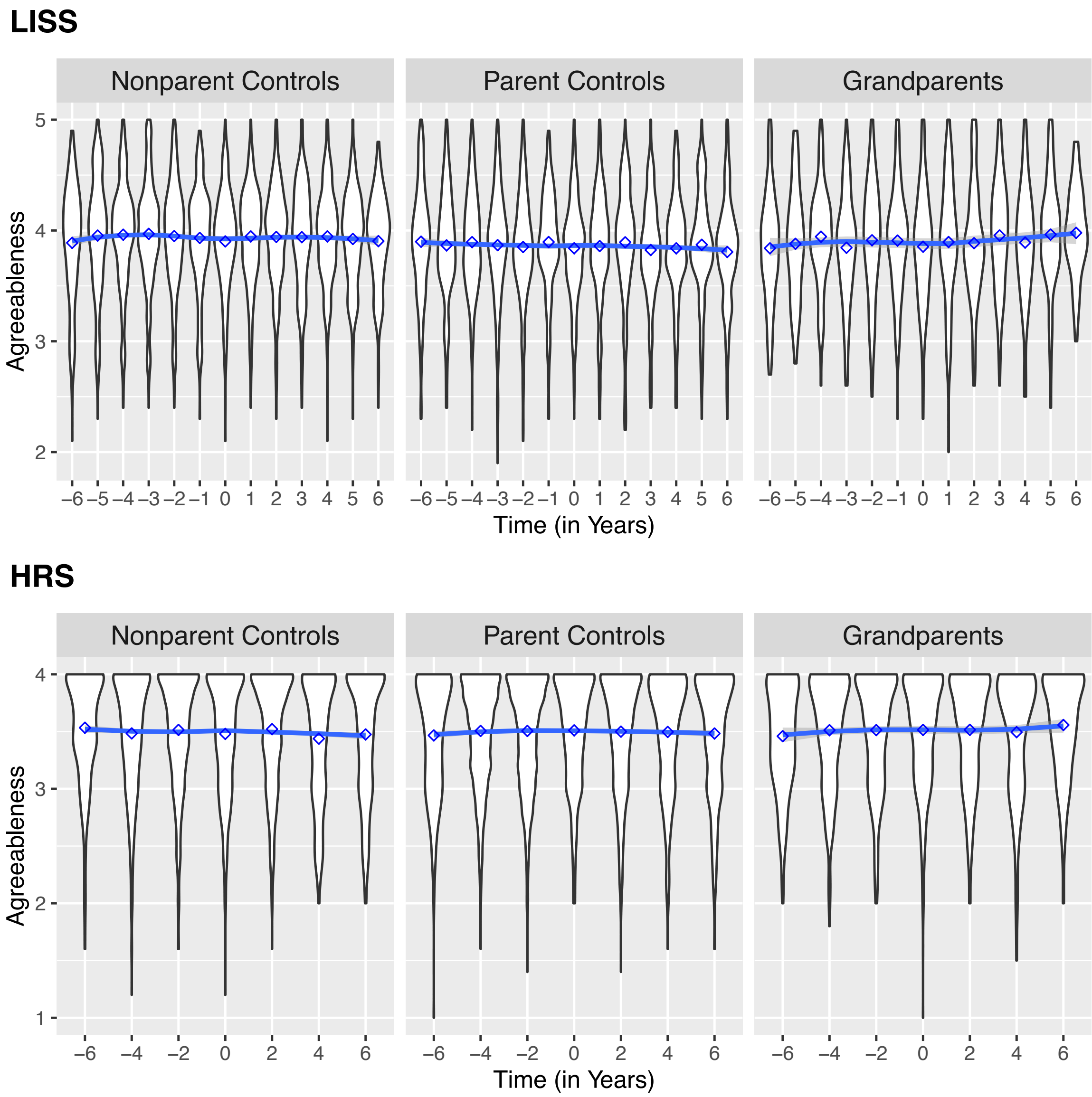

Figure S2

Violin Plots for Agreeableness Including Means Over Time and LOESS Line.

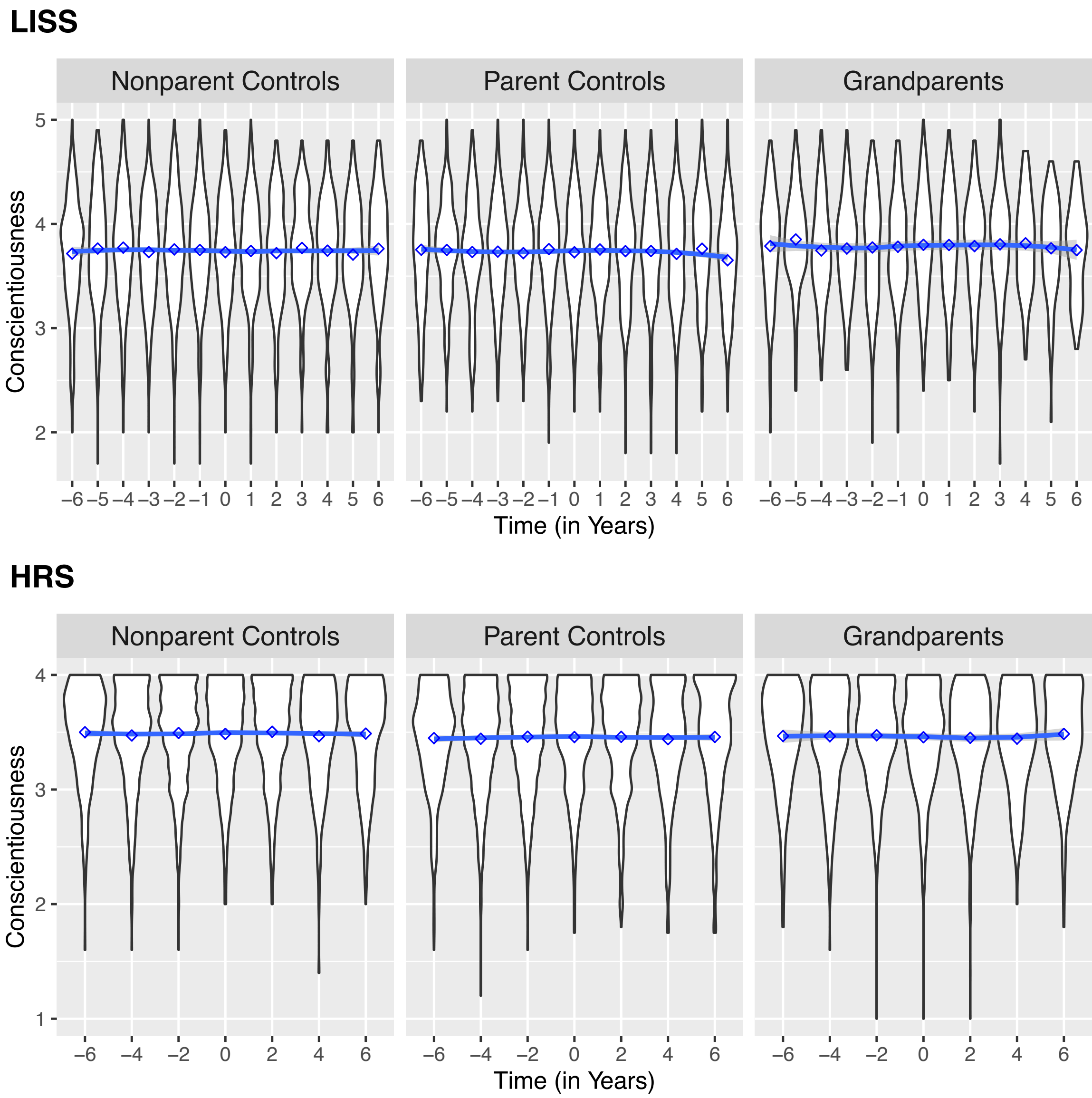

Figure S3

Violin Plots for Conscientiousness Including Means Over Time and LOESS Line.

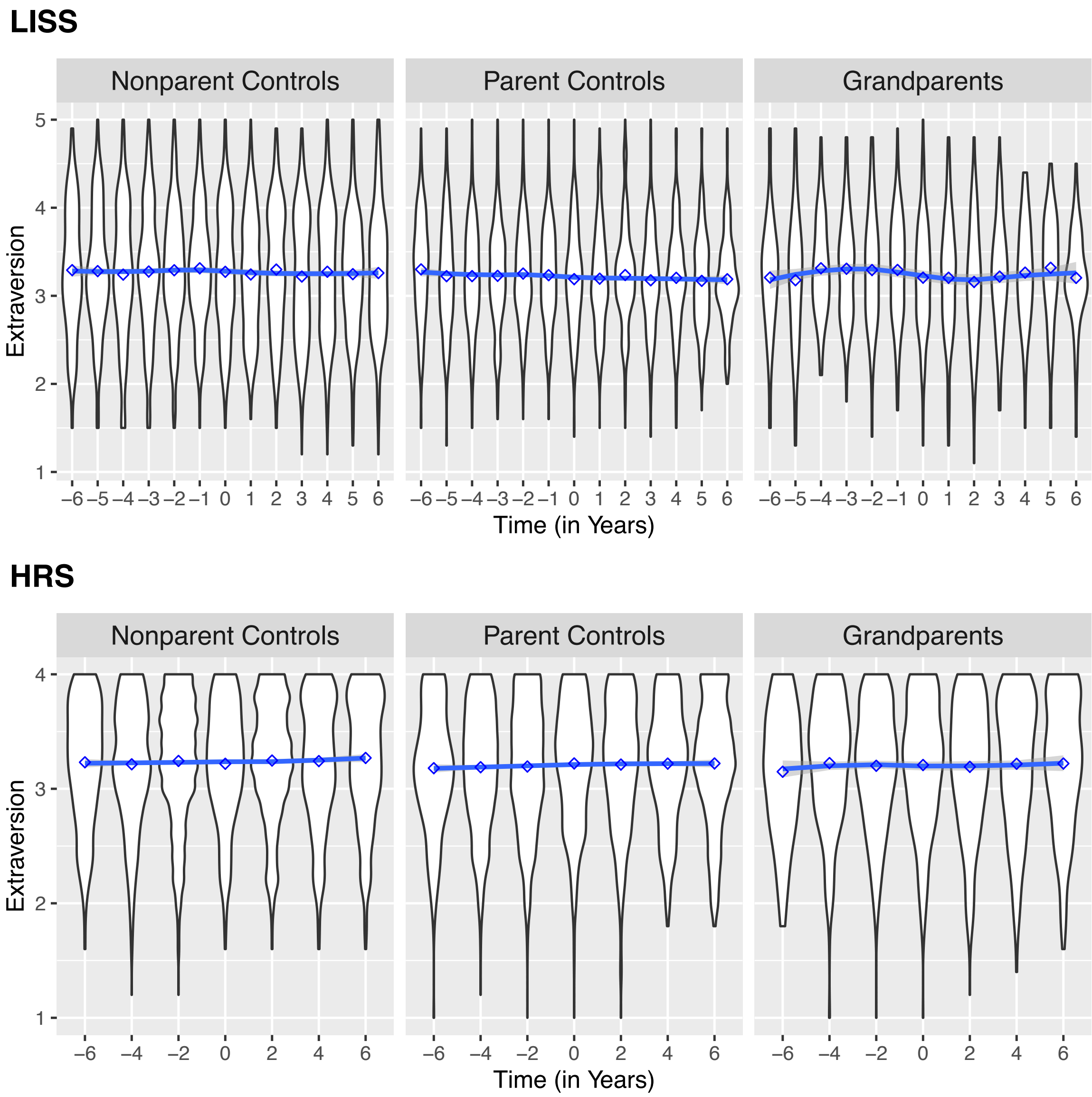

Figure S4

Violin Plots for Extraversion Including Means Over Time and LOESS Line.

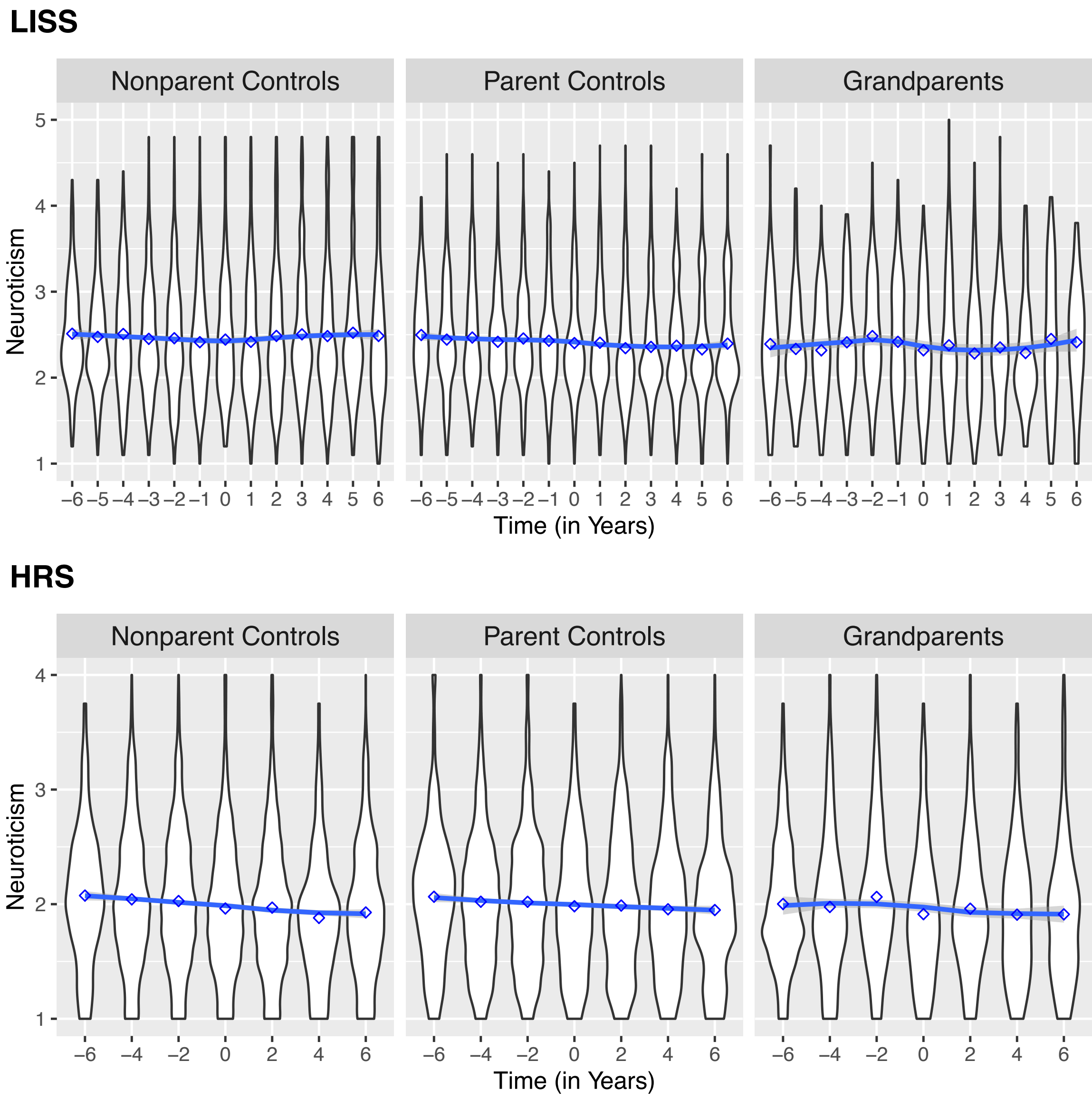

Figure S5

Violin Plots for Neuroticism Including Means Over Time and LOESS Line.

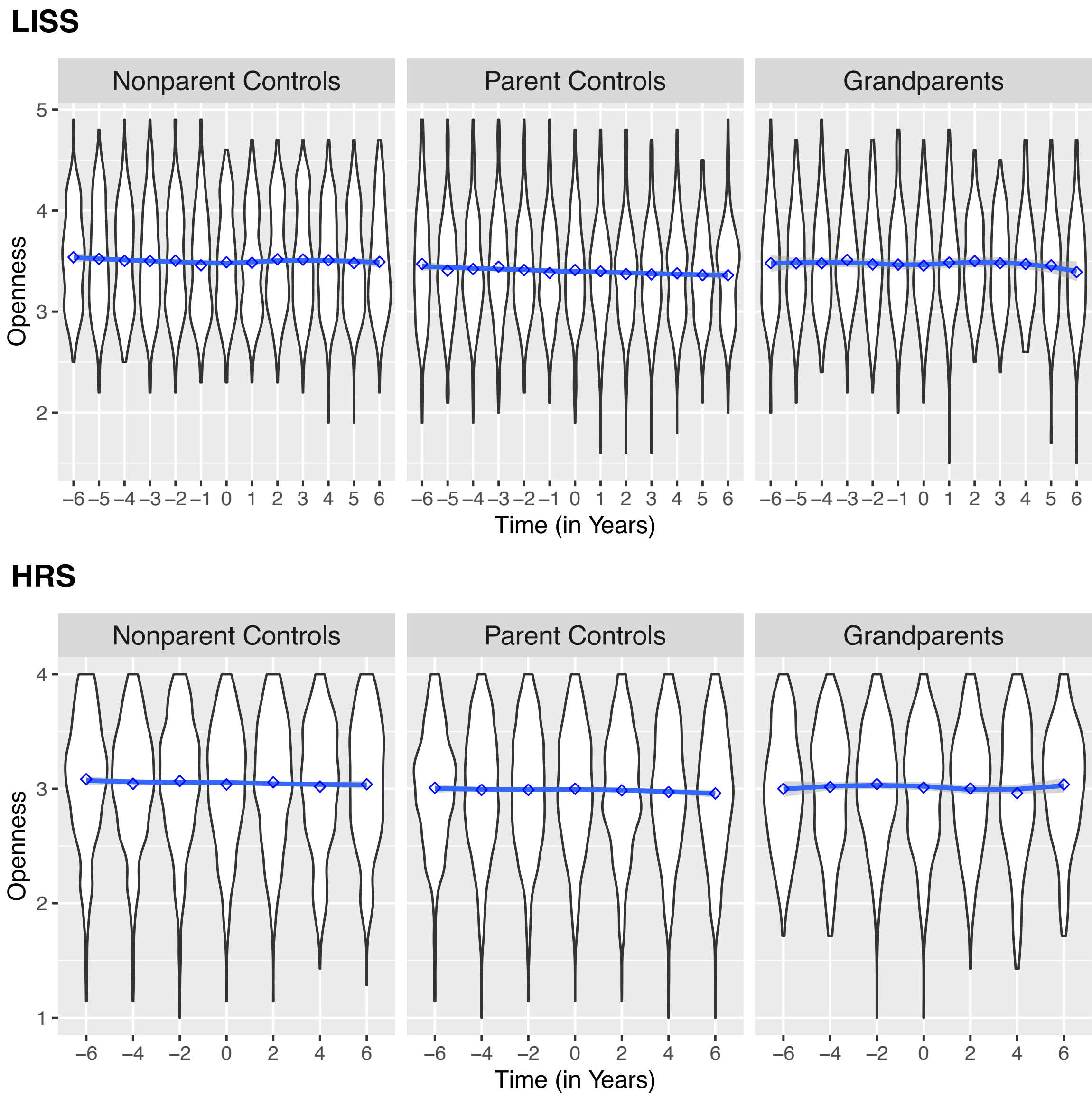

Figure S6

Violin Plots for Openness Including Means Over Time and LOESS Line.

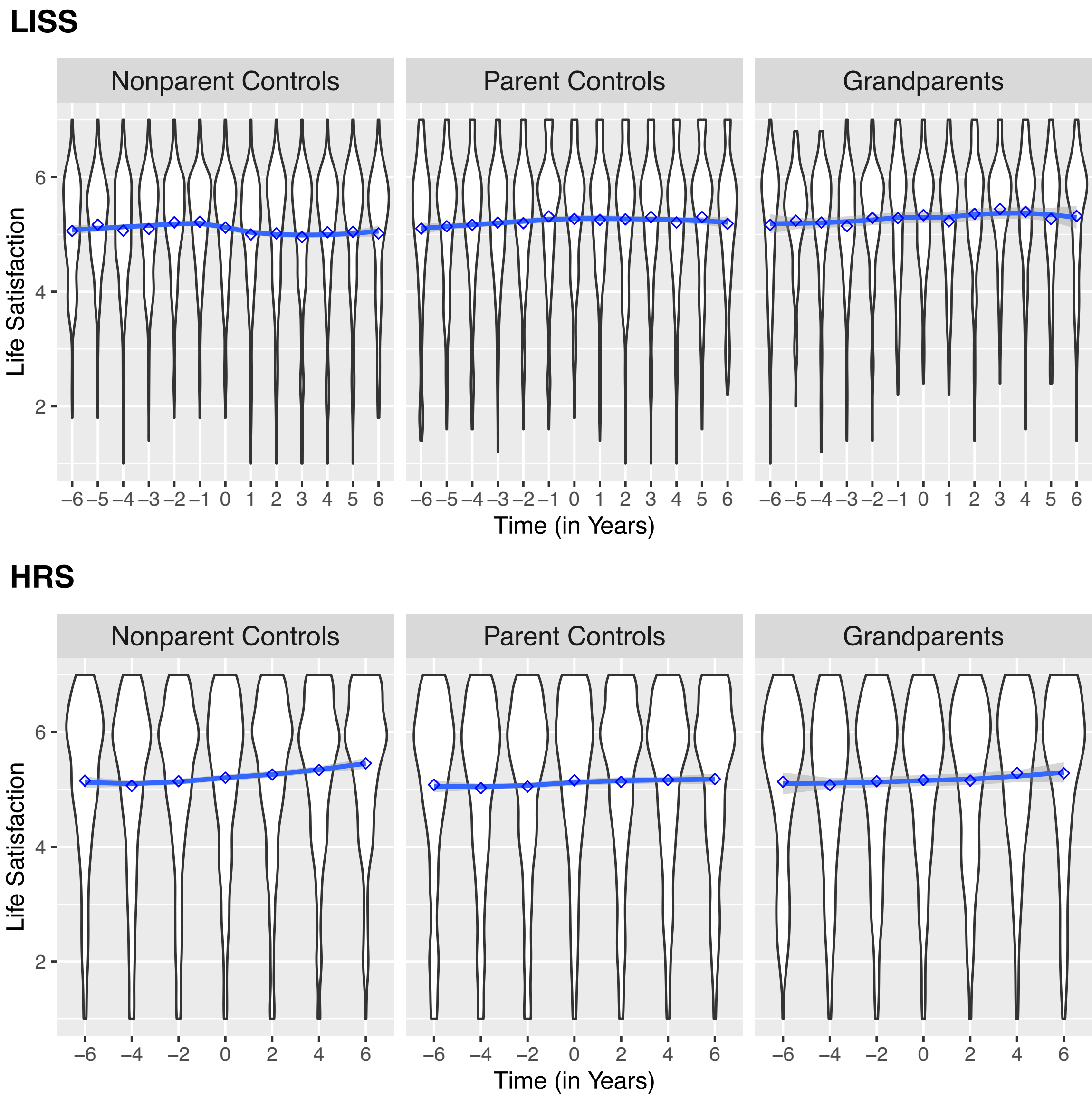

Figure S7

Violin Plots for Life Satisfaction Including Means Over Time and LOESS Line.

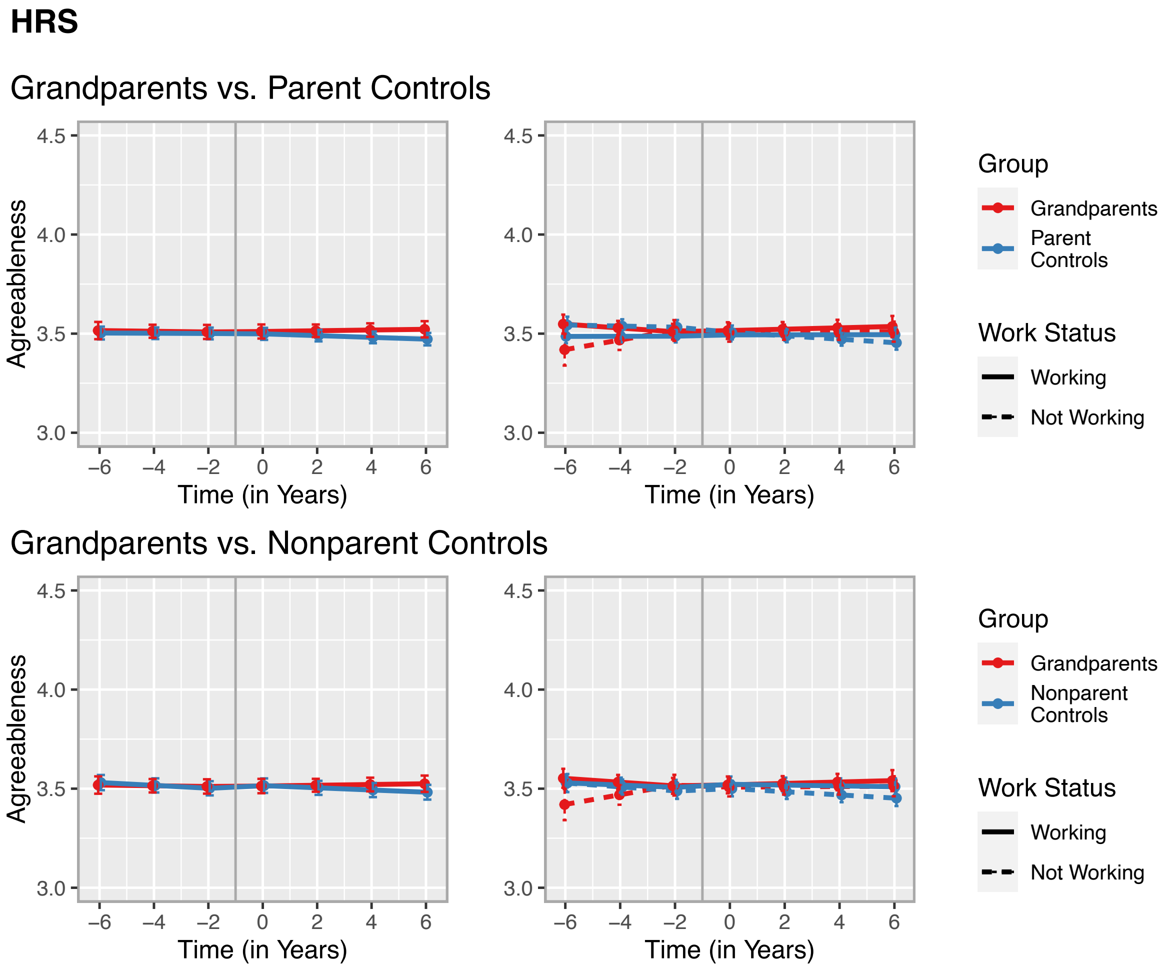

Figure S8

Change trajectories of agreeableness based on the models of moderation by paid work (see Table S10). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure 4 (basic models) and added here for better comparability.

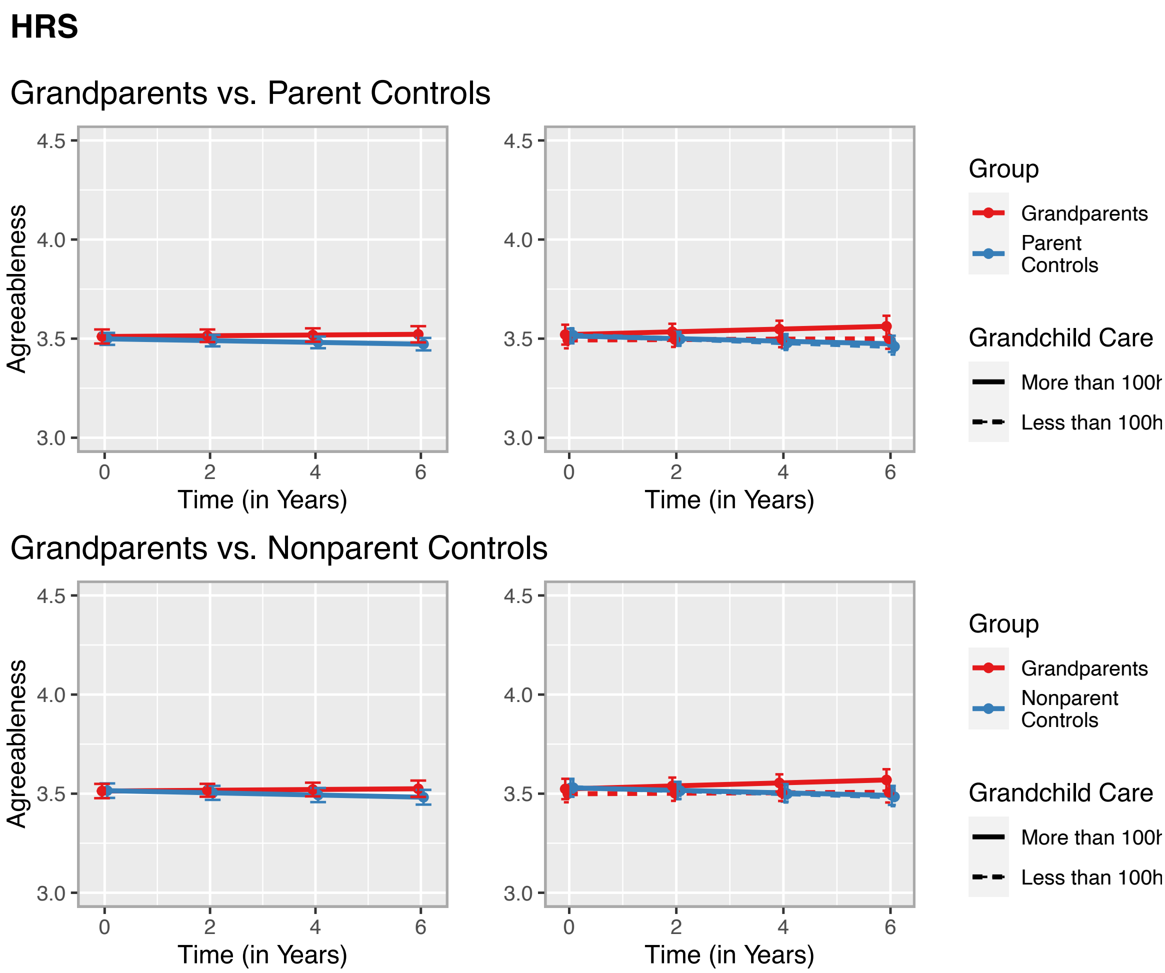

Figure S9

Change trajectories of agreeableness based on the models of moderation by grandchild care (see Table S12). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The plots in the left column are the same as in Figure 4 (basic models) but restricted to the post-transition period for better comparability.

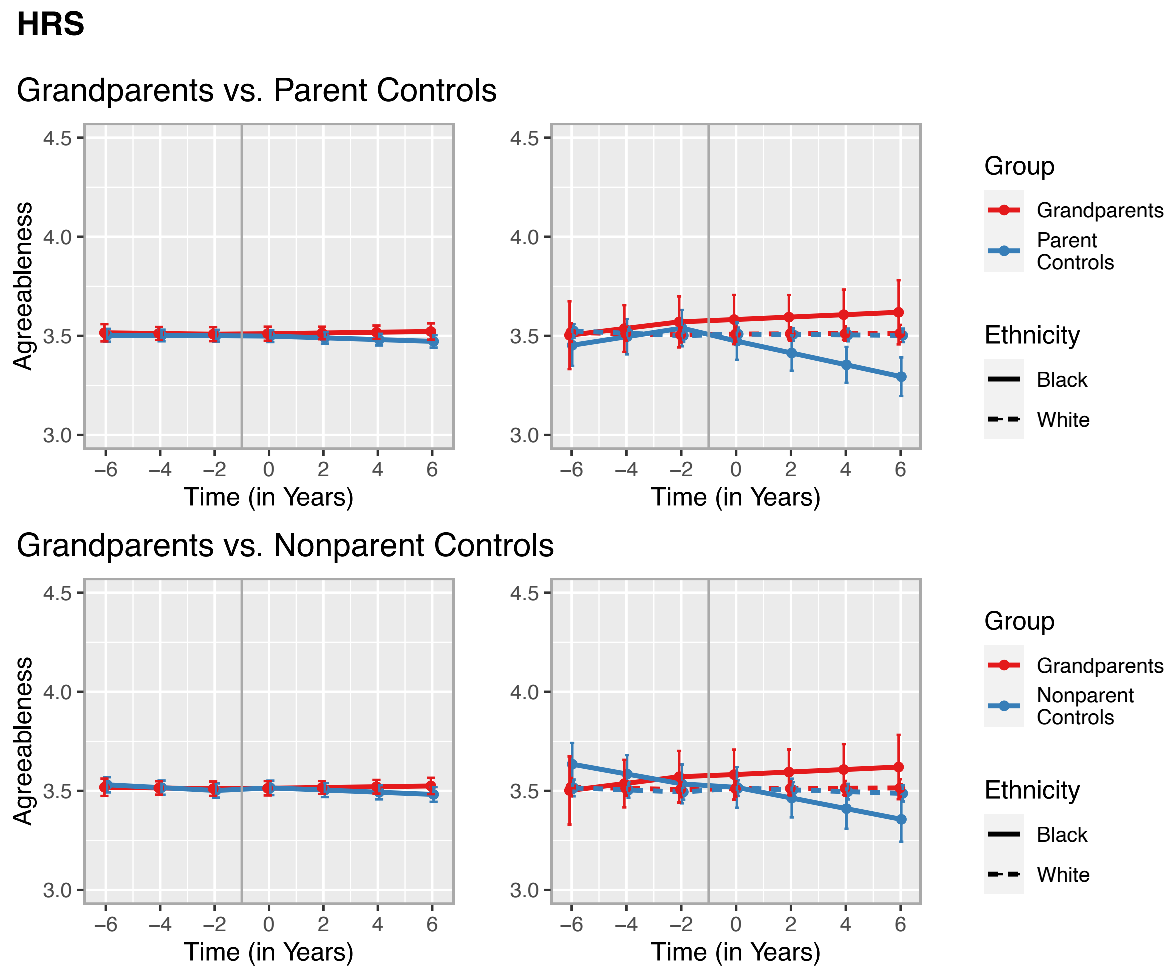

Figure S10

Change trajectories of agreeableness based on the models of moderation by ethnicity (see Table S14). black = 0 indicates White/Caucasian ethnicity, black = 1 indicates Black/African American ethnicity. The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure 4 (basic models) and added here for better comparability.

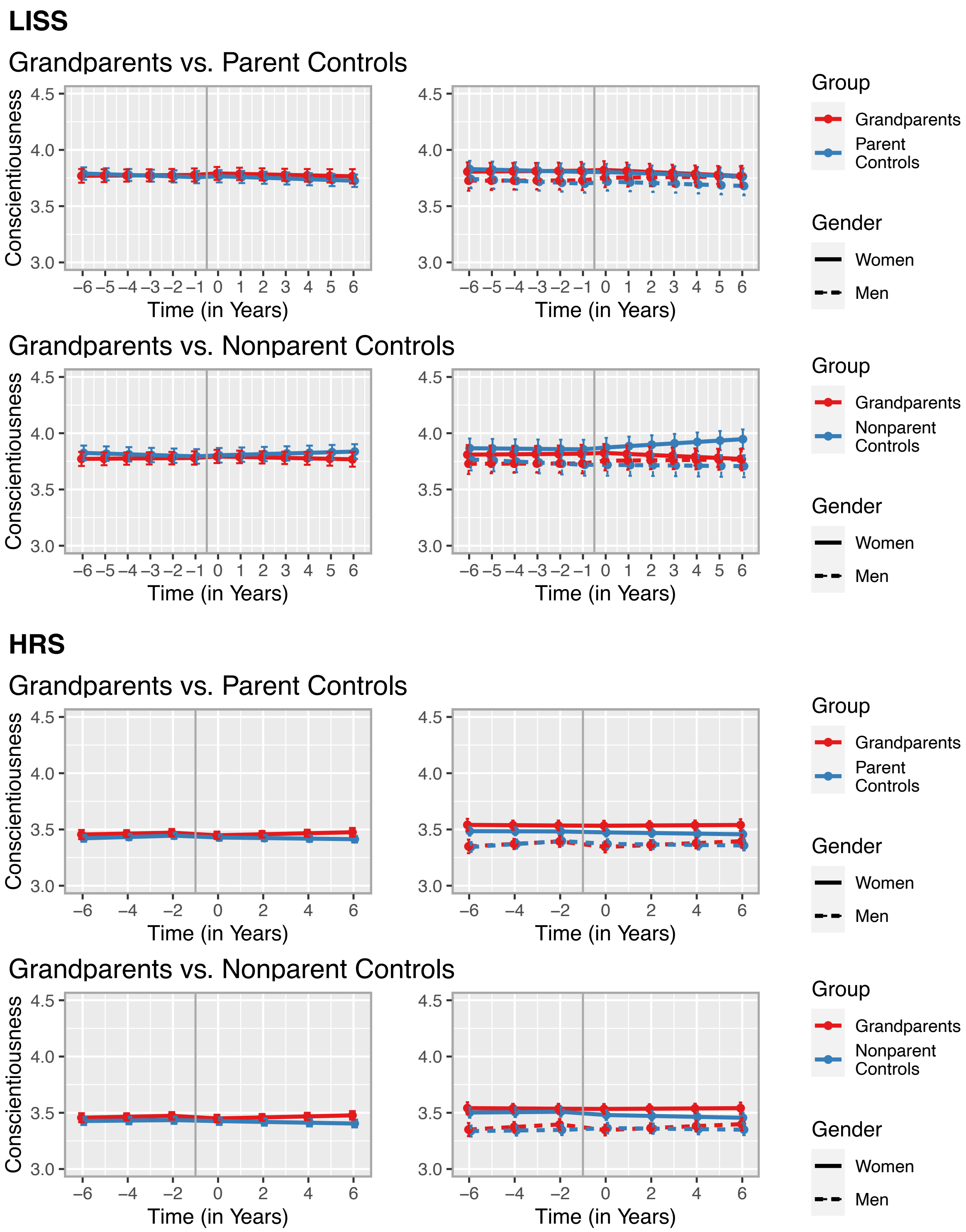

Figure S11

Change trajectories of conscientiousness based on the basic models (left column) and the models including the gender interaction (right column). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood.

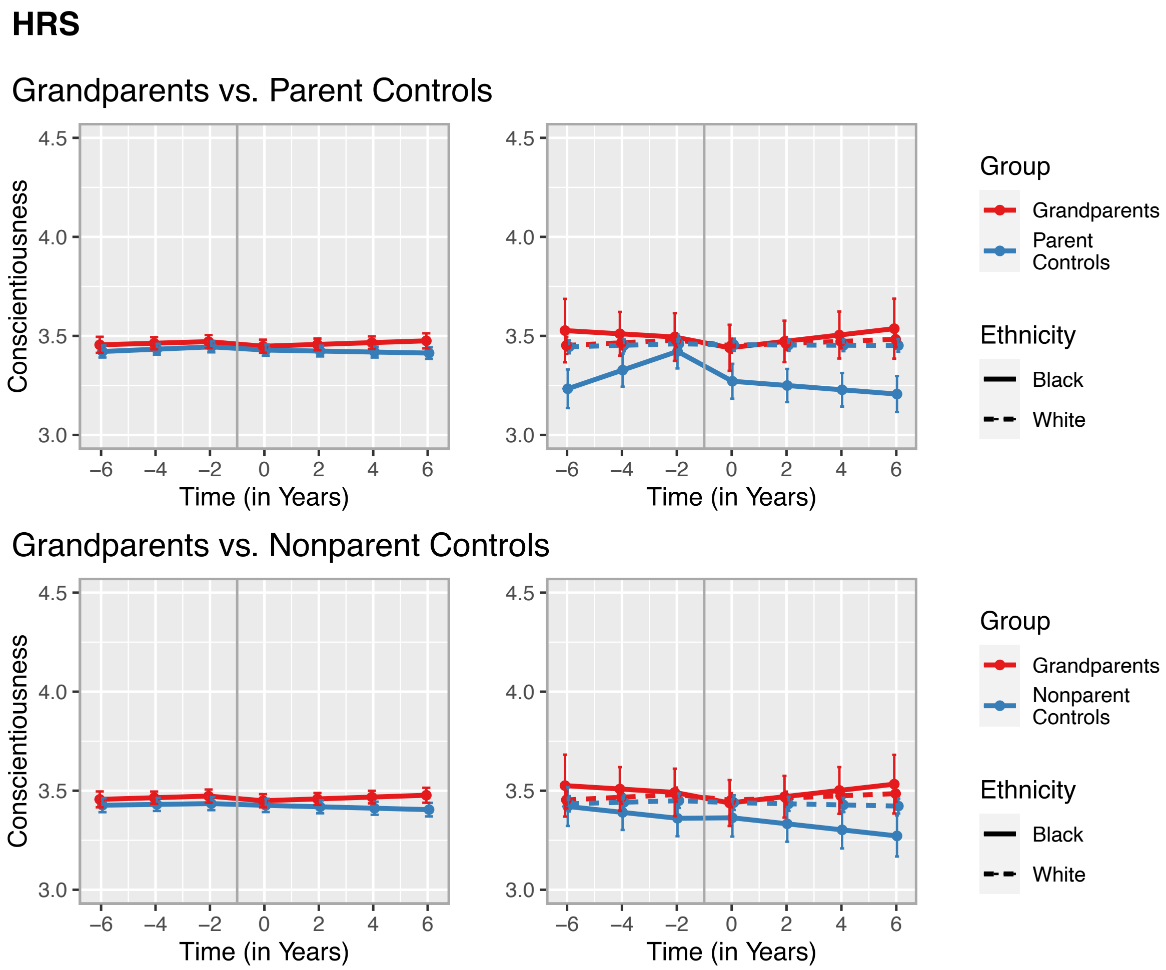

Figure S12

Change trajectories of conscientiousness based on the models of moderation by ethnicity (see Table S22). black = 0 indicates White/Caucasian ethnicity, black = 1 indicates Black/African American ethnicity. The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S11 (basic models) and added here for better comparability.

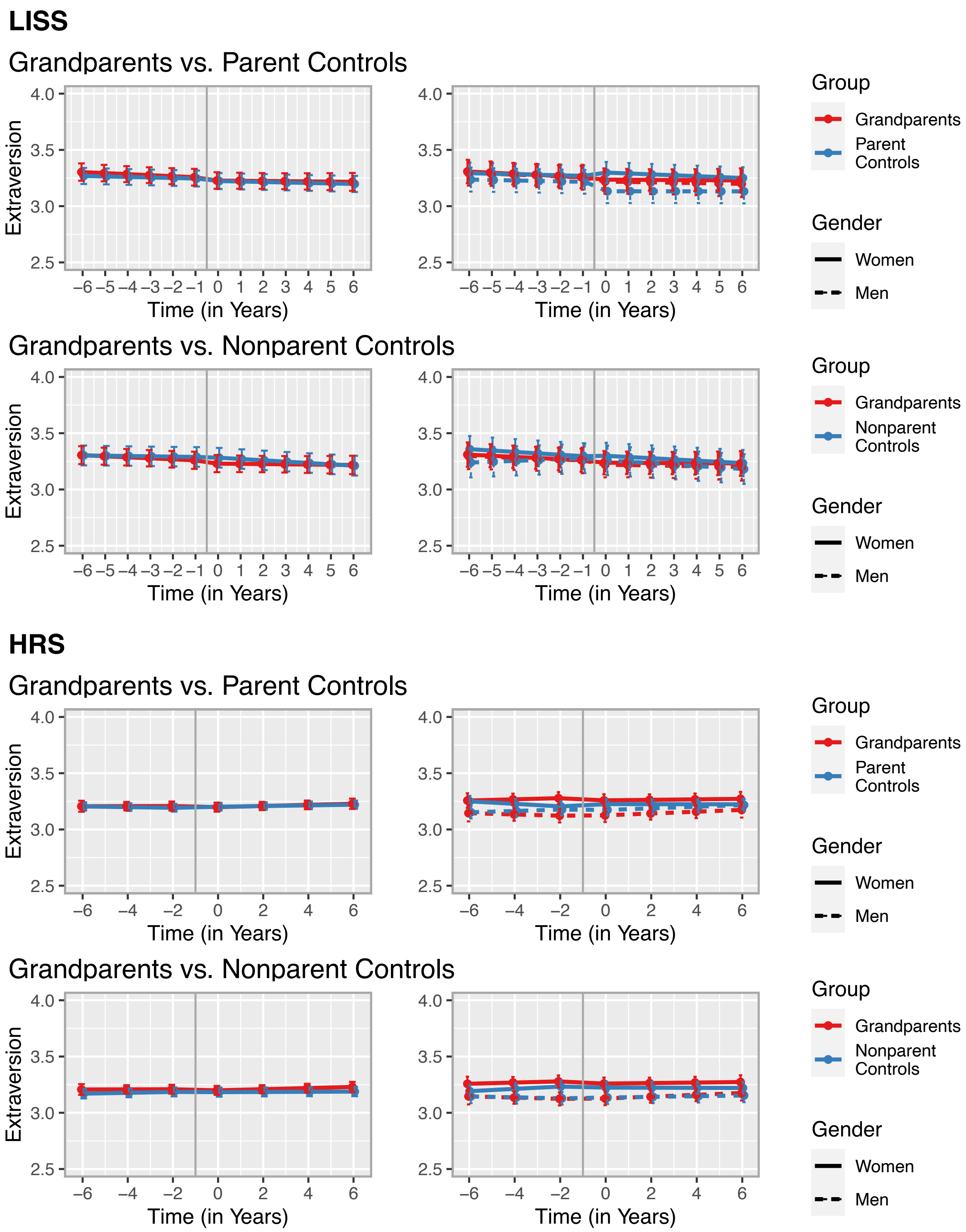

Figure S13

Change trajectories of extraversion based on the basic models (left column) and the models including the gender interaction (right column). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood.

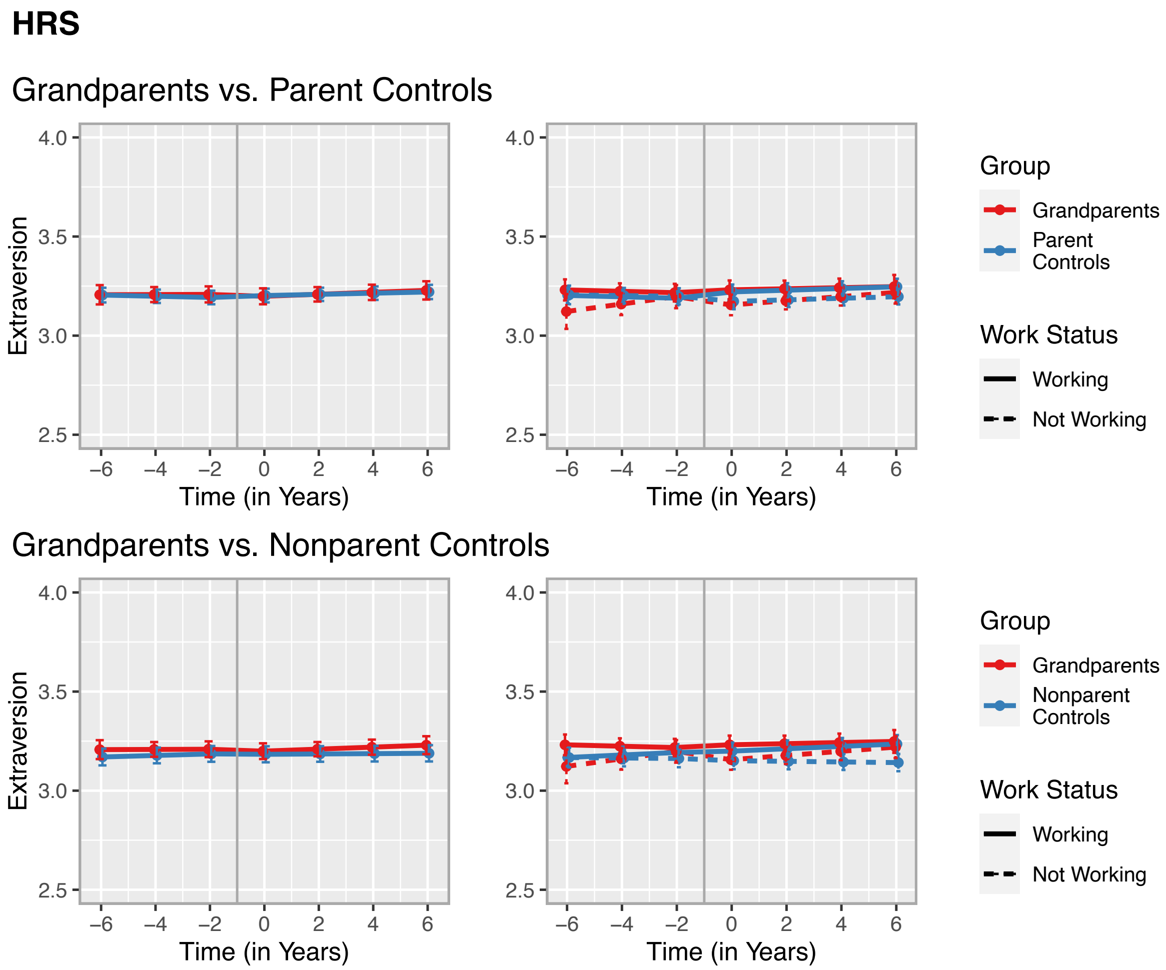

Figure S14

Change trajectories of extraversion based on the models of moderation by paid work (see Table S28). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S13 (basic models) and added here for better comparability.

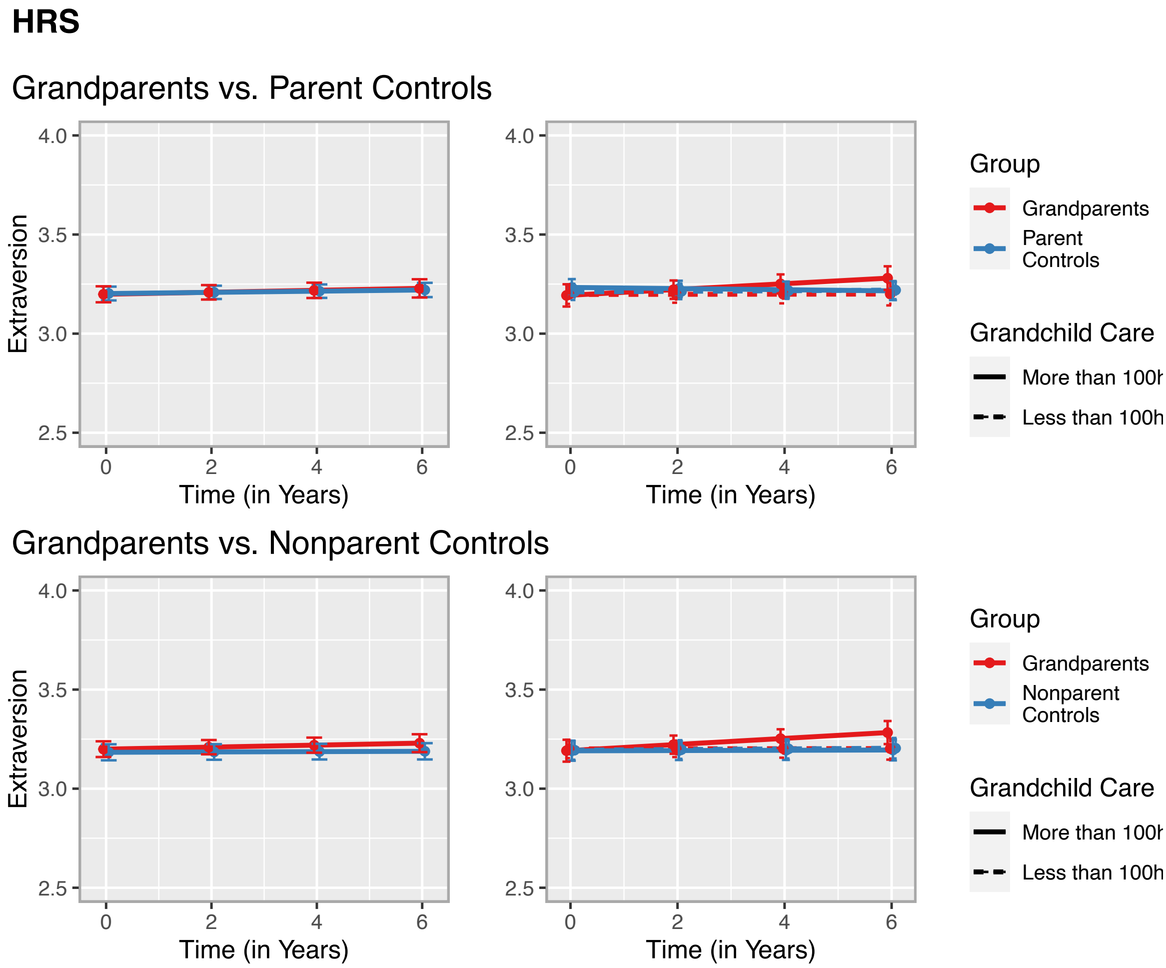

Figure S15

Change trajectories of extraversion based on the models of moderation by grandchild care (see Table S30). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The plots in the left column are the same as in Figure S13 (basic models) but restricted to the post-transition period for better comparability.

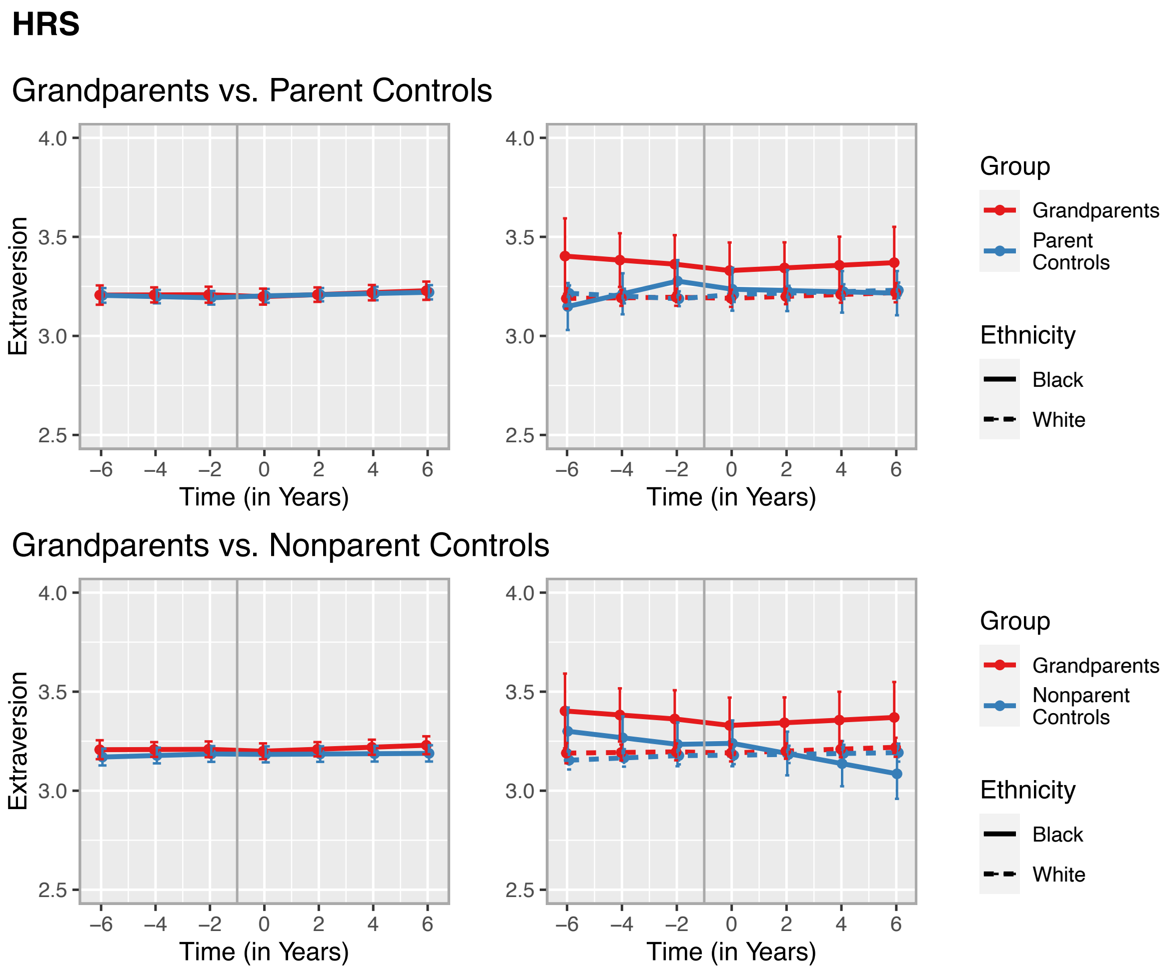

Figure S16

Change trajectories of extraversion based on the models of moderation by ethnicity (see Table S32). black = 0 indicates White/Caucasian ethnicity, black = 1 indicates Black/African American ethnicity. The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S13 (basic models) and added here for better comparability.

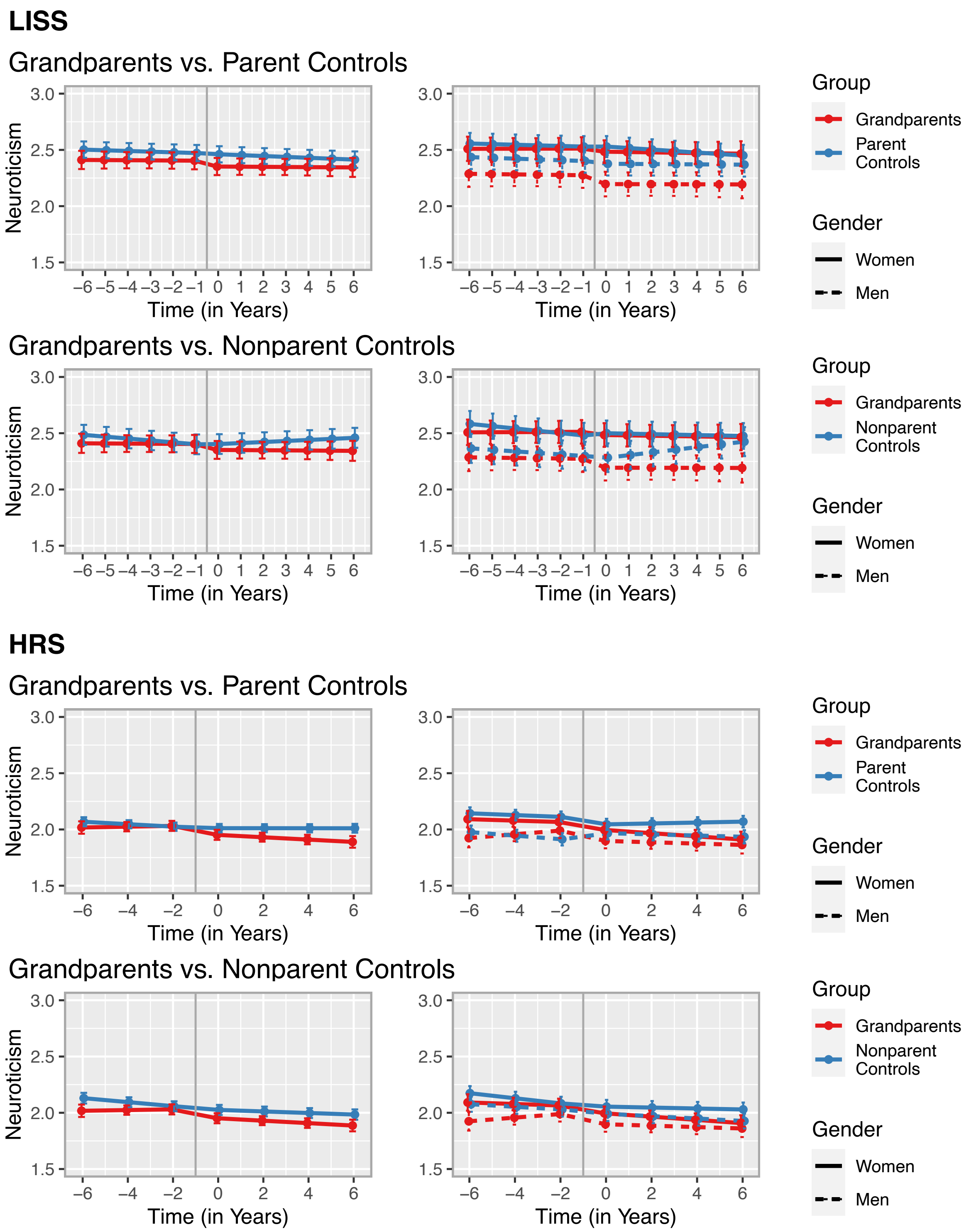

Figure S17

Change trajectories of neuroticism based on the basic models (left column) and the models including the gender interaction (right column). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood.

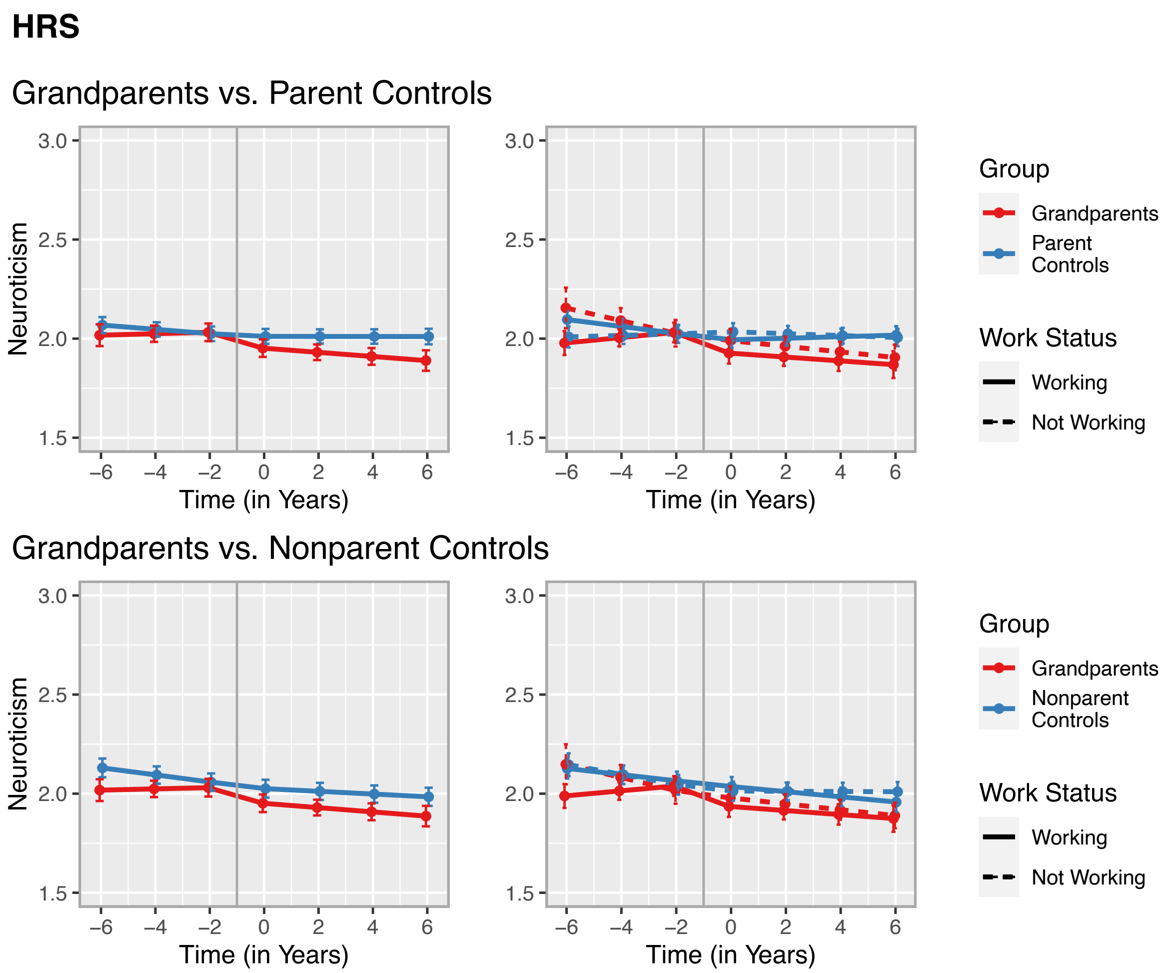

Figure S18

Change trajectories of neuroticism based on the models of moderation by paid work (see Table S38). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S17 (basic models) and added here for better comparability.

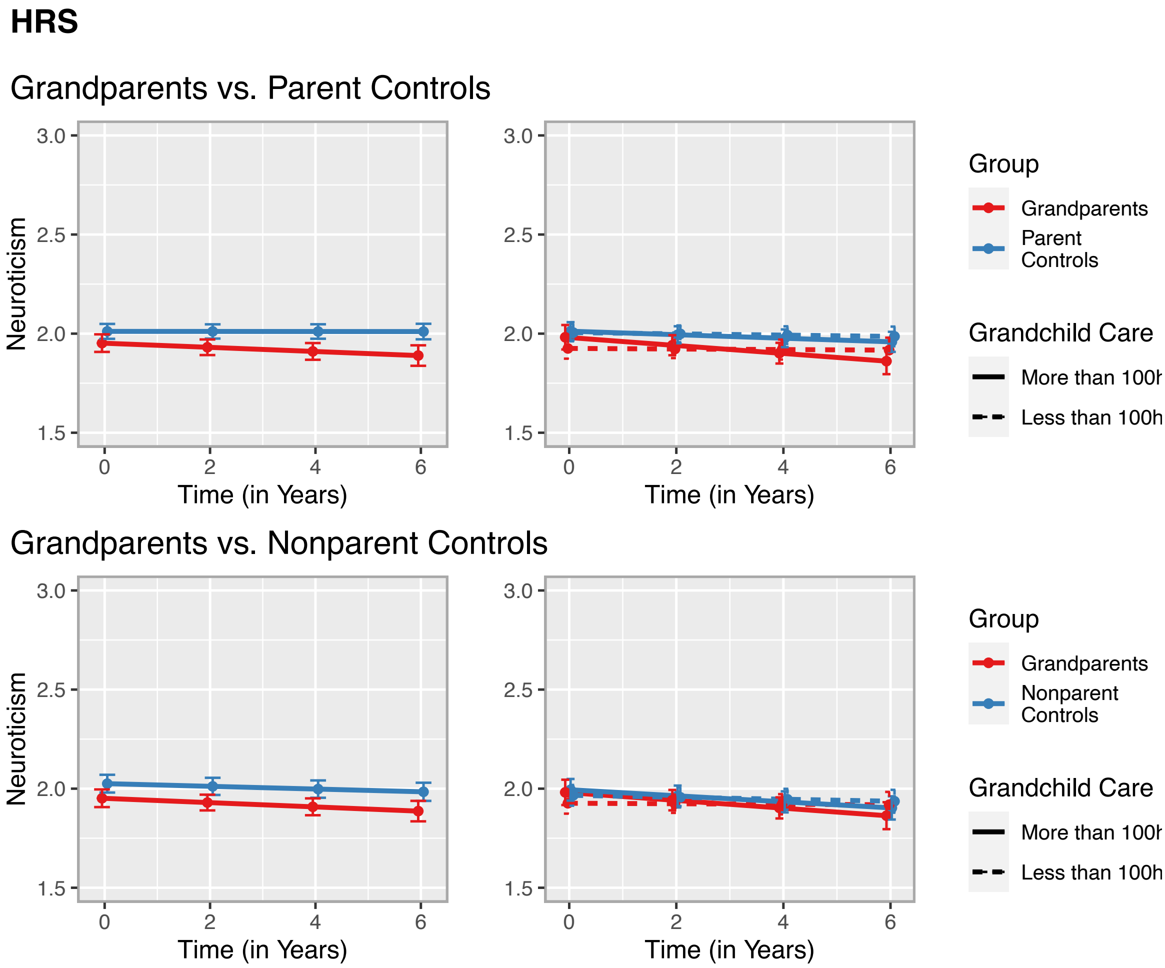

Figure S19

Change trajectories of neuroticism based on the models of moderation by grandchild care (see Table S40). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The plots in the left column are the same as in Figure S17 (basic models) but restricted to the post-transition period for better comparability.

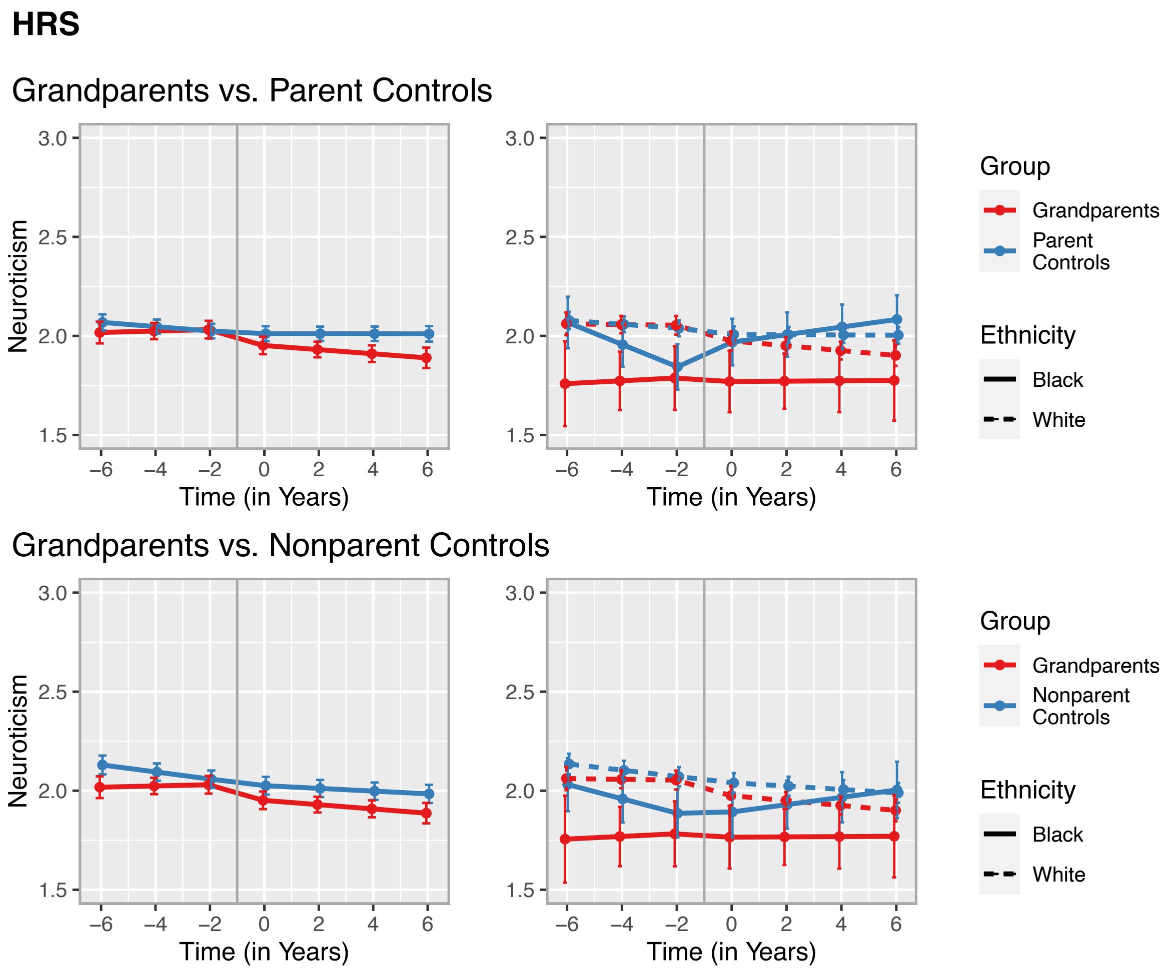

Figure S20

Change trajectories of neuroticism based on the models of moderation by ethnicity (see Table S42). black = 0 indicates White/Caucasian ethnicity, black = 1 indicates Black/African American ethnicity. The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S17 (basic models) and added here for better comparability.

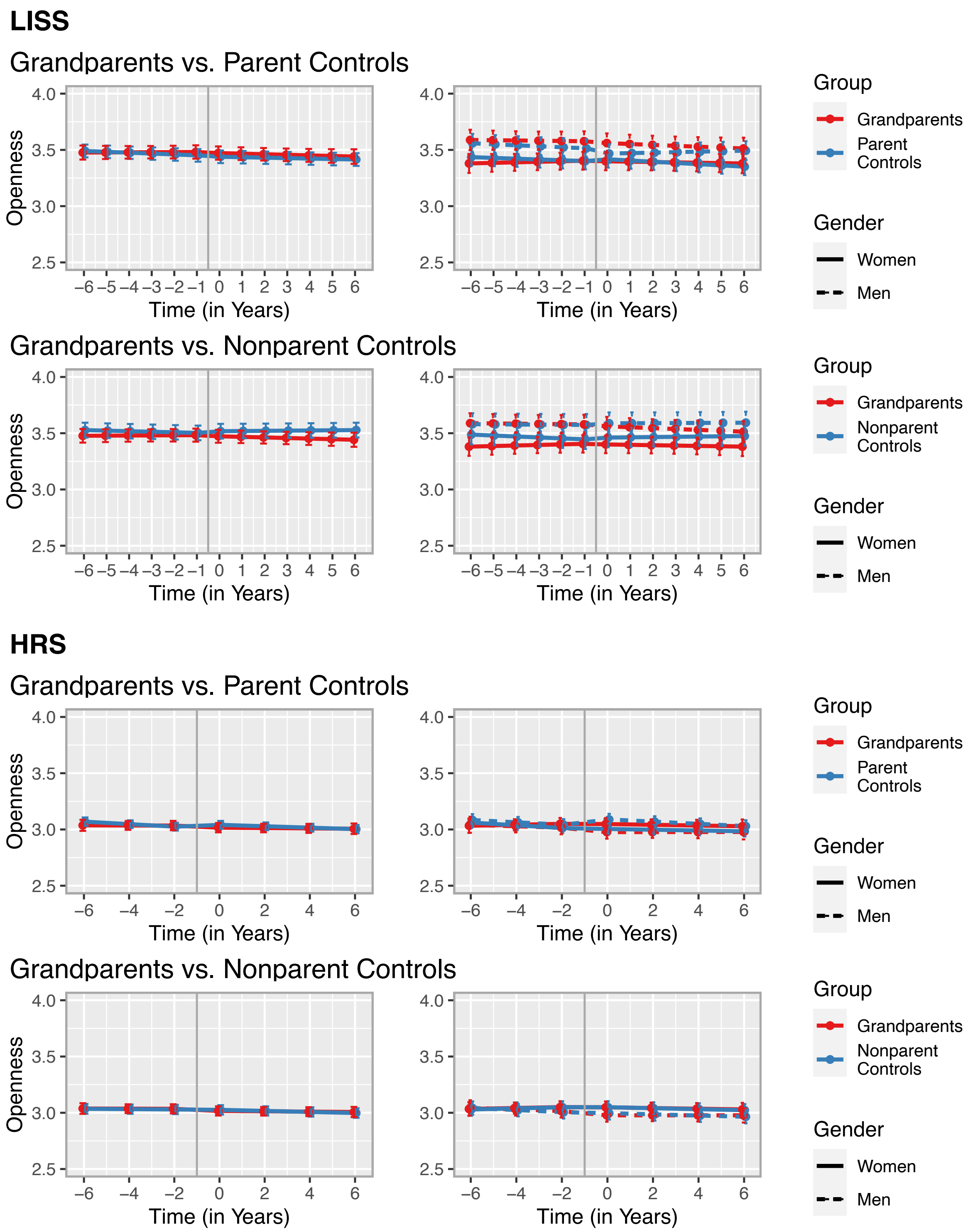

Figure S21

Change trajectories of openness based on the basic models (left column) and the models including the gender interaction (right column). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood.

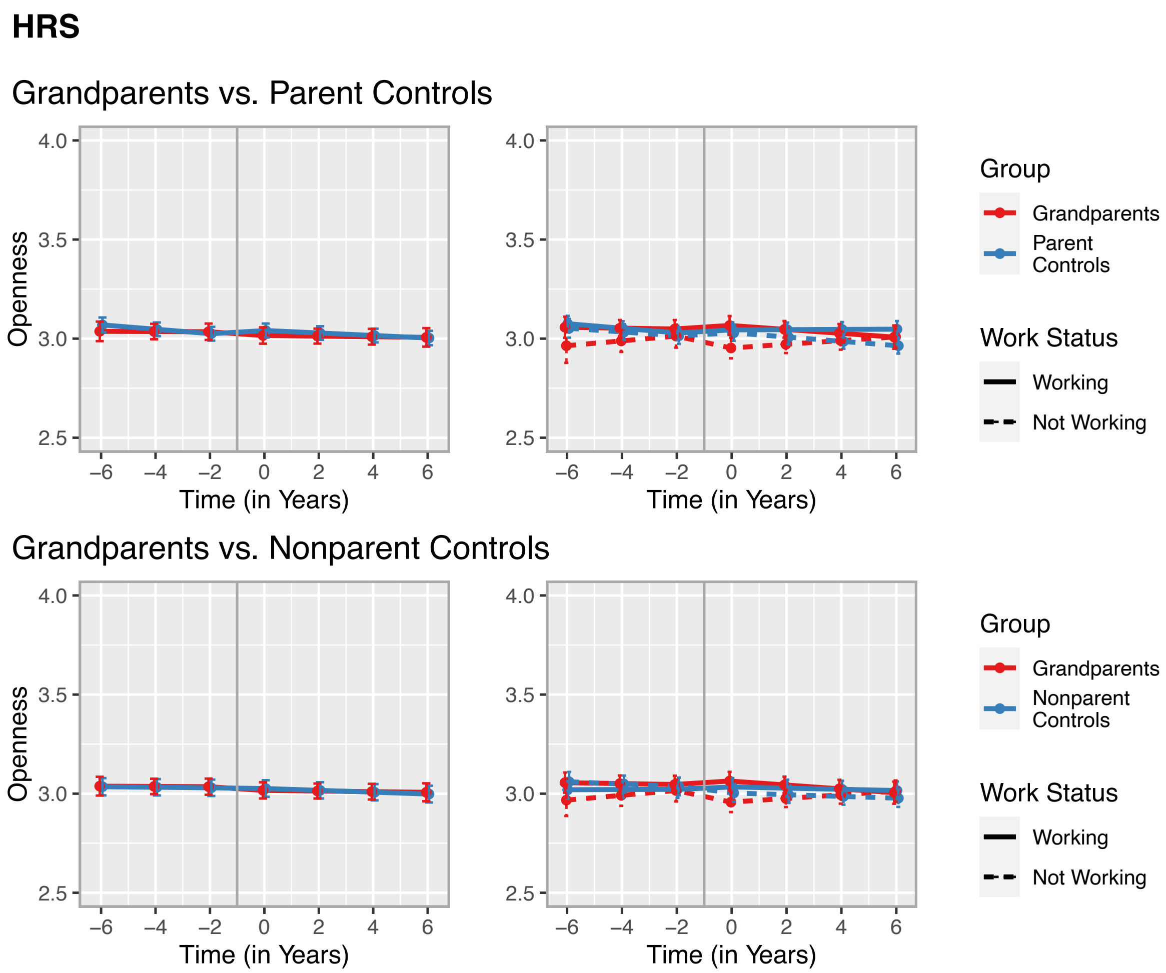

Figure S22

Change trajectories of openness based on the models of moderation by paid work (see Table S48). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S21 (basic models) and added here for better comparability.

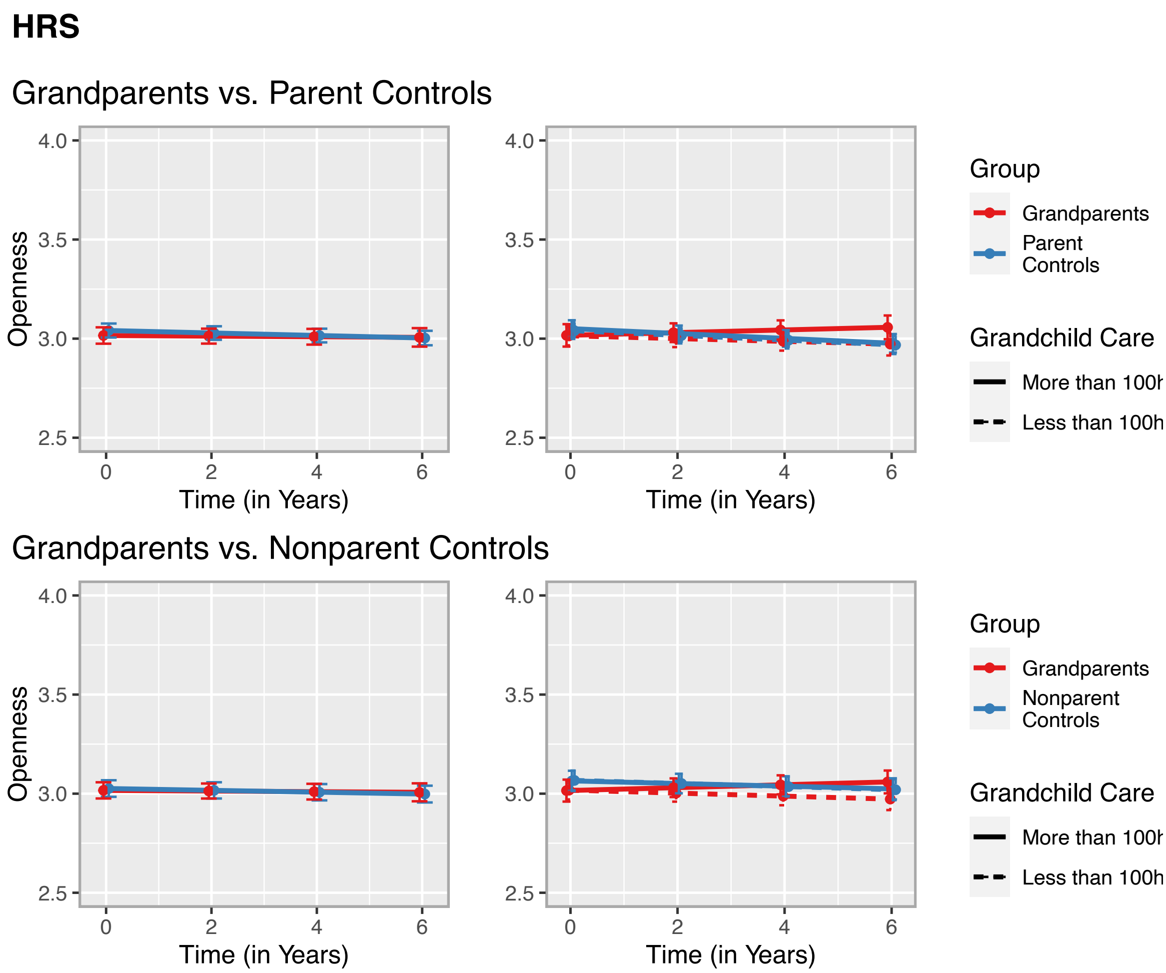

Figure S23

Change trajectories of openness based on the models of moderation by grandchild care (see Table S50). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The plots in the left column are the same as in Figure S21 (basic models) but restricted to the post-transition period for better comparability.

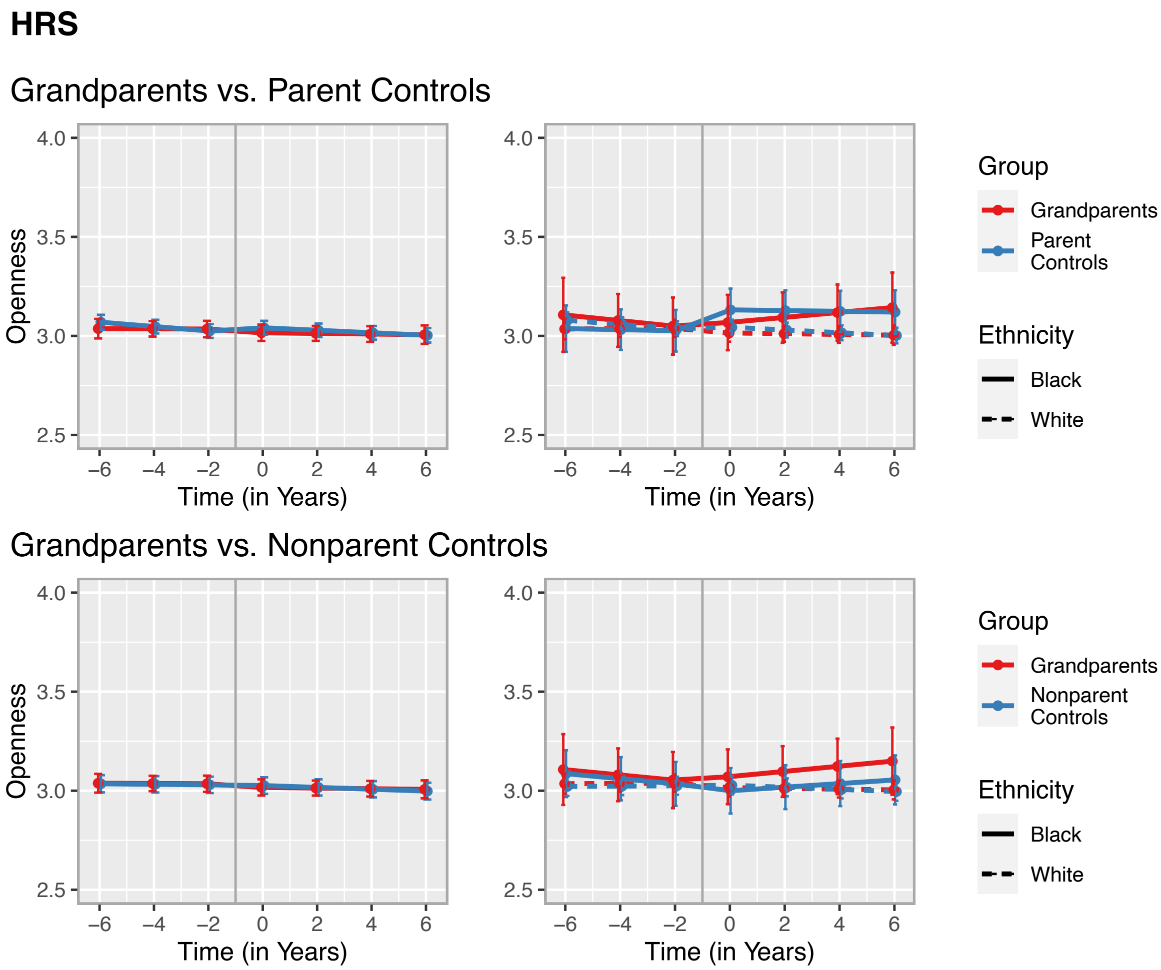

Figure S24

Change trajectories of openness based on the models of moderation by ethnicity (see Table S52). black = 0 indicates White/Caucasian ethnicity, black = 1 indicates Black/African American ethnicity. The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S21 (basic models) and added here for better comparability.

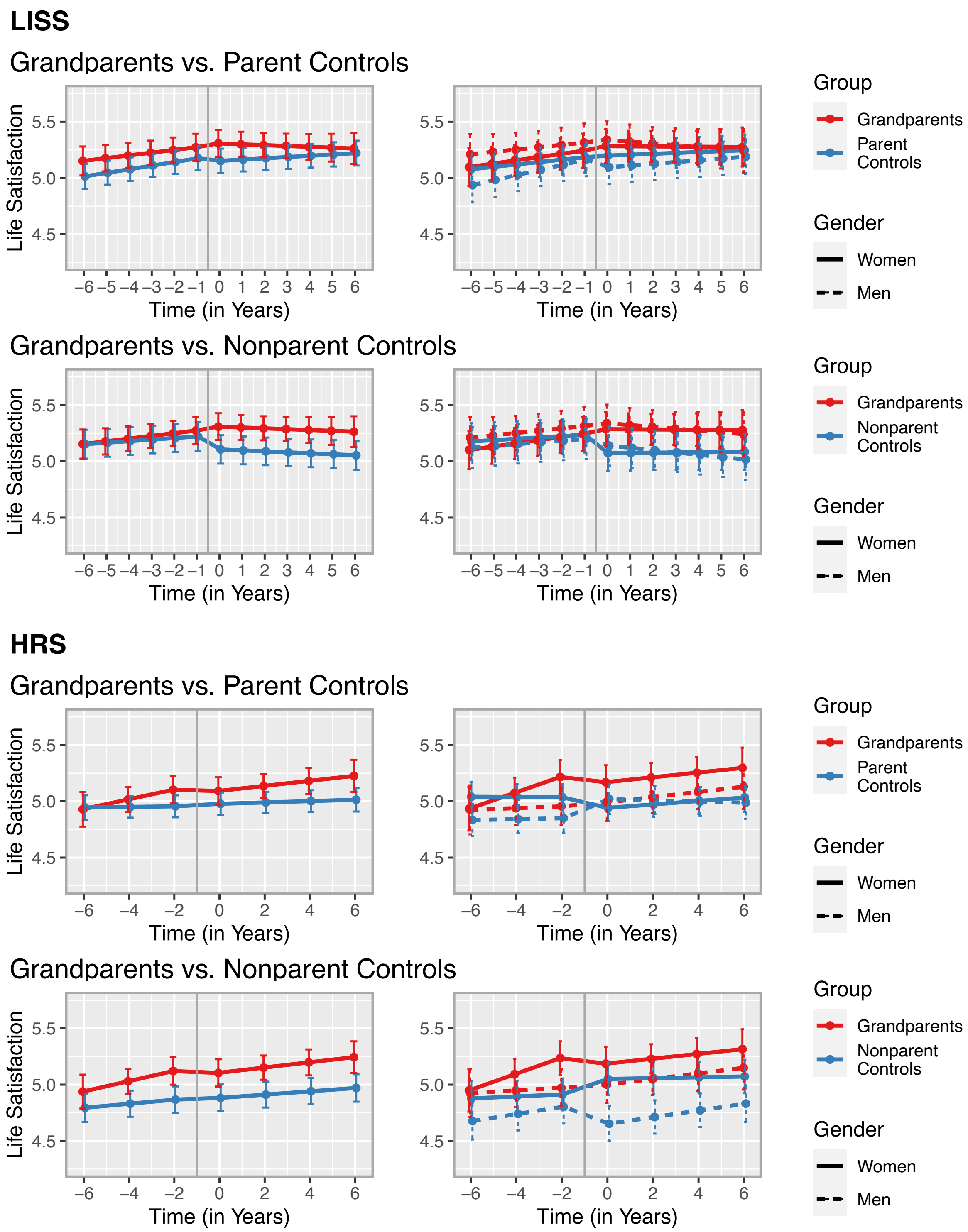

Figure S25

Change trajectories of life satisfaction based on the basic models (left column) and the models including the gender interaction (right column). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood.

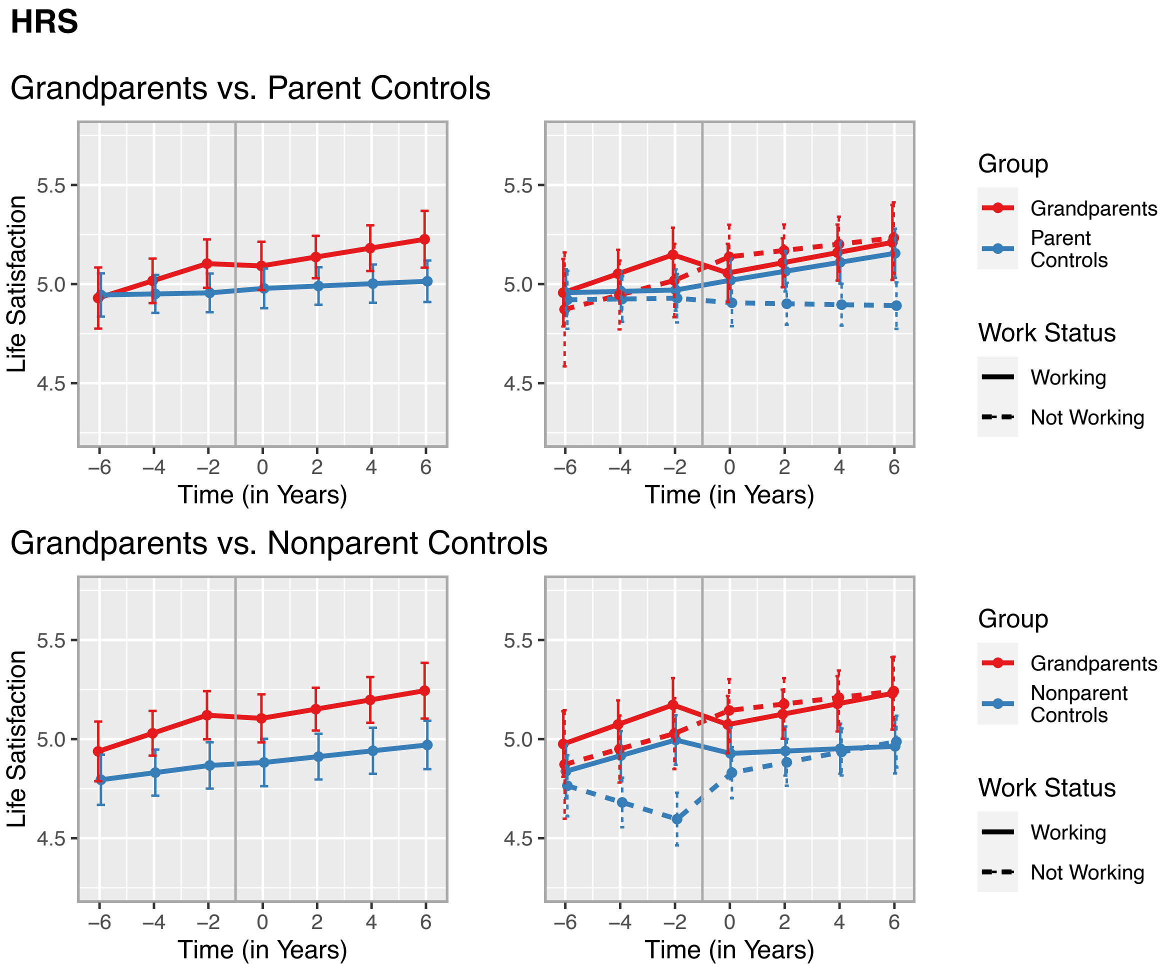

Figure S26

Change trajectories of life satisfaction based on the models of moderation by paid work (see Table S58). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S25 (basic models) and added here for better comparability.

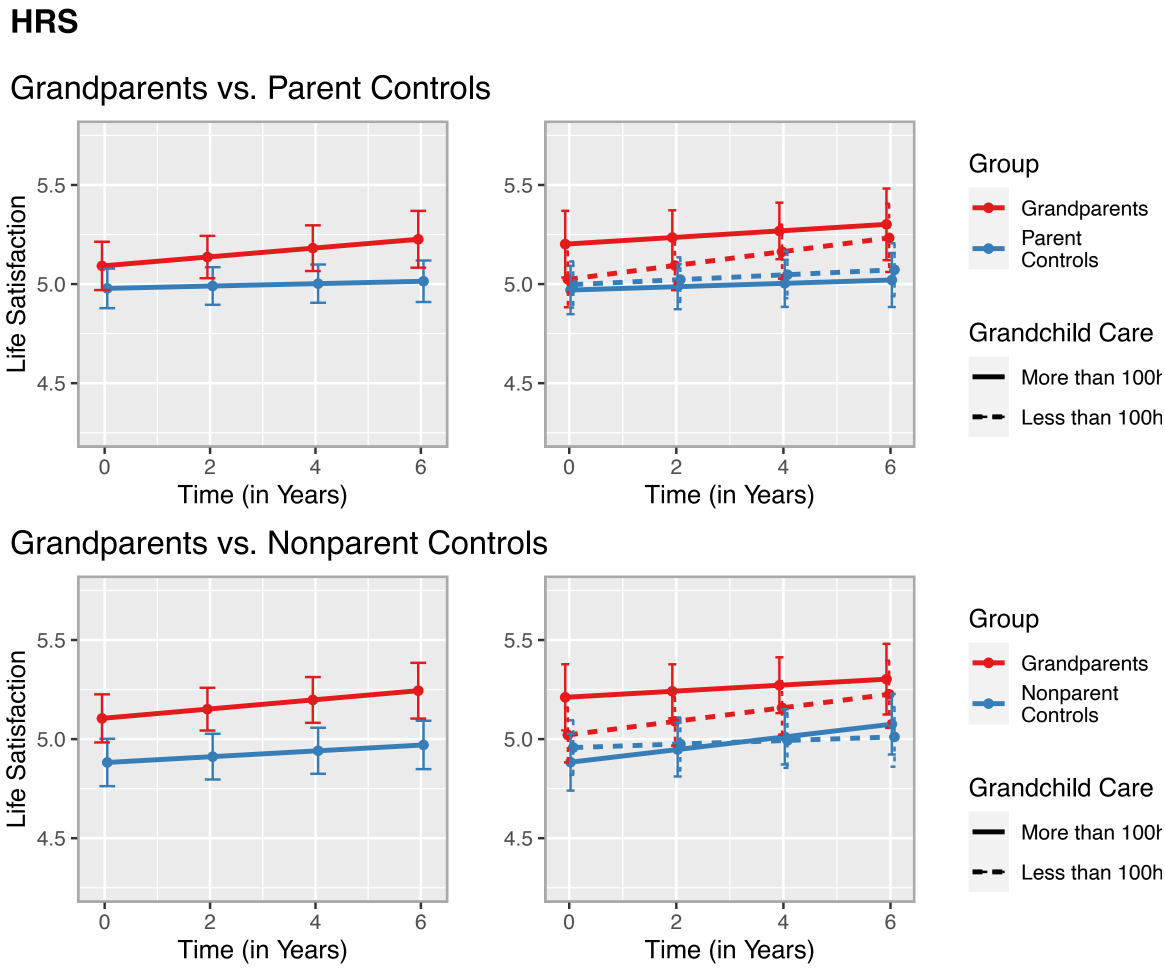

Figure S27

Change trajectories of life satisfaction based on the models of moderation by grandchild care (see Table S60). The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The plots in the left column are the same as in Figure S25 (basic models) but restricted to the post-transition period for better comparability.

HRS

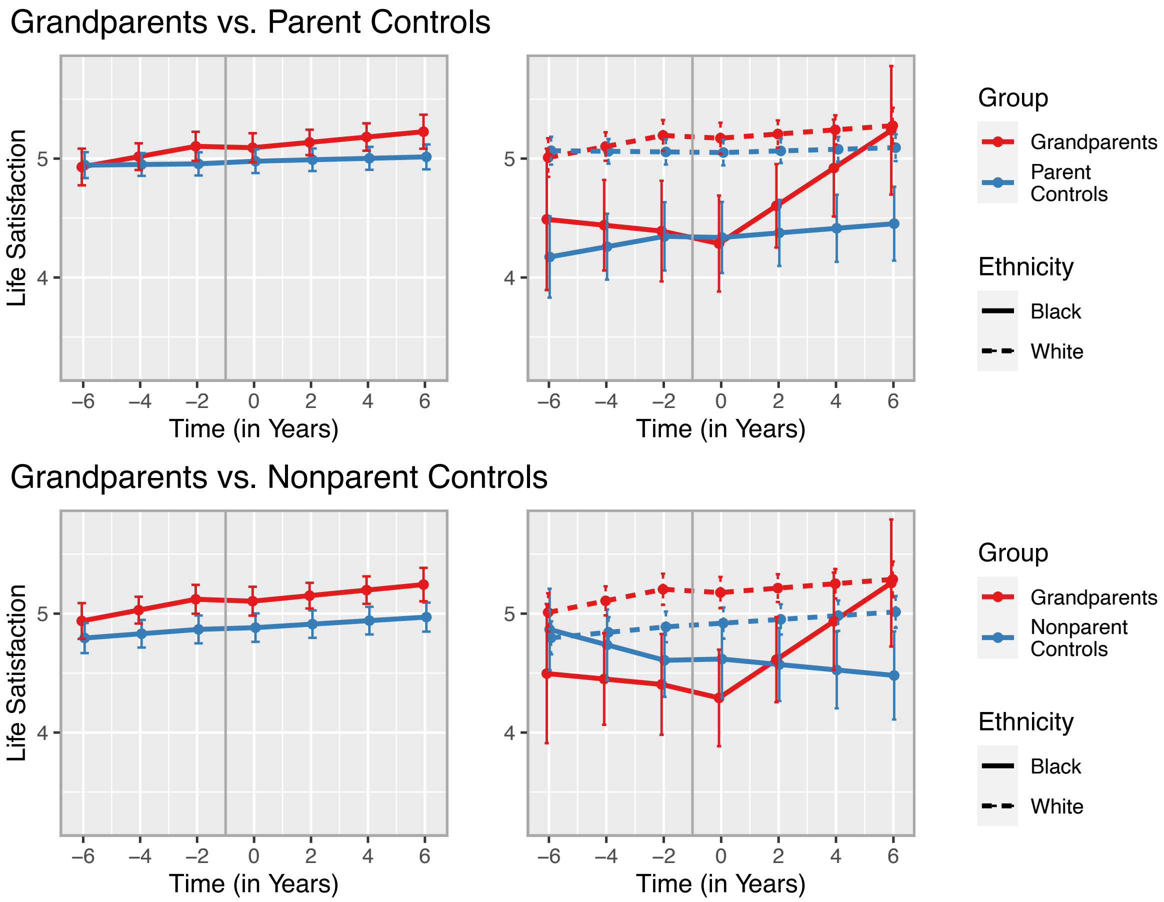

Figure S28

Change trajectories of life satisfaction based on the models of moderation by ethnicity (see Table S62). black $= 0$ *indicates White/Caucasian ethnicity, black* $= 1$ *indicates Black/African American ethnicity. The error bars are 95% confidence intervals of the predicted values, which only account for the fixed-effects portion of the model. The vertical line indicates the approximate time of the transition to grandparenthood. The plots in the left column are the same as in Figure S25 (basic models) and added here for better comparability.*

Complete Software and Session Information

We used R (Version 4.0.4; R Core Team, 2021) and the R-packages *car* (Fox et al., 2020; Version 3.0.12; Fox & Weisberg, 2019b), *carData* (Version 3.0.4; Fox et al., 2020), *citr* (Version 0.3.2; Aust, 2019), *cowplot* (Version 1.1.1; Wilke, 2020), *dplyr* (Version 1.0.7; Wickham, François, et al., 2021), *forcats* (Version 0.5.1; Wickham, 2021a), *Formula* (Version 1.2.4; Zeileis & Croissant, 2010), *ggplot2* (Version 3.3.5; Wickham, 2016), *GPArotation* (Version 2014.11.1; Bernaards & I.Jennrich, 2005), *Hmisc* (Version 4.6.0; Harrell Jr, 2021), *lattice* (Version 0.20.41; Sarkar, 2008), *lme4* (Version 1.1.27.1; Bates et al., 2015), *lmerTest* (Version 3.1.3; Kuznetsova et al., 2017), *magick* (Version 2.7.3; Ooms, 2021), *MASS* (Version 7.3.53; Venables & Ripley, 2002), *Matrix* (Version 1.3.2; Bates & Maechler, 2021), *multcomp* (Version 1.4.18; Hothorn et al., 2008), *mvtnorm* (Version 1.1.1; Genz & Bretz, 2009), *nlme* (Version 3.1.152; Pinheiro et al., 2021), *papaja* (Version 0.1.0.9997; Aust & Barth, 2020), *png* (Version 0.1.7; Urbanek, 2013), *psych* (Version 2.1.9; Revelle, 2021), *purrr* (Version 0.3.4; Henry & Wickham, 2020), *readr* (Version 2.1.1; Wickham, Hester, et al., 2021), *scales* (Version 1.1.1; Wickham & Seidel, 2020), *shiny* (Version 1.7.1; Chang et al., 2021), *stringr* (Version 1.4.0; Wickham, 2019), *survival* (Version 3.2.7; Terry M. Therneau & Patricia M. Grambsch, 2000), *TH.data* (Version 1.0.10; Hothorn, 2019), *tibble* (Version 3.1.6; Müller & Wickham, 2021), *tidyr* (Version 1.1.4; Wickham, 2021b), *tidyverse* (Version 1.3.1; Wickham et al., 2019), and *tinylabels* (Version 0.2.2; Barth, 2021) for data wrangling, analyses, and plots. We used *renv* to create a reproducible environment for this R-project (Version 0.15.2, Ushey, 2022).

The following is the output of R's *sessionInfo()* command, which shows information to aid analytic reproducibility of the analyses.

R version 4.0.4 (2021-02-15) Platform: x86_64-apple-darwin17.0 (64-bit) Running under: macOS Big Sur 10.16

Matrix products: default BLAS:

/Library/Frameworks/R.framework/Versions/4.0/Resources/lib/libRblas.dylib LAPACK: /Library/Frameworks/R.framework/Versions/4.0/Resources/lib/libRlapack.dylib

locale: [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8

attached base packages: [1] grid stats graphics grDevices datasets utils methods
[8] base

other attached packages: [1] png_0.1-7 magick_2.7.3 car_3.0-12
[4] carData_3.0-4 scales_1.1.1 cowplot_1.1.1
[7] nlme_3.1-152 lmerTest_3.1-3 lme4_1.1-27.1
[10] Matrix_1.3-2 GPArotation_2014.11-1 psych_2.1.9
[13] forcats_0.5.1 stringr_1.4.0 dplyr_1.0.7
[16] purrr_0.3.4 readr_2.1.1 tidyr_1.1.4
[19] tibble_3.1.6 tidyverse_1.3.1 Hmisc_4.6-0
[22] ggplot2_3.3.5 Formula_1.2-4 lattice_0.20-41
[25] multcomp_1.4-18 TH.data_1.0-10 MASS_7.3-53
[28] survival_3.2-7 mvtnorm_1.1-1 citr_0.3.2
[31] papaja_0.1.0.9997 tinylabels_0.2.2

loaded via a namespace (and not attached): [1] minqa_1.2.4 colorspace_2.0-2 ellipsis_0.3.2
[4] htmlTable_2.4.0 base64enc_0.1-3 fs_1.5.2
[7] rstudioapi_0.13 fansi_1.0.2 lubridate_1.8.0
[10] xml2_1.3.3 codetools_0.2-18 splines_4.0.4
[13] mnormt_2.0.2 knitr_1.37 jsonlite_1.7.3
[16] nloptr_1.2.2.2 broom_0.7.11.9000 cluster_2.1.0
[19] dbplyr_2.1.1 shiny_1.7.1 compiler_4.0.4
[22] httr_1.4.2 backports_1.4.1 assertthat_0.2.1

```
[25] fastmap_1.1.0 cli_3.1.1 later_1.3.0
[28] htmltools_0.5.2 tools_4.0.4 gtable_0.3.0
[31] glue_1.6.1 Rcpp_1.0.7 cellranger_1.1.0
[34] vctrs_0.3.8 xfun_0.29 rvest_1.0.2
[37] mime_0.12 miniUI_0.1.1.1 lifecycle_1.0.1
[40] renv_0.15.2 zoo_1.8-8 hms_1.1.1
[43] promises_1.2.0.1 parallel_4.0.4 sandwich_3.0-0
[46] RColorBrewer_1.1-2 yaml_2.2.2 gridExtra_2.3
[49] rpart_4.1-15 latticeExtra_0.6-29 stringi_1.7.6
[52] checkmate_2.0.0 boot_1.3-26 rlang_1.0.0
[55] pkgconfig_2.0.3 evaluate_0.14 htmlwidgets_1.5.2
[58] tidyselect_1.1.1 magrittr_2.0.2 bookdown_0.24
[61] R6_2.5.1 generics_0.1.1 DBI_1.1.0
[64] pillar_1.6.5 haven_2.4.3 foreign_0.8-81
[67] withr_2.4.3 abind_1.4-5 nnet_7.3-15
[70] modelr_0.1.8 crayon_1.4.2 utf8_1.2.2
[73] tmvnsim_1.0-2 tzdb_0.2.0 rmarkdown_2.11
[76] jpeg_0.1-8.1 readxl_1.3.1 data.table_1.13.2
[79] reprex_2.0.1 digest_0.6.29 xtable_1.8-4
[82] httpuv_1.6.5 numDeriv_2016.8-1.1 munsell_0.5.0
```

References

Aust, F. (2019). *Citr: 'RStudio' add-in to insert markdown citations.* https://github.com/crsh/citr

Aust, F., & Barth, M. (2020). *papaja: Prepare reproducible APA journal articles with R Markdown.* https://github.com/crsh/papaja

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, *46*(3), 399–424. https://doi.org/10.1080/00273171.2011.568786

Barth, M. (2021). *tinylabels: Lightweight variable labels.* https://cran.r-project.org/package=tinylabels

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Bates, D., & Maechler, M. (2021). *Matrix: Sparse and dense matrix classes and methods.* https://CRAN.R-project.org/package=Matrix

Bernaards, C. A., & I.Jennrich, R. (2005). Gradient projection algorithms and software for arbitrary rotation criteria in factor analysis. *Educational and Psychological Measurement*, *65*, 676–696.

Chang, W., Cheng, J., Allaire, J., Sievert, C., Schloerke, B., Xie, Y., Allen, J., McPherson, J., Dipert, A., & Borges, B. (2021). *Shiny: Web application framework for r.* https://CRAN.R-project.org/package=shiny

Fox, J., & Weisberg, S. (2019a). *An R companion to applied regression* (3rd ed.). Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Fox, J., & Weisberg, S. (2019b). *An R companion to applied regression* (Third). Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Fox, J., Weisberg, S., & Price, B. (2020). *carData: Companion to applied regression data sets.* https://CRAN.R-project.org/package=carData

Genz, A., & Bretz, F. (2009). *Computation of multivariate normal and t probabilities.* Springer-Verlag.

Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. *Personality Psychology in Europe*, *7*(1), 7–28.

Harrell Jr, F. E. (2021). *Hmisc: Harrell miscellaneous.* https://CRAN.R-project.org/package=Hmisc

Henry, L., & Wickham, H. (2020). *Purrr: Functional programming tools.* https://CRAN.R-project.org/package=purrr

Hothorn, T. (2019). *TH.data: TH's data archive.* https://CRAN.R-project.org/package=TH.data

Hothorn, T., Bretz, F., & Westfall, P. (2008). Simultaneous inference in general parametric models. *Biometrical Journal*, *50*(3), 346–363.

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Müller, K., & Wickham, H. (2021). *Tibble: Simple data frames.* https://CRAN.R-project.org/package=tibble

Ooms, J. (2021). *Magick: Advanced graphics and image-processing in r.* https://CRAN.R-project.org/package=magick

Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D., & R Core Team. (2021). *nlme: Linear and nonlinear mixed effects models.* https://CRAN.R-project.org/package=nlme

R Core Team. (2021). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing. https://www.R-project.org/

Revelle, W. (2021). *Psych: Procedures for psychological, psychometric, and personality research.* Northwestern University. https://CRAN.R-project.org/package=psych

Sarkar, D. (2008). *Lattice: Multivariate data visualization with r.* Springer.

http://lmdvr.r-forge.r-project.org

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science: A Review Journal Of The Institute Of Mathematical Statistics*, *25*(1), 1–21. https://doi.org/10.1214/09-STS313

Terry M. Therneau, & Patricia M. Grambsch. (2000). *Modeling survival data: Extending the Cox model*. Springer.

Urbanek, S. (2013). *Png: Read and write PNG images*. https://CRAN.R-project.org/package=png

Ushey, K. (2022). *Renv: Project environments* [R package version 0.15.2]. https://rstudio.github.io/renv/

Venables, W. N., & Ripley, B. D. (2002). *Modern applied statistics with s* (Fourth). Springer. http://www.stats.ox.ac.uk/pub/MASS4/

Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis*. Springer-Verlag New York. https://ggplot2.tidyverse.org

Wickham, H. (2019). *Stringr: Simple, consistent wrappers for common string operations*. https://CRAN.R-project.org/package=stringr

Wickham, H. (2021a). *Forcats: Tools for working with categorical variables (factors)*. https://CRAN.R-project.org/package=forcats

Wickham, H. (2021b). *Tidyr: Tidy messy data*. https://CRAN.R-project.org/package=tidyr

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T. L., Miller, E., Bache, S. M., Müller, K., Ooms, J., Robinson, D., Seidel, D. P., Spinu, V., … Yutani, H. (2019). Welcome to the tidyverse. *Journal of Open Source Software*, *4*(43), 1686. https://doi.org/10.21105/joss.01686

Wickham, H., François, R., Henry, L., & Müller, K. (2021). *Dplyr: A grammar of data manipulation*. https://CRAN.R-project.org/package=dplyr

Wickham, H., Hester, J., & Bryan, J. (2021). *Readr: Read rectangular text data.* https://CRAN.R-project.org/package=readr

Wickham, H., & Seidel, D. (2020). *Scales: Scale functions for visualization.* https://CRAN.R-project.org/package=scales

Wilke, C. O. (2020). *Cowplot: Streamlined plot theme and plot annotations for 'ggplot2'.* https://CRAN.R-project.org/package=cowplot

Zeileis, A., & Croissant, Y. (2010). Extended model formulas in R: Multiple parts and multiple responses. *Journal of Statistical Software*, *34*(1), 1–13. https://doi.org/10.18637/jss.v034.i01

Appendix B

Supplemental Materials for Study II

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https://doi.org/10.1016/j.jrp.2022.104223

Appendix C

Supplemental Materials for Study III

Supplemental Material

Model Equations

H1a and H2a

Model equation for the models related to H1a and H2a, in this example with positive affect (PA) as the outcome and social deprivation episodes (SDE) as the predictor of interest:

$$\begin{aligned} PA_{ti} =& \beta_{0i} + \beta_{1i} SDE_{ti} + \beta_{2i} weekend_{ti} + e_{ti} \\ & \beta_{0i} = \gamma_{00} + \gamma_{01} female_i + \gamma_{02} age_i + \upsilon_{0i} \\ & \beta_{1i} = \gamma_{10} + \upsilon_{1i} \\ & \beta_{2i} = \gamma_{20} \end{aligned} \tag{A1}$$

where at time t for participant i $e_{ti} \sim N(0, \sigma_e^2)$ and $\begin{bmatrix} \upsilon_{0i} \\ \upsilon_{1i} \end{bmatrix} \sim MVN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \tau_{00} & \\ \tau_{10} & \tau_{11} \end{bmatrix}\right)$.

H3a, H3b, and H3c

Model equation for the models related to H3a, H3b, and H3c, in this example with positive affect (PA) as the outcome, social deprivation episodes (SDE) as the predictor of interest, and extraversion as the moderator (cross-level interaction):

$$\begin{aligned} PA_{ti} =& \beta_{0i} + \beta_{1i} SDE_{ti} + \beta_{2i} weekend_{ti} + e_{ti} \\ & \beta_{0i} = \gamma_{00} + \gamma_{01} female_i + \gamma_{02} age_i + \gamma_{03} extraversion_i + \upsilon_{0i} \\ & \beta_{1i} = \gamma_{10} + \gamma_{11} extraversion_i + \upsilon_{1i} \\ & \beta_{2i} = \gamma_{20} \end{aligned} \tag{A2}$$

where at time t for participant i $e_{ti} \sim N(0, \sigma_e^2)$ and $\begin{bmatrix} \upsilon_{0i} \\ \upsilon_{1i} \end{bmatrix} \sim MVN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \tau_{00} & \\ \tau_{10} & \tau_{11} \end{bmatrix}\right)$.

Exploratory Models of Social Contact and Social Desire

Model equation for the basic exploratory models, in this example with positive affect (PA) as the outcome and desire to be alone alongside personal contact duration as predictors (see Table 2):

$$
\begin{aligned}
PA_{ti} =& \beta_{0i} + \beta_{1i} personalWP_{ti} + \beta_{2i} desireAloneWP_{ti} + \beta_{3i} personalWP_{ti} * desireAloneWP_{ti} \\
& + \beta_{4i} weekend_{ti} + e_{ti} \\
& \beta_{0i} = \gamma_{00} + \gamma_{01} female_i + \gamma_{02} age_i + \gamma_{03} personalBP_i + \gamma_{04} desireAloneBP_i \\
& + \gamma_{05} personalBP_i * desireAloneBP_i + \upsilon_{0i} \\
& \beta_{1i} = \gamma_{10} + \gamma_{11} desireAloneBP_i + \upsilon_{1i} \\
& \beta_{2i} = \gamma_{20} + \gamma_{21} personalBP_i + \upsilon_{2i} \\
& \beta_{3i} = \gamma_{30} + \upsilon_{3i} \\
& \beta_{3i} = \gamma_{40}
\end{aligned}
\tag{A3}
$$

where at time t for participant i $e_{ti} \sim N(0, \sigma_e^2)$ and

$$
\begin{bmatrix} \upsilon_{0i} \\ \upsilon_{1i} \\ \upsilon_{2i} \\ \upsilon_{3i} \end{bmatrix} \sim MVN\left(\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \tau_{00} & & & \\ \tau_{10} & \tau_{11} & & \\ \tau_{20} & \tau_{21} & \tau_{22} & \\ \tau_{30} & \tau_{31} & \tau_{32} & \tau_{33} \end{bmatrix}\right).
$$

In this case, $personalWP_{ti}$ and $desireAloneWP_{ti}$ denote the person-mean-centered within-person components of the predictor variables, and $personalBP_i$ and $desireAloneBP_i$ the grand-mean-centered between-person components.

Specification Curve Analysis – Coding Choices

The specification curve analyses (SCA, see Simonsohn et al., 2020) served the purpose of scrutinizing the operationalization of social deprivation episodes (SDE) and social oversatiation episodes (SOE) and their confirmatory analytical models.

In general, these episodes were coded based on a mismatch between social contact and momentary social desire using variables from the experience sampling data. The condition of mismatch applied for SDE when participants reported low levels of social contact together with a high desire for social contact. For SOE, this was the case when participants reported substantial social contact while at the same time reporting a high desire to be alone. The effect sizes displayed in SCA plots correspond to the coefficient for SDE or SOE ($\hat{\gamma}_{10}$, see Fig. 1, 2, S2, & S3), or the coefficient of the cross-level interaction between SDE or SOE and each social trait ($\hat{\gamma}_{11}$, see Fig. S4-S23). Subplots **a** always show the ranked effect sizes of the different specifications including their 95% confidence intervals; subplots **b** show the frequency of occurrence of the respective social dynamics episode (SDE or SOE) in the different specifications; and subplots **c** mark the options that define the different specifications.

We preregistered the specifications at https://osf.io/4syhg. In the table below, options in brackets indicate the combination of decisions that make up the specification that we thought was most sensible from a theoretical standpoint and that was used in confirmatory models (see Table 1).

Abbreviation	Options	Explanation
consec	1 / [2] / 3	Minimum number of consecutive ESM assessments in which the conditions for coding SDE/SOE have to apply (i.e., the mismatch between social contact status and momentary social desire). The set of specifications with *consec*=1 was added after the preregistration.

Abbreviation	Options	Explanation
cut_desire	[5] / 6	Cutoff value for high desire for social contact or high desire to be alone in the coding of SDE/SOE: either 5 or 6 on the 7-point scale.
cut_time	5 / [10] / 20	Minimum duration of self-reported social contact that is included (i.e., considered as meaningful) in the coding (in min).
exclude_val	[no] / yes	Exclude social contact from coding of episodes based on valence (below 3 for SDE / above 5 for SOE). If *exclude_val*=yes, only neutral or pleasant contact is considered for SDE. Unpleasant social contact is then not considered under the assumption that it may not meaningfully contribute to alleviating social deprivation. For SOE, only unpleasant or neutral social contact is considered if *exclude_val*=yes. In this case, we assume that additional pleasant social contact is irrelevant to define a spell of social oversatiation.
calls	[no] / yes	Include indirect contact duration in the form of self-reported calls and video calls as social contact.
two_days	[no] / yes	Allow episodes (SDE / SOE) to span the two days of the observation period. ESM assessments covered social contact roughly in the period between 8:00 a.m. and 9:00 p.m..

Abbreviation	Options	Explanation
trait_affect	[no] / yes	Include trait-level affect as a level-2 variable in the multilevel models to account for between-person differences in affective experiences. We assessed trait-level affect in the baseline survey using the same affect adjectives as for momentary affect but in reference to the last two weeks.
random_slope (not used)	no / [yes]	Include random slopes of SDE/SOE in the multilevel models. We deviated from our preregistration because we were unable to estimate random slopes in all specifications due to model nonconvergence of some of the specifications.

Robustness Check

For additional, exploratory analyses we formed a composite social desire variable based on the reverse-scored desire to be alone (when participants were in personal contact with others immediately before the ESM prompt), and the desire for social contact (when they were alone). This had the advantage of including all observations in one model (i.e., increased power) but the disadvantage of creating a psychometrically blurred variable. Models with this composite social desire variable supported the results of the main exploratory models: Higher than usual social desire was associated with increased PA, $\hat{\gamma}_{20} = 0.22$, 95% CI $[0.18, 0.25]$, $p < .001$, and decreased NA, $\hat{\gamma}_{20} = -0.14$, 95% CI $[-0.17, -0.11]$, $p < .001$ (see Table S10). For NA, we also found a significant interaction effect between the within-person components of personal contact and social desire: When in a state of lower than usual social desire, participants with longer than usual personal contact experienced increased NA, $\hat{\gamma}_{30} = -0.03$, 95% CI $[-0.05, 0.00]$, $p = .022$ (see Fig. S27c,d). This interaction effect supported our results for desire for social contact, but was not in line with the interaction effect involving desire to be alone described in the main text.

Supplementary Tables

Table S1

Mean, Standard Deviation, Median, Minimum, Maximum, Number of Observations, and Intra-Class Correlation of Level-1 Variables

	M	*SD*	*med.*	*min*	*max*	*n*	*ICC*
Based on ESM Self-Report							
Positive Affect	4.63	1.14	4.75	1.21	7.00	4,524	0.49
Negative Affect	1.94	1.06	1.50	1.00	5.20	4,524	0.52
Desire for Social Contact	3.30	1.48	3.50	1.00	7.00	1,934	0.42
Desire to be Alone	3.20	1.77	3.00	1.00	7.00	2,571	0.32
Personal Contact Duration	25.77	29.26	10.00	0.00	98.52	4,524	0.22
Social Deprivation Episode	0.02	0.15	0.00	0.00	1.00	3,674	0.14
Social Oversatiation Episode	0.04	0.20	0.00	0.00	1.00	3,723	0.28
Based on Mobile Sensing							
Detected Conversation Proportion	0.10	0.17	0.00	0.00	0.97	3,198	0.25
Call Frequency	0.17	0.58	0.00	0.00	12.00	4,524	0.19
Call Duration	0.72	3.72	0.00	0.00	65.88	4,524	0.05
Communication Apps Frequency	4.96	6.21	3.00	0.00	68.00	4,524	0.41
Communication Apps Duration	3.42	6.12	1.05	0.00	86.14	4,524	0.24
Social Media Apps Frequency	1.73	3.58	0.00	0.00	56.00	4,524	0.38
Social Media Apps Duration	3.17	7.45	0.00	0.00	83.66	4,524	0.26

Note. Presented are the unstandardized variables. Duration variables are scaled in minutes. Personal contact duration was censored to the duration of the corresponding ESM episode. M = mean, SD = standard deviation, *med.* = median, *min* = minimum value, *max* = maximum value, n = number of observations, ICC = intra-class correlation, that is, the proportion of variance that lies at the between-person level.

Table S2

Fixed Effects of Social Dynamics on Momentary Affect (Alternative Predictor Centering).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Social Deprivation Episode								
Intercept, $\hat{\gamma}_{00}$	4.73	[4.59, 4.87]	66.42	$<$ .001	2.04	[1.91, 2.17]	30.22	$<$ .001
SDE (BP), $\hat{\gamma}_{03}$	-0.84	[-2.12, 0.44]	-1.29	.200	-0.08	[-1.29, 1.13]	-0.13	.899
SDE (WP), $\hat{\gamma}_{10}$	0.12	[-0.09, 0.33]	1.12	.261	-0.08	[-0.27, 0.11]	-0.84	.401
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.03]	-0.99	.320	-0.09	[-0.15, -0.03]	-3.12	.002
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.13]	-0.62	.536	-0.16	[-0.34, 0.01]	-1.85	.066
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.27	.001	-0.01	[-0.01, 0.00]	-1.65	.100
Social Oversatiation Episode								
Intercept, $\hat{\gamma}_{00}$	4.74	[4.60, 4.87]	67.92	$<$ .001	2.04	[1.90, 2.17]	30.45	$<$ .001
SOE (BP), $\hat{\gamma}_{03}$	-0.89	[-1.67, -0.10]	-2.23	.026	0.43	[-0.33, 1.18]	1.11	.268
SOE (WP), $\hat{\gamma}_{10}$	-0.27	[-0.44, -0.10]	-3.11	.002	0.42	[0.24, 0.59]	4.52	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.04]	-0.90	.370	-0.09	[-0.15, -0.04]	-3.17	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.24, 0.13]	-0.59	.553	-0.17	[-0.34, 0.01]	-1.87	.062
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.30	.001	-0.01	[-0.01, 0.00]	-1.70	.091

Note. Using the centering strategy for binary predictors described in Yaremych et al. (2021). Separate models were computed for each of the two types of episodes (SDE, SOE) and two affect outcomes (PA, NA). SDE = Social Deprivation Episode, SOE = Social Oversatiation Episode, CI = confidence interval, BP = between-person effect, WP = within-person effect.

Table S3

Fixed Effects of Social Dynamics on Momentary Affect as Moderated by Extraversion.

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Social Deprivation Episode								
Intercept, $\hat{\gamma}_{00}$	4.74	[4.61, 4.87]	70.07	$<$ .001	2.02	[1.89, 2.14]	31.21	$<$ .001
SDE, $\hat{\gamma}_{10}$	0.10	[-0.11, 0.30]	0.90	.369	-0.08	[-0.26, 0.11]	-0.84	.403
Extraversion, $\hat{\gamma}_{03}$	0.20	[0.11, 0.29]	4.38	$<$ .001	-0.14	[-0.22, -0.05]	-3.07	.002
Extraversion * SDE, $\hat{\gamma}_{11}$	-0.09	[-0.26, 0.08]	-0.98	.326	-0.02	[-0.17, 0.13]	-0.22	.827
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.03]	-0.99	.320	-0.09	[-0.15, -0.03]	-3.12	.002
Female, $\hat{\gamma}_{01}$	-0.11	[-0.29, 0.07]	-1.17	.243	-0.12	[-0.30, 0.05]	-1.39	.164
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.20	.002	-0.01	[-0.01, 0.00]	-1.63	.103
Social Oversatiation Episode								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	71.42	$<$ .001	2.02	[1.89, 2.14]	31.24	$<$ .001
SOE, $\hat{\gamma}_{10}$	-0.28	[-0.45, -0.11]	-3.16	.002	0.41	[0.23, 0.59]	4.41	$<$ .001
Extraversion, $\hat{\gamma}_{03}$	0.20	[0.11, 0.29]	4.47	$<$ .001	-0.13	[-0.22, -0.05]	-3.02	.003
Extraversion * SOE, $\hat{\gamma}_{11}$	0.04	[-0.12, 0.19]	0.47	.638	-0.03	[-0.19, 0.14]	-0.31	.757
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.04]	-0.88	.378	-0.09	[-0.15, -0.04]	-3.17	.002
Female, $\hat{\gamma}_{01}$	-0.12	[-0.30, 0.06]	-1.31	.192	-0.12	[-0.30, 0.05]	-1.41	.159
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.28	.001	-0.01	[-0.01, 0.00]	-1.67	.096

Note. Separate models were computed for each of the two types of episodes (SDE, SOE) and two affect outcomes (PA, NA). SDE = Social Deprivation Episode, SOE = Social Oversatiation Episode, CI = confidence interval.

Table S4

Fixed Effects of Social Dynamics on Momentary Affect as Moderated by Affiliation Motive.

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Social Deprivation Episode								
Intercept, $\hat{\gamma}_{00}$	4.71	[4.58, 4.84]	71.06	< .001	2.04	[1.91, 2.16]	31.49	< .001
SDE, $\hat{\gamma}_{10}$	0.22	[-0.04, 0.47]	1.67	.095	-0.09	[-0.31, 0.14]	-0.75	.451
Affiliation Motive, $\hat{\gamma}_{03}$	0.24	[0.15, 0.33]	5.34	< .001	-0.10	[-0.19, -0.01]	-2.20	.028
Affiliation Motive * SDE, $\hat{\gamma}_{11}$	-0.22	[-0.44, 0.00]	-1.93	.054	0.02	[-0.18, 0.21]	0.20	.844
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.03]	-0.96	.335	-0.09	[-0.15, -0.03]	-3.14	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.56	.575	-0.16	[-0.34, 0.01]	-1.85	.065
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.94	< .001	-0.01	[-0.01, 0.00]	-1.92	.055
Social Oversatiation Episode								
Intercept, $\hat{\gamma}_{00}$	4.72	[4.59, 4.84]	72.27	< .001	2.04	[1.91, 2.16]	31.57	< .001
SOE, $\hat{\gamma}_{10}$	-0.35	[-0.54, -0.15]	-3.51	< .001	0.50	[0.30, 0.69]	5.03	< .001
Affiliation Motive, $\hat{\gamma}_{03}$	0.24	[0.15, 0.33]	5.42	< .001	-0.10	[-0.19, -0.01]	-2.21	.028
Affiliation Motive * SOE, $\hat{\gamma}_{11}$	-0.11	[-0.27, 0.05]	-1.39	.166	0.15	[-0.01, 0.31]	1.83	.067
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.04]	-0.82	.411	-0.09	[-0.15, -0.04]	-3.21	.001
Female, $\hat{\gamma}_{01}$	-0.06	[-0.23, 0.11]	-0.66	.508	-0.17	[-0.34, 0.01]	-1.90	.059
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	4.04	< .001	-0.01	[-0.01, 0.00]	-1.96	.051

Note. Separate models were computed for each of the two types of episodes (SDE, SOE) and two affect outcomes (PA, NA). SDE = Social Deprivation Episode, SOE = Social Oversatiation Episode, CI = confidence interval.

Table S5

Fixed Effects of Social Dynamics on Momentary Affect as Moderated by Neuroticism.

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Social Deprivation Episode								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.54, 4.79]	73.27	< .001	2.08	[1.97, 2.20]	34.86	< .001
SDE, $\hat{\gamma}_{10}$	0.10	[-0.11, 0.31]	0.92	.355	-0.09	[-0.27, 0.10]	-0.90	.368
Neuroticism, $\hat{\gamma}_{03}$	-0.34	[-0.42, -0.25]	-7.82	< .001	0.33	[0.25, 0.41]	7.97	< .001
Neuroticism * SDE, $\hat{\gamma}_{11}$	-0.06	[-0.32, 0.19]	-0.48	.631	0.06	[-0.16, 0.29]	0.55	.581
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.03]	-1.01	.312	-0.09	[-0.15, -0.03]	-3.14	.002
Female, $\hat{\gamma}_{01}$	0.05	[-0.12, 0.21]	0.53	.600	-0.26	[-0.42, -0.10]	-3.14	.002
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.01]	2.80	.005	0.00	[-0.01, 0.00]	-1.13	.259
Social Oversatiation Episode								
Intercept, $\hat{\gamma}_{00}$	4.67	[4.54, 4.79]	74.78	< .001	2.08	[1.97, 2.20]	35.00	< .001
SOE, $\hat{\gamma}_{10}$	-0.30	[-0.47, -0.13]	-3.45	.001	0.41	[0.23, 0.59]	4.50	< .001
Neuroticism, $\hat{\gamma}_{03}$	-0.34	[-0.43, -0.26]	-8.05	< .001	0.33	[0.25, 0.41]	8.05	< .001
Neuroticism * SOE, $\hat{\gamma}_{11}$	0.02	[-0.16, 0.20]	0.25	.803	0.00	[-0.19, 0.19]	-0.02	.981
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.04]	-0.86	.388	-0.09	[-0.15, -0.04]	-3.20	.001
Female, $\hat{\gamma}_{01}$	0.04	[-0.13, 0.21]	0.47	.642	-0.26	[-0.42, -0.10]	-3.18	.002
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.01]	2.88	.004	0.00	[-0.01, 0.00]	-1.17	.243

Note. Separate models were computed for each of the two types of episodes (SDE, SOE) and two affect outcomes (PA, NA). SDE = Social Deprivation Episode, SOE = Social Oversatiation Episode, CI = confidence interval.

Table S6

Fixed Effects of Social Dynamics on Momentary Affect (Including Nonsignificant Cross-Level Interactions with Gender.and Age).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Social Deprivation Episode								
Intercept, $\hat{\gamma}_{00}$	4.71	[4.57, 4.84]	68.04	< .001	2.04	[1.91, 2.16]	31.24	< .001
SDE, $\hat{\gamma}_{10}$	0.14	[-0.14, 0.41]	0.97	.333	-0.06	[-0.30, 0.18]	-0.48	.632
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.14]	-0.49	.627	-0.16	[-0.34, 0.01]	-1.84	.067
Female * SDE, $\hat{\gamma}_{11}$	-0.15	[-0.59, 0.29]	-0.66	.509	-0.02	[-0.41, 0.36]	-0.11	.910
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.09	.002	-0.01	[-0.01, 0.00]	-1.60	.110
Age * SDE, $\hat{\gamma}_{12}$	0.01	[0.00, 0.03]	1.82	.068	-0.01	[-0.02, 0.01]	-0.99	.323
Weekend, $\hat{\gamma}_{20}$	-0.04	[-0.10, 0.03]	-1.02	.306	-0.09	[-0.15, -0.03]	-3.12	.002
Social Oversatiation Episode								
Intercept, $\hat{\gamma}_{00}$	4.71	[4.58, 4.84]	69.08	< .001	2.03	[1.91, 2.16]	31.20	< .001
SOE, $\hat{\gamma}_{10}$	-0.27	[-0.52, -0.02]	-2.10	.036	0.48	[0.22, 0.75]	3.56	< .001
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.55	.579	-0.16	[-0.34, 0.01]	-1.81	.071
Female * SOE, $\hat{\gamma}_{11}$	-0.06	[-0.40, 0.28]	-0.36	.721	-0.11	[-0.47, 0.24]	-0.62	.534
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.15	.002	-0.01	[-0.01, 0.00]	-1.67	.096
Age * SOE, $\hat{\gamma}_{12}$	0.01	[-0.01, 0.02]	1.15	.252	0.00	[-0.02, 0.01]	-0.24	.807
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.04]	-0.88	.381	-0.09	[-0.15, -0.04]	-3.17	.002

Note. Separate models were computed for each of the two types of episodes (SDE, SOE) and two affect outcomes (PA, NA). SDE = Social Deprivation Episode, SOE = Social Oversatiation Episode, CI = confidence interval.

Table S7

Fixed Effects of Personal Contact Duration and Social Desire on Momentary Affect (Including Quadratic Effects of Social Desire).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.80	[4.63, 4.97]	56.74	< .001	2.00	[1.84, 2.16]	24.58	< .001
Weekend, $\hat{\gamma}_{50}$	-0.01	[-0.09, 0.06]	-0.38	.702	-0.10	[-0.17, -0.03]	-2.89	.004
Female, $\hat{\gamma}_{01}$	-0.07	[-0.24, 0.11]	-0.76	.449	-0.12	[-0.29, 0.05]	-1.39	.167
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.67	< .001	0.00	[-0.01, 0.00]	-1.43	.155
Personal Contact (BP), $\hat{\gamma}_{03}$	0.11	[0.01, 0.21]	2.07	.039	-0.05	[-0.15, 0.04]	-1.10	.273
[Personal Contact (BP)]^2, $\hat{\gamma}_{04}$	-0.03	[-0.10, 0.05]	-0.70	.487	0.01	[-0.07, 0.08]	0.14	.886
Personal Contact (WP), $\hat{\gamma}_{10}$	0.02	[-0.02, 0.07]	1.06	.289	0.00	[-0.05, 0.04]	-0.13	.893
[Personal Contact (WP)]^2, $\hat{\gamma}_{20}$	0.00	[-0.03, 0.03]	0.07	.941	0.00	[-0.02, 0.03]	0.35	.727
Desire Alone (BP), $\hat{\gamma}_{05}$	-0.13	[-0.23, -0.04]	-2.81	.005	0.09	[0.00, 0.18]	1.99	.048
[Desire Alone (BP)]^2, $\hat{\gamma}_{06}$	-0.03	[-0.09, 0.03]	-0.94	.349	-0.02	[-0.08, 0.04]	-0.76	.446
Desire Alone (WP), $\hat{\gamma}_{30}$	-0.25	[-0.29, -0.21]	-11.90	< .001	0.18	[0.14, 0.22]	8.57	< .001
[Desire Alone (WP)]^2, $\hat{\gamma}_{40}$	-0.02	[-0.04, 0.01]	-1.22	.223	0.04	[0.02, 0.07]	3.56	< .001
Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.69	[4.48, 4.90]	43.05	< .001	2.11	[1.90, 2.31]	19.77	< .001
Weekend, $\hat{\gamma}_{50}$	-0.03	[-0.11, 0.06]	-0.60	.546	-0.08	[-0.16, 0.00]	-1.98	.047
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	-0.89	.376	-0.15	[-0.35, 0.05]	-1.43	.152
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.46	.001	-0.01	[-0.01, 0.00]	-1.81	.072
Personal Contact (BP), $\hat{\gamma}_{03}$	0.12	[-0.01, 0.25]	1.87	.063	-0.05	[-0.17, 0.08]	-0.75	.453
[Personal Contact (BP)]^2, $\hat{\gamma}_{04}$	0.07	[-0.02, 0.16]	1.44	.151	-0.03	[-0.12, 0.05]	-0.75	.455
Personal Contact (WP), $\hat{\gamma}_{10}$	0.03	[-0.04, 0.11]	0.92	.359	0.05	[-0.03, 0.12]	1.25	.211
[Personal Contact (WP)]^2, $\hat{\gamma}_{20}$	-0.05	[-0.11, 0.01]	-1.47	.141	0.01	[-0.05, 0.07]	0.41	.681
Desire Contact (BP), $\hat{\gamma}_{05}$	0.17	[0.07, 0.28]	3.27	.001	-0.07	[-0.17, 0.03]	-1.40	.163
[Desire Contact (BP)]^2, $\hat{\gamma}_{06}$	-0.09	[-0.16, -0.01]	-2.23	.027	0.02	[-0.05, 0.10]	0.59	.555
Desire Contact (WP), $\hat{\gamma}_{30}$	0.13	[0.09, 0.18]	5.38	< .001	-0.05	[-0.09, -0.01]	-2.55	.011
[Desire Contact (WP)]^2, $\hat{\gamma}_{40}$	-0.03	[-0.06, -0.01]	-2.79	.005	0.03	[0.01, 0.05]	2.69	.007

Note. CI = confidence interval, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Table S8

Fixed Effects of Personal Contact Duration and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	69.72	$<$ .001	2.10	[1.97, 2.22]	32.53	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.03]	-1.02	.307	-0.09	[-0.15, -0.04]	-3.24	.001
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.12]	-0.64	.525	-0.19	[-0.36, -0.02]	-2.14	.033
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.52	.001	-0.01	[-0.01, 0.00]	-1.91	.057
Personal Contact (BP), $\hat{\gamma}_{03}$	0.11	[0.03, 0.20]	2.57	.011	-0.07	[-0.15, 0.01]	-1.62	.107
Personal Contact (WP), $\hat{\gamma}_{10}$	0.09	[0.06, 0.12]	6.38	$<$ .001	-0.02	[-0.05, 0.00]	-1.98	.048
Restricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.71	[4.57, 4.84]	68.17	$<$ .001	2.07	[1.94, 2.20]	30.58	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.11, 0.05]	-0.79	.430	-0.09	[-0.16, -0.02]	-2.41	.016
Female, $\hat{\gamma}_{01}$	-0.07	[-0.25, 0.11]	-0.72	.469	-0.16	[-0.34, 0.01]	-1.81	.071
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.42	.001	-0.01	[-0.01, 0.00]	-1.90	.059
Personal Contact (BP), $\hat{\gamma}_{03}$	0.13	[0.04, 0.22]	2.80	.005	-0.07	[-0.15, 0.02]	-1.46	.144
Personal Contact (WP), $\hat{\gamma}_{10}$	0.07	[0.04, 0.10]	3.95	$<$ .001	-0.03	[-0.07, 0.01]	-1.53	.125
Adding Social Desire Variables								
Intercept, $\hat{\gamma}_{00}$	4.73	[4.60, 4.87]	70.12	$<$ .001	2.02	[1.90, 2.15]	31.04	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.01	[-0.09, 0.06]	-0.35	.726	-0.10	[-0.17, -0.03]	-2.90	.004
Female, $\hat{\gamma}_{01}$	-0.08	[-0.25, 0.10]	-0.84	.402	-0.11	[-0.28, 0.06]	-1.32	.189
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.56	$<$ .001	-0.01	[-0.01, 0.00]	-1.67	.096
Personal Contact (BP), $\hat{\gamma}_{03}$	0.09	[0.00, 0.18]	1.93	.054	-0.05	[-0.13, 0.04]	-1.02	.310
Personal Contact (WP), $\hat{\gamma}_{10}$	0.02	[-0.01, 0.06]	1.38	.169	0.00	[-0.03, 0.04]	0.21	.834
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.15	[-0.24, -0.06]	-3.21	.001	0.10	[0.02, 0.19]	2.34	.020
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.25	[-0.29, -0.21]	-12.43	$<$ .001	0.19	[0.15, 0.23]	9.36	$<$ .001
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.73	[4.60, 4.87]	69.32	$<$ .001	2.02	[1.89, 2.15]	30.69	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.02	[-0.09, 0.06]	-0.42	.673	-0.10	[-0.17, -0.04]	-2.99	.003
Female, $\hat{\gamma}_{01}$	-0.07	[-0.25, 0.11]	-0.76	.447	-0.11	[-0.28, 0.06]	-1.29	.199
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.50	.001	-0.01	[-0.01, 0.00]	-1.67	.097
Personal Contact (BP), $\hat{\gamma}_{03}$	0.09	[-0.01, 0.18]	1.85	.066	-0.03	[-0.12, 0.06]	-0.72	.474
Personal Contact (WP), $\hat{\gamma}_{10}$	0.02	[-0.01, 0.06]	1.27	.205	0.00	[-0.03, 0.04]	0.22	.825
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.13	[-0.22, -0.04]	-2.76	.006	0.10	[0.01, 0.19]	2.08	.038
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.21]	-10.75	$<$ .001	0.20	[0.16, 0.25]	8.56	$<$ .001
Personal Contact (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	0.00	[-0.09, 0.09]	0.00	.999	0.00	[-0.09, 0.09]	0.08	.934

Table S8 continued

Parameter	Positive Affect (PA)				Negative Affect (NA)			
	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Personal Contact (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	-0.03	[-0.06, 0.01]	-1.26	.206	0.02	[-0.02, 0.06]	0.76	.449
Personal Contact (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	-0.03	[-0.06, 0.01]	-1.51	.131	0.01	[-0.03, 0.04]	0.37	.711
Personal Contact (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.02	[-0.02, 0.05]	1.09	.274	-0.04	[-0.07, 0.00]	-2.08	.037

Note. Four models were computed for each of the two affect outcomes (PA, NA): First, an unrestricted model with all available observations (N = 306, $N_{episodes}$ = 4524). Second, a model with the same variables but restricted to assessments where desire to be alone was assessed (when in momentary contact; N = 299, $N_{episodes}$ = 2571). Third, the model with desire to be alone added. Fourth, the model with added interaction terms of personal contact and desire to be alone. CI = confidence interval, WP = within-person effect, Desire Alone = desire to be alone.

Table S9

Fixed Effects of Personal Contact Duration and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	69.72	$< .001$	2.10	[1.97, 2.22]	32.53	$< .001$
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.03]	-1.02	.307	-0.09	[-0.15, -0.04]	-3.24	.001
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.12]	-0.64	.525	-0.19	[-0.36, -0.02]	-2.14	.033
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.52	.001	-0.01	[-0.01, 0.00]	-1.91	.057
Personal Contact (BP), $\hat{\gamma}_{03}$	0.11	[0.03, 0.20]	2.57	.011	-0.07	[-0.15, 0.01]	-1.62	.107
Personal Contact (WP), $\hat{\gamma}_{10}$	0.09	[0.06, 0.12]	6.38	$< .001$	-0.02	[-0.05, 0.00]	-1.98	.048
Restricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.63	[4.46, 4.80]	53.99	$< .001$	2.12	[1.96, 2.28]	26.06	$< .001$
Weekend, $\hat{\gamma}_{20}$	-0.05	[-0.14, 0.04]	-1.19	.233	-0.07	[-0.15, 0.01]	-1.75	.081
Female, $\hat{\gamma}_{01}$	-0.14	[-0.35, 0.06]	-1.36	.174	-0.13	[-0.33, 0.07]	-1.25	.211
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.53	$< .001$	-0.01	[-0.01, 0.00]	-1.96	.051
Personal Contact (BP), $\hat{\gamma}_{03}$	0.08	[-0.03, 0.20]	1.43	.155	-0.04	[-0.15, 0.07]	-0.74	.462
Personal Contact (WP), $\hat{\gamma}_{10}$	0.04	[-0.04, 0.12]	1.00	.316	0.05	[-0.03, 0.12]	1.15	.251
Adding Social Desire Variables								
Intercept, $\hat{\gamma}_{00}$	4.59	[4.43, 4.75]	55.05	$< .001$	2.13	[1.97, 2.29]	26.32	$< .001$
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.05]	-0.71	.480	-0.08	[-0.16, 0.00]	-1.96	.050
Female, $\hat{\gamma}_{01}$	-0.10	[-0.30, 0.11]	-0.91	.361	-0.14	[-0.34, 0.06]	-1.36	.173
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.53	$< .001$	-0.01	[-0.01, 0.00]	-1.89	.059
Personal Contact (BP), $\hat{\gamma}_{03}$	0.09	[-0.02, 0.20]	1.58	.114	-0.05	[-0.15, 0.06]	-0.85	.398
Personal Contact (WP), $\hat{\gamma}_{10}$	0.04	[-0.04, 0.11]	0.99	.322	0.04	[-0.03, 0.12]	1.12	.264
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.05, 0.26]	2.86	.005	-0.07	[-0.17, 0.03]	-1.30	.195
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.19	$< .001$	-0.05	[-0.09, -0.01]	-2.33	.020
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.60	[4.43, 4.76]	54.37	$< .001$	2.13	[1.97, 2.29]	26.30	$< .001$
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	-0.69	.488	-0.08	[-0.16, 0.00]	-2.02	.044
Female, $\hat{\gamma}_{01}$	-0.10	[-0.31, 0.10]	-0.99	.324	-0.14	[-0.34, 0.06]	-1.35	.177
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.54	$< .001$	-0.01	[-0.01, 0.00]	-1.92	.056
Personal Contact (BP), $\hat{\gamma}_{03}$	0.10	[-0.02, 0.21]	1.70	.091	-0.05	[-0.15, 0.06]	-0.83	.405
Personal Contact (WP), $\hat{\gamma}_{10}$	0.04	[-0.04, 0.12]	1.02	.309	0.05	[-0.03, 0.12]	1.20	.231
Desire Contact (BP), $\hat{\gamma}_{04}$	0.13	[0.01, 0.25]	2.08	.038	-0.10	[-0.22, 0.02]	-1.63	.103

Table S9 continued

Parameter	Positive Affect (PA)				Negative Affect (NA)			
	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Desire Contact (WP), $\hat{\gamma}_{20}$	0.17	[0.08, 0.26]	3.74	$< .001$	-0.11	[-0.19, -0.04]	-3.12	.002
Personal Contact (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.02	[-0.09, 0.14]	0.40	.688	-0.01	[-0.12, 0.10]	-0.24	.813
Personal Contact (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.02	[-0.05, 0.09]	0.59	.559	-0.05	[-0.10, 0.01]	-1.65	.098
Personal Contact (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	-0.03	[-0.11, 0.05]	-0.79	.430	-0.04	[-0.11, 0.03]	-1.07	.285
Personal Contact (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.04	[-0.05, 0.13]	0.95	.343	-0.08	[-0.15, 0.00]	-2.01	.045

Note. Four models were computed for each of the two affect outcomes (PA, NA): First, an unrestricted model with all available observations ($N = 306$, $N_{episodes} = 4524$). Second, a model with the same variables but restricted to assessments where desire for social contact was assessed (when not in momentary contact; $N = 292$, $N_{episodes} = 1934$). Third, the model with desire for social contact added. Fourth, the model with added interaction terms of personal contact and desire for social contact. CI = confidence interval, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Table S10

Fixed Effects of Personal Contact Duration and Social Desire on Momentary Affect.

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	69.72	$< .001$	2.10	[1.97, 2.22]	32.53	$< .001$
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.10, 0.03]	-1.02	.307	-0.09	[-0.15, -0.04]	-3.24	.001
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.12]	-0.64	.525	-0.19	[-0.36, -0.02]	-2.14	.033
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.52	.001	-0.01	[-0.01, 0.00]	-1.91	.057
Personal Contact (BP), $\hat{\gamma}_{03}$	0.11	[0.03, 0.20]	2.57	.011	-0.07	[-0.15, 0.01]	-1.62	.107
Personal Contact (WP), $\hat{\gamma}_{10}$	0.09	[0.06, 0.12]	6.38	$< .001$	-0.02	[-0.05, 0.00]	-1.98	.048
Adding Social Desire Variables								
Intercept, $\hat{\gamma}_{00}$	4.65	[4.52, 4.78]	71.16	$< .001$	2.09	[1.96, 2.21]	33.04	$< .001$
Weekend, $\hat{\gamma}_{30}$	-0.02	[-0.08, 0.04]	-0.51	.608	-0.11	[-0.16, -0.05]	-3.93	$< .001$
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.12]	-0.61	.542	-0.15	[-0.32, 0.01]	-1.80	.073
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.48	.001	0.00	[-0.01, 0.00]	-1.57	.118
Personal Contact (BP), $\hat{\gamma}_{03}$	0.05	[-0.04, 0.15]	1.10	.271	-0.04	[-0.13, 0.05]	-0.88	.378
Personal Contact (WP), $\hat{\gamma}_{10}$	0.01	[-0.01, 0.04]	1.02	.309	0.02	[0.00, 0.05]	1.71	.088
Social Desire (BP), $\hat{\gamma}_{04}$	0.16	[0.06, 0.26]	3.28	.001	-0.10	[-0.19, -0.01]	-2.14	.033
Social Desire (WP), $\hat{\gamma}_{20}$	0.22	[0.18, 0.25]	12.44	$< .001$	-0.14	[-0.17, -0.11]	-8.78	$< .001$
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.65	[4.51, 4.78]	69.00	$< .001$	2.09	[1.96, 2.22]	31.95	$< .001$
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.07, 0.04]	-0.49	.622	-0.11	[-0.16, -0.05]	-3.88	$< .001$
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.68	.498	-0.14	[-0.31, 0.03]	-1.66	.097
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.51	.001	0.00	[-0.01, 0.00]	-1.53	.126
Personal Contact (BP), $\hat{\gamma}_{03}$	0.05	[-0.05, 0.14]	0.98	.328	-0.02	[-0.12, 0.07]	-0.49	.626
Personal Contact (WP), $\hat{\gamma}_{10}$	0.01	[-0.02, 0.04]	0.86	.389	0.03	[0.00, 0.05]	2.12	.034
Social Desire (BP), $\hat{\gamma}_{04}$	0.16	[0.06, 0.25]	3.19	.002	-0.09	[-0.19, 0.00]	-1.97	.050
Social Desire (WP), $\hat{\gamma}_{20}$	0.21	[0.18, 0.25]	12.16	$< .001$	-0.13	[-0.16, -0.10]	-8.53	$< .001$
Personal Contact (BP) * Social Desire (BP), $\hat{\gamma}_{05}$	0.00	[-0.08, 0.09]	0.10	.918	-0.01	[-0.09, 0.07]	-0.20	.845
Personal Contact (BP) * Social Desire (WP), $\hat{\gamma}_{21}$	0.02	[-0.02, 0.05]	0.99	.321	-0.02	[-0.05, 0.01]	-1.29	.198
Personal Contact (WP) * Social Desire (BP), $\hat{\gamma}_{11}$	0.02	[-0.01, 0.05]	1.24	.215	-0.02	[-0.04, 0.01]	-1.31	.189

Table S10 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Personal Contact (WP) * Social Desire (WP), $\hat{\gamma}_{30}$	0.02	[0.00, 0.05]	1.82	.069	-0.03	[-0.05, 0.00]	-2.29	.022

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, an unrestricted model with all available observations. Second, a model with composite social desire added. Third, the model with added interaction terms of personal contact and social desire. CI = confidence interval, BP = between-person effect, WP = within-person effect.

Table S11

Fixed Effects of Detected Conversations and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
AWARE Subsample								
Intercept, $\hat{\gamma}_{00}$	4.67	[4.53, 4.81]	65.55	$< .001$	2.08	[1.94, 2.22]	29.50	$< .001$
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.10, 0.06]	-0.42	.675	-0.05	[-0.13, 0.02]	-1.50	.133
Female, $\hat{\gamma}_{01}$	-0.08	[-0.27, 0.11]	-0.84	.402	-0.20	[-0.39, -0.01]	-2.09	.038
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	2.74	.007	0.00	[-0.01, 0.00]	-1.06	.290
Conv. (BP), $\hat{\gamma}_{03}$	0.06	[-0.04, 0.15]	1.18	.241	-0.05	[-0.15, 0.04]	-1.05	.295
Conv. (WP), $\hat{\gamma}_{10}$	0.07	[0.04, 0.09]	4.66	$< .001$	0.00	[-0.03, 0.03]	-0.15	.884
Adding Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.76	[4.62, 4.90]	65.66	$< .001$	2.03	[1.89, 2.17]	28.44	$< .001$
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.06]	-0.69	.490	-0.05	[-0.14, 0.03]	-1.25	.211
Female, $\hat{\gamma}_{01}$	-0.09	[-0.29, 0.10]	-0.95	.343	-0.16	[-0.35, 0.03]	-1.68	.094
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	2.66	.008	0.00	[-0.01, 0.00]	-0.77	.440
Conv. (BP), $\hat{\gamma}_{03}$	0.04	[-0.06, 0.13]	0.75	.455	-0.03	[-0.12, 0.06]	-0.63	.532
Conv. (WP), $\hat{\gamma}_{10}$	0.05	[0.02, 0.09]	3.01	.003	0.00	[-0.04, 0.03]	-0.27	.784
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.07]	-3.34	.001	0.11	[0.01, 0.21]	2.26	.025
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.31, -0.21]	-10.74	$< .001$	0.20	[0.16, 0.25]	8.30	$< .001$
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.76	[4.62, 4.91]	65.83	$< .001$	2.04	[1.90, 2.18]	28.51	$< .001$
Weekend, $\hat{\gamma}_{40}$	-0.04	[-0.13, 0.06]	-0.75	.456	-0.06	[-0.15, 0.02]	-1.49	.137
Female, $\hat{\gamma}_{01}$	-0.10	[-0.30, 0.09]	-1.06	.288	-0.15	[-0.34, 0.04]	-1.53	.126
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	2.72	.007	0.00	[-0.01, 0.00]	-0.91	.365
Conv. (BP), $\hat{\gamma}_{03}$	0.02	[-0.07, 0.12]	0.47	.638	-0.01	[-0.11, 0.08]	-0.26	.795
Conv. (WP), $\hat{\gamma}_{10}$	0.05	[0.02, 0.09]	2.78	.006	0.00	[-0.03, 0.04]	0.24	.812
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.18	[-0.28, -0.08]	-3.54	$< .001$	0.12	[0.02, 0.21]	2.36	.019
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.31, -0.21]	-10.48	$< .001$	0.20	[0.15, 0.25]	8.00	$< .001$
Conv. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.04	[-0.15, 0.06]	-0.85	.397	0.05	[-0.05, 0.15]	0.97	.334
Conv. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	-0.02	[-0.06, 0.03]	-0.66	.511	0.01	[-0.03, 0.06]	0.53	.593
Conv. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.02	[-0.02, 0.06]	1.05	.294	0.00	[-0.04, 0.04]	0.13	.897

Table S11 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Conv. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.00	[-0.04, 0.04]	0.09	.926	0.02	[-0.02, 0.06]	1.11	.265

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model containing all ESM episodes with 5 or more AWARE Conversations samplings (3198 episodes, 279 participants). Second, a model with desire to be alone added and restricted to assessments when in momentary contact (1773 episodes, 260 participants). Third, a model with added interaction terms of detected conversations and desire to be alone. CI = confidence interval, BP = between-person effect, WP = within-person effect, Conv. = proportion of detected conversations in an episode, Desire Alone = desire to be alone.

Table S12

Fixed Effects of Detected Conversations and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
AWARE Subsample								
Intercept, $\hat{\gamma}_{00}$	4.67	[4.53, 4.81]	65.55	$<$ .001	2.08	[1.94, 2.22]	29.50	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.10, 0.06]	-0.42	.675	-0.05	[-0.13, 0.02]	-1.50	.133
Female, $\hat{\gamma}_{01}$	-0.08	[-0.27, 0.11]	-0.84	.402	-0.20	[-0.39, -0.01]	-2.09	.038
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	2.74	.007	0.00	[-0.01, 0.00]	-1.06	.290
Conv. (BP), $\hat{\gamma}_{03}$	0.06	[-0.04, 0.15]	1.18	.241	-0.05	[-0.15, 0.04]	-1.05	.295
Conv. (WP), $\hat{\gamma}_{10}$	0.07	[0.04, 0.09]	4.66	$<$ .001	0.00	[-0.03, 0.03]	-0.15	.884
Adding Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.56	[4.40, 4.73]	54.53	$<$ .001	2.10	[1.94, 2.26]	25.95	$<$ .001
Weekend, $\hat{\gamma}_{30}$	0.02	[-0.09, 0.12]	0.30	.763	-0.07	[-0.16, 0.03]	-1.41	.159
Female, $\hat{\gamma}_{01}$	-0.09	[-0.32, 0.14]	-0.76	.449	-0.20	[-0.42, 0.02]	-1.80	.073
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	2.34	.020	0.00	[-0.01, 0.00]	-0.82	.415
Conv. (BP), $\hat{\gamma}_{03}$	0.06	[-0.05, 0.18]	1.12	.263	-0.09	[-0.20, 0.02]	-1.61	.109
Conv. (WP), $\hat{\gamma}_{10}$	0.02	[-0.03, 0.07]	0.78	.433	0.03	[-0.02, 0.08]	1.08	.280
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.27]	2.61	.010	-0.07	[-0.18, 0.04]	-1.21	.228
Desire Contact (WP), $\hat{\gamma}_{20}$	0.12	[0.07, 0.18]	4.36	$<$ .001	-0.05	[-0.10, -0.01]	-2.26	.024
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.56	[4.40, 4.72]	54.56	$<$ .001	2.11	[1.95, 2.26]	26.00	$<$ .001
Weekend, $\hat{\gamma}_{40}$	0.02	[-0.08, 0.12]	0.41	.679	-0.07	[-0.17, 0.02]	-1.51	.131
Female, $\hat{\gamma}_{01}$	-0.08	[-0.31, 0.14]	-0.72	.471	-0.21	[-0.43, 0.01]	-1.87	.063
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	2.36	.019	0.00	[-0.01, 0.00]	-0.82	.416
Conv. (BP), $\hat{\gamma}_{03}$	0.06	[-0.06, 0.17]	0.99	.323	-0.07	[-0.18, 0.03]	-1.33	.184
Conv. (WP), $\hat{\gamma}_{10}$	0.03	[-0.02, 0.08]	1.26	.208	0.02	[-0.03, 0.07]	0.77	.444
Desire Contact (BP), $\hat{\gamma}_{04}$	0.16	[0.04, 0.27]	2.67	.008	-0.07	[-0.18, 0.04]	-1.22	.222
Desire Contact (WP), $\hat{\gamma}_{20}$	0.12	[0.07, 0.18]	4.50	$<$ .001	-0.05	[-0.09, 0.00]	-2.06	.040
Conv. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.06	[-0.05, 0.17]	1.05	.295	0.02	[-0.09, 0.13]	0.40	.690
Conv. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.03	[-0.02, 0.09]	1.20	.230	-0.03	[-0.08, 0.01]	-1.34	.179

Table S12 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Conv. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	-0.03	[-0.07, 0.02]	-1.03	.301	-0.02	[-0.07, 0.02]	-0.92	.356
Conv. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	-0.01	[-0.05, 0.04]	-0.23	.814	0.02	[-0.02, 0.07]	0.99	.322

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model containing all ESM episodes with 5 or more AWARE Conversations samplings (3198 episodes, 279 participants). Second, a model with desire for social contact added and restricted to assessments when not in momentary contact (1410 episodes, 260 participants). Third, a model with added interaction terms of detected conversations and desire for social contact. CI = confidence interval, Conv. = proportion of detected conversations in an episode, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Table S13

Fixed Effects of the Number of Calls, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.76	[4.63, 4.89]	< .001	2.03	[1.90, 2.15]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.08, 0.07]	.845	-0.09	[-0.16, -0.03]	.006
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	.470	-0.13	[-0.30, 0.03]	.114
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	< .001	0.00	[-0.01, 0.00]	.149
Calls (BP), $\hat{\gamma}_{03}$	-0.05	[-0.13, 0.03]	.218	0.02	[-0.06, 0.10]	.643
Calls (WP), $\hat{\gamma}_{10}$	0.01	[-0.03, 0.04]	.689	0.02	[-0.01, 0.06]	.156
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	< .001	0.11	[0.03, 0.20]	.007
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	< .001	0.19	[0.15, 0.23]	< .001
Calls (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	0.04	[-0.05, 0.13]	.420	0.04	[-0.04, 0.13]	.329
Calls (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.02	[-0.02, 0.06]	.388	-0.02	[-0.06, 0.02]	.329
Calls (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.04	[0.00, 0.08]	.037	-0.01	[-0.05, 0.02]	.531
Calls (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.03	[-0.01, 0.06]	.168	-0.02	[-0.05, 0.01]	.266
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.57	[4.42, 4.72]	< .001	2.09	[1.95, 2.24]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	.475	-0.07	[-0.15, 0.01]	.073
Female, $\hat{\gamma}_{01}$	-0.11	[-0.32, 0.09]	.277	-0.13	[-0.33, 0.07]	.192
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	< .001	-0.01	[-0.01, 0.00]	.074
Calls (BP), $\hat{\gamma}_{03}$	-0.01	[-0.12, 0.10]	.861	0.02	[-0.08, 0.13]	.690
Calls (WP), $\hat{\gamma}_{10}$	0.02	[-0.02, 0.07]	.279	0.02	[-0.03, 0.06]	.451
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.05, 0.25]	.005	-0.06	[-0.16, 0.04]	.219
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	< .001	-0.05	[-0.09, -0.01]	.019
Calls (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	-0.07	[-0.16, 0.01]	.074	0.02	[-0.06, 0.10]	.557
Calls (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.01	[-0.04, 0.06]	.654	0.00	[-0.04, 0.04]	.858
Calls (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.00	[-0.04, 0.04]	.905	-0.01	[-0.05, 0.03]	.631
Calls (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	-0.01	[-0.05, 0.03]	.728	0.01	[-0.03, 0.05]	.535

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S19 and S20. CI = confidence interval, Calls = number of calls in an episode, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Table S14

Fixed Effects of Call Duration, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.89]	< .001	2.02	[1.89, 2.15]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	.710	-0.09	[-0.16, -0.02]	.008
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	.483	-0.12	[-0.29, 0.05]	.156
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.001	0.00	[-0.01, 0.00]	.131
Call Duration (BP), $\hat{\gamma}_{03}$	0.01	[-0.07, 0.10]	.762	0.00	[-0.08, 0.08]	.961
Call Duration (WP), $\hat{\gamma}_{10}$	0.01	[-0.02, 0.04]	.634	0.03	[0.00, 0.07]	.079
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	< .001	0.11	[0.03, 0.20]	.008
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	< .001	0.19	[0.15, 0.23]	< .001
Call Duration (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.01	[-0.09, 0.08]	.873	0.04	[-0.04, 0.12]	.361
Call Duration (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.02	[-0.01, 0.06]	.207	-0.03	[-0.07, 0.00]	.081
Call Duration (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.01	[-0.03, 0.04]	.631	0.00	[-0.04, 0.04]	.872
Call Duration (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.00	[-0.03, 0.03]	.995	0.00	[-0.05, 0.04]	.835
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.57	[4.42, 4.72]	< .001	2.09	[1.94, 2.24]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	.458	-0.07	[-0.15, 0.01]	.075
Female, $\hat{\gamma}_{01}$	-0.12	[-0.32, 0.09]	.264	-0.13	[-0.33, 0.07]	.198
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	< .001	-0.01	[-0.01, 0.00]	.050
Call Duration (BP), $\hat{\gamma}_{03}$	0.03	[-0.08, 0.13]	.629	-0.04	[-0.14, 0.07]	.463
Call Duration (WP), $\hat{\gamma}_{10}$	0.03	[-0.01, 0.07]	.124	0.02	[-0.02, 0.06]	.324
Desire Contact (BP), $\hat{\gamma}_{04}$	0.14	[0.04, 0.25]	.007	-0.06	[-0.16, 0.04]	.240
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	< .001	-0.05	[-0.09, -0.01]	.025
Call Duration (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	-0.12	[-0.22, -0.02]	.019	0.07	[-0.02, 0.17]	.145
Call Duration (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.01	[-0.04, 0.06]	.740	0.01	[-0.04, 0.05]	.765
Call Duration (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.01	[-0.04, 0.05]	.746	-0.01	[-0.05, 0.03]	.527
Call Duration (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.01	[-0.05, 0.07]	.694	0.01	[-0.05, 0.08]	.654

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S21 and S22. CI = confidence interval, Call Duration = duration of all calls in an episode, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Table S15

Fixed Effects of Communication App Usage Frequency, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	$<$ .001	2.02	[1.89, 2.14]	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	.748	-0.09	[-0.16, -0.03]	.006
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	.473	-0.10	[-0.27, 0.06]	.228
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.001	0.00	[-0.01, 0.00]	.142
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.03	[-0.06, 0.12]	.534	0.06	[-0.03, 0.15]	.197
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.03]	.886	0.02	[-0.01, 0.05]	.241
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	$<$ .001	0.12	[0.04, 0.21]	.004
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	$<$ .001	0.19	[0.15, 0.23]	$<$ .001
Comm. Freq. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.03	[-0.12, 0.07]	.586	0.05	[-0.04, 0.14]	.261
Comm. Freq. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.00	[-0.04, 0.04]	.922	0.01	[-0.03, 0.05]	.590
Comm. Freq. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	-0.01	[-0.05, 0.02]	.461	0.01	[-0.02, 0.04]	.671
Comm. Freq. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.01	[-0.03, 0.04]	.671	0.01	[-0.02, 0.04]	.622
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	$<$ .001	2.12	[1.98, 2.27]	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	.467	-0.08	[-0.16, 0.00]	.054
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	.375	-0.17	[-0.37, 0.03]	.089
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	$<$ .001	-0.01	[-0.01, 0.00]	.079
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.05	[-0.06, 0.15]	.390	0.06	[-0.04, 0.17]	.215
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.03]	.985	0.04	[0.00, 0.07]	.030
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	.007	-0.07	[-0.17, 0.03]	.146
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	$<$ .001	-0.05	[-0.09, -0.01]	.011
Comm. Freq. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.00	[-0.10, 0.11]	.929	-0.05	[-0.15, 0.05]	.325
Comm. Freq. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	-0.01	[-0.06, 0.04]	.627	0.01	[-0.02, 0.05]	.460
Comm. Freq. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.02	[-0.02, 0.05]	.300	-0.01	[-0.05, 0.02]	.477
Comm. Freq. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	-0.02	[-0.05, 0.02]	.337	-0.02	[-0.05, 0.01]	.244

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S23 and S24. CI = confidence interval, Comm. Freq. = number of usage sessions of communication apps in an episode, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Table S16

Fixed Effects of Communication App Usage Duration, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.76	[4.63, 4.89]	< .001	2.02	[1.90, 2.15]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	.730	-0.10	[-0.16, -0.03]	.004
Female, $\hat{\gamma}_{01}$	-0.08	[-0.26, 0.10]	.387	-0.11	[-0.28, 0.06]	.203
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.001	0.00	[-0.01, 0.00]	.139
Comm. Dur. (BP), $\hat{\gamma}_{03}$	0.00	[-0.09, 0.09]	.968	0.06	[-0.02, 0.15]	.163
Comm. Dur. (WP), $\hat{\gamma}_{10}$	0.02	[-0.02, 0.05]	.362	0.03	[-0.01, 0.07]	.102
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.18	[-0.26, -0.09]	< .001	0.12	[0.04, 0.21]	.004
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	< .001	0.19	[0.15, 0.23]	< .001
Comm. Dur. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.03	[-0.12, 0.06]	.565	0.06	[-0.02, 0.15]	.153
Comm. Dur. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.02	[-0.02, 0.06]	.282	-0.02	[-0.05, 0.02]	.392
Comm. Dur. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.00	[-0.03, 0.04]	.842	0.00	[-0.04, 0.03]	.849
Comm. Dur. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.01	[-0.03, 0.05]	.526	-0.01	[-0.05, 0.04]	.754
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.54	[4.39, 4.70]	< .001	2.12	[1.97, 2.26]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.02	[-0.11, 0.06]	.576	-0.09	[-0.17, -0.01]	.033
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.12]	.389	-0.16	[-0.36, 0.04]	.117
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	.001	-0.01	[-0.01, 0.00]	.066
Comm. Dur. (BP), $\hat{\gamma}_{03}$	0.02	[-0.08, 0.12]	.713	0.07	[-0.03, 0.16]	.178
Comm. Dur. (WP), $\hat{\gamma}_{10}$	0.01	[-0.03, 0.04]	.751	0.03	[-0.01, 0.07]	.161
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	.005	-0.08	[-0.18, 0.02]	.126
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	< .001	-0.05	[-0.08, -0.01]	.026
Comm. Dur. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.00	[-0.11, 0.12]	.957	-0.09	[-0.19, 0.02]	.128
Comm. Dur. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.03	[-0.02, 0.07]	.294	0.01	[-0.03, 0.05]	.514
Comm. Dur. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.00	[-0.04, 0.03]	.789	0.00	[-0.04, 0.03]	.827
Comm. Dur. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.01	[-0.03, 0.06]	.513	-0.02	[-0.07, 0.03]	.508

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S25 and S26. CI = confidence interval, Comm. Dur. = duration of all usage sessions of communication apps in an episode, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Table S17

Fixed Effects of Social Media App Usage Frequency, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	< .001	2.01	[1.89, 2.14]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	.711	-0.09	[-0.15, -0.02]	.009
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	.495	-0.11	[-0.28, 0.05]	.189
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.001	0.00	[-0.01, 0.00]	.218
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.02	[-0.11, 0.07]	.740	0.07	[-0.02, 0.16]	.106
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.05, 0.04]	.907	-0.01	[-0.05, 0.03]	.602
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.08]	< .001	0.10	[0.02, 0.19]	.017
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	< .001	0.19	[0.15, 0.23]	< .001
SocMed. Freq. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.03	[-0.15, 0.09]	.634	-0.06	[-0.17, 0.06]	.339
SocMed. Freq. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	-0.01	[-0.04, 0.03]	.790	0.03	[-0.01, 0.07]	.115
SocMed. Freq. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.04	[-0.01, 0.09]	.168	-0.01	[-0.06, 0.03]	.573
SocMed. Freq. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.00	[-0.03, 0.04]	.772	0.00	[-0.04, 0.04]	.997
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	< .001	2.10	[1.96, 2.24]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.04	[-0.12, 0.04]	.356	-0.07	[-0.15, 0.00]	.066
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	.368	-0.13	[-0.32, 0.07]	.203
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	< .001	-0.01	[-0.01, 0.00]	.080
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.02	[-0.13, 0.08]	.654	0.10	[0.00, 0.20]	.059
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	-0.02	[-0.05, 0.02]	.318	0.00	[-0.04, 0.04]	.997
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	.006	-0.07	[-0.17, 0.03]	.184
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	< .001	-0.05	[-0.08, -0.01]	.017
SocMed. Freq. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.07	[-0.06, 0.20]	.314	-0.12	[-0.25, 0.00]	.059
SocMed. Freq. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.02	[-0.03, 0.07]	.395	-0.02	[-0.06, 0.02]	.318
SocMed. Freq. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.01	[-0.03, 0.05]	.740	0.02	[-0.02, 0.06]	.243
SocMed. Freq. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.03	[-0.02, 0.07]	.249	-0.04	[-0.09, 0.01]	.082

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S27 and S28. CI = confidence interval, SocMed. Freq. = number of usage sessions of social media apps in an episode, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Table S18

Fixed Effects of Social Media App Usage Duration, Social Desire, and their Interaction on Momentary Affect.

	Positive Affect (PA)			Negative Affect (NA)		
Parameter	$\hat{\gamma}$	95% CI	p	$\hat{\gamma}$	95% CI	p
Desire to be Alone						
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	< .001	2.02	[1.89, 2.15]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.02	[-0.09, 0.06]	.655	-0.09	[-0.16, -0.03]	.005
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.12]	.502	-0.12	[-0.28, 0.05]	.170
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.001	0.00	[-0.01, 0.00]	.153
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.08	[-0.17, 0.01]	.100	0.06	[-0.03, 0.15]	.185
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.06, 0.03]	.485	0.00	[-0.04, 0.04]	.949
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	< .001	0.11	[0.03, 0.20]	.010
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	< .001	0.19	[0.15, 0.23]	< .001
SocMed. Dur. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.05	[-0.15, 0.05]	.347	-0.02	[-0.12, 0.07]	.655
SocMed. Dur. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.00	[-0.04, 0.04]	.884	0.03	[-0.01, 0.06]	.172
SocMed. Dur. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.04	[-0.01, 0.08]	.111	-0.01	[-0.05, 0.03]	.679
SocMed. Dur. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.01	[-0.02, 0.04]	.415	-0.01	[-0.05, 0.02]	.506
Desire for Social Contact						
Intercept, $\hat{\gamma}_{00}$	4.54	[4.39, 4.69]	< .001	2.12	[1.97, 2.26]	< .001
Weekend, $\hat{\gamma}_{40}$	-0.04	[-0.12, 0.05]	.399	-0.07	[-0.15, 0.00]	.065
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	.376	-0.16	[-0.36, 0.03]	.105
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	.001	-0.01	[-0.01, 0.00]	.106
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.15	[-0.26, -0.04]	.009	0.14	[0.04, 0.25]	.009
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.05, 0.02]	.357	0.00	[-0.02, 0.03]	.764
Desire Contact (BP), $\hat{\gamma}_{04}$	0.14	[0.04, 0.25]	.006	-0.06	[-0.16, 0.04]	.245
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.17]	< .001	-0.04	[-0.08, -0.01]	.026
SocMed. Dur. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.04	[-0.07, 0.15]	.506	-0.05	[-0.16, 0.05]	.328
SocMed. Dur. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.01	[-0.04, 0.07]	.617	0.00	[-0.04, 0.04]	.913
SocMed. Dur. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.00	[-0.03, 0.03]	.862	0.02	[-0.01, 0.05]	.127
SocMed. Dur. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.02	[-0.01, 0.06]	.251	-0.03	[-0.06, 0.01]	.124

Note. Separate models were computed for each of the two affect outcomes (PA, NA). For the complete model building strategy, see Tables S29 and S30. CI = confidence interval, SocMed. Dur. = duration of all usage sessions of social media apps in an episode, BP = between-person effect, WP = within-person effect, Desire Alone = desire to be alone, Desire Contact = desire for social contact.

Table S19

Fixed Effects of the Number of Calls and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	69.38	$<$ .001	2.09	[1.97, 2.22]	32.33	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.09, 0.04]	-0.65	.513	-0.09	[-0.15, -0.03]	-3.15	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.12]	-0.61	.545	-0.19	[-0.37, -0.02]	-2.19	.029
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.48	.001	-0.01	[-0.01, 0.00]	-1.83	.069
Calls (BP), $\hat{\gamma}_{03}$	-0.04	[-0.12, 0.04]	-0.89	.376	0.03	[-0.05, 0.11]	0.76	.449
Calls (WP), $\hat{\gamma}_{10}$	0.01	[-0.01, 0.04]	0.97	.331	0.02	[0.00, 0.05]	1.92	.055
Adding Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.76	[4.63, 4.89]	71.11	$<$ .001	2.02	[1.90, 2.15]	31.60	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.01	[-0.08, 0.07]	-0.20	.840	-0.09	[-0.16, -0.03]	-2.78	.005
Female, $\hat{\gamma}_{01}$	-0.07	[-0.24, 0.11]	-0.74	.462	-0.13	[-0.29, 0.04]	-1.50	.134
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.61	$<$ .001	0.00	[-0.01, 0.00]	-1.53	.128
Calls (BP), $\hat{\gamma}_{03}$	-0.05	[-0.13, 0.03]	-1.31	.193	0.03	[-0.04, 0.11]	0.82	.416
Calls (WP), $\hat{\gamma}_{10}$	0.01	[-0.03, 0.05]	0.54	.591	0.02	[-0.02, 0.05]	1.03	.303
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.19	[-0.27, -0.10]	-4.22	$<$ .001	0.12	[0.04, 0.20]	2.80	.005
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-13.19	$<$ .001	0.19	[0.15, 0.23]	9.53	$<$ .001
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.76	[4.63, 4.89]	71.05	$<$ .001	2.03	[1.90, 2.15]	31.66	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.08, 0.07]	-0.20	.845	-0.09	[-0.16, -0.03]	-2.74	.006
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.72	.470	-0.13	[-0.30, 0.03]	-1.58	.114
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.61	$<$ .001	0.00	[-0.01, 0.00]	-1.45	.149
Calls (BP), $\hat{\gamma}_{03}$	-0.05	[-0.13, 0.03]	-1.23	.218	0.02	[-0.06, 0.10]	0.46	.643
Calls (WP), $\hat{\gamma}_{10}$	0.01	[-0.03, 0.04]	0.40	.689	0.02	[-0.01, 0.06]	1.42	.156
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	-3.94	$<$ .001	0.11	[0.03, 0.20]	2.70	.007
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-13.16	$<$ .001	0.19	[0.15, 0.23]	9.60	$<$ .001
Calls (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	0.04	[-0.05, 0.13]	0.81	.420	0.04	[-0.04, 0.13]	0.98	.329
Calls (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.02	[-0.02, 0.06]	0.86	.388	-0.02	[-0.06, 0.02]	-0.98	.329
Calls (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.04	[0.00, 0.08]	2.08	.037	-0.01	[-0.05, 0.02]	-0.63	.531

Table S19 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Calls (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.03	[-0.01, 0.06]	1.38	.168	-0.02	[-0.05, 0.01]	-1.11	.266

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire to be alone added and restricted to assessments when in momentary contact (2571 episodes, 299 participants). Third, a model with added interaction terms of number of calls and desire to be alone. CI = confidence interval, BP = between-person effect, WP = within-person effect, Calls = number of calls in an episode, Desire Alone = desire to be alone.

Table S20

Fixed Effects of the Number of Calls and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	69.38	$<$ .001	2.09	[1.97, 2.22]	32.33	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.09, 0.04]	-0.65	.513	-0.09	[-0.15, -0.03]	-3.15	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.12]	-0.61	.545	-0.19	[-0.37, -0.02]	-2.19	.029
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.48	.001	-0.01	[-0.01, 0.00]	-1.83	.069
Calls (BP), $\hat{\gamma}_{03}$	-0.04	[-0.12, 0.04]	-0.89	.376	0.03	[-0.05, 0.11]	0.76	.449
Calls (WP), $\hat{\gamma}_{10}$	0.01	[-0.01, 0.04]	0.97	.331	0.02	[0.00, 0.05]	1.92	.055
Adding Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	58.97	$<$ .001	2.10	[1.96, 2.25]	28.16	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.05]	-0.70	.482	-0.07	[-0.15, 0.01]	-1.72	.086
Female, $\hat{\gamma}_{01}$	-0.10	[-0.30, 0.11]	-0.92	.356	-0.15	[-0.35, 0.05]	-1.49	.138
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.46	.001	-0.01	[-0.01, 0.00]	-1.92	.055
Calls (BP), $\hat{\gamma}_{03}$	-0.05	[-0.15, 0.04]	-1.10	.273	0.04	[-0.06, 0.13]	0.77	.444
Calls (WP), $\hat{\gamma}_{10}$	0.02	[-0.02, 0.06]	1.02	.309	0.02	[-0.02, 0.05]	0.92	.358
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.05, 0.25]	2.86	.005	-0.07	[-0.17, 0.04]	-1.28	.201
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.18	$<$ .001	-0.04	[-0.07, -0.01]	-2.38	.017
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.57	[4.42, 4.72]	59.08	$<$ .001	2.09	[1.95, 2.24]	27.91	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	-0.71	.475	-0.07	[-0.15, 0.01]	-1.79	.073
Female, $\hat{\gamma}_{01}$	-0.11	[-0.32, 0.09]	-1.09	.277	-0.13	[-0.33, 0.07]	-1.31	.192
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.65	$<$ .001	-0.01	[-0.01, 0.00]	-1.80	.074
Calls (BP), $\hat{\gamma}_{03}$	-0.01	[-0.12, 0.10]	-0.18	.861	0.02	[-0.08, 0.13]	0.40	.690
Calls (WP), $\hat{\gamma}_{10}$	0.02	[-0.02, 0.07]	1.08	.279	0.02	[-0.03, 0.06]	0.75	.451
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.05, 0.25]	2.83	.005	-0.06	[-0.16, 0.04]	-1.23	.219
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.17	$<$ .001	-0.05	[-0.09, -0.01]	-2.34	.019
Calls (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	-0.07	[-0.16, 0.01]	-1.79	.074	0.02	[-0.06, 0.10]	0.59	.557
Calls (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.01	[-0.04, 0.06]	0.45	.654	0.00	[-0.04, 0.04]	0.18	.858

Table S20 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Calls (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.00	[-0.04, 0.04]	-0.12	.905	-0.01	[-0.05, 0.03]	-0.48	.631
Calls (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	-0.01	[-0.05, 0.03]	-0.35	.728	0.01	[-0.03, 0.05]	0.62	.535

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire for social contact added and restricted to assessments when not in momentary contact (1934 episodes, 292 participants). Third, a model with added interaction terms of number of calls and desire for social contact. CI = confidence interval, Calls = number of calls in an episode, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Table S21

Fixed Effects of Call Duration and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	68.94	$<$ .001	2.09	[1.96, 2.22]	32.17	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.09, 0.04]	-0.72	.469	-0.09	[-0.15, -0.04]	-3.23	.001
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.12]	-0.63	.527	-0.18	[-0.35, 0.00]	-2.00	.046
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.41	.001	-0.01	[-0.01, 0.00]	-1.85	.065
Call Duration (BP), $\hat{\gamma}_{03}$	0.02	[-0.06, 0.10]	0.46	.646	-0.01	[-0.09, 0.07]	-0.23	.818
Call Duration (WP), $\hat{\gamma}_{10}$	0.01	[-0.01, 0.03]	0.94	.347	0.01	[-0.01, 0.03]	1.25	.210
Adding Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.89]	70.70	$<$ .001	2.02	[1.89, 2.14]	31.31	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.01	[-0.09, 0.06]	-0.31	.756	-0.09	[-0.16, -0.03]	-2.75	.006
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.71	.478	-0.11	[-0.28, 0.05]	-1.32	.186
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.50	.001	0.00	[-0.01, 0.00]	-1.62	.106
Call Duration (BP), $\hat{\gamma}_{03}$	0.01	[-0.07, 0.09]	0.25	.800	0.02	[-0.06, 0.09]	0.45	.650
Call Duration (WP), $\hat{\gamma}_{10}$	0.01	[-0.02, 0.04]	0.69	.493	0.02	[-0.01, 0.06]	1.20	.230
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	-3.90	$<$ .001	0.12	[0.03, 0.20]	2.71	.007
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-12.98	$<$ .001	0.19	[0.15, 0.23]	9.54	$<$ .001
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.89]	70.39	$<$ .001	2.02	[1.89, 2.15]	31.32	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	-0.37	.710	-0.09	[-0.16, -0.02]	-2.64	.008
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.70	.483	-0.12	[-0.29, 0.05]	-1.42	.156
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.47	.001	0.00	[-0.01, 0.00]	-1.51	.131
Call Duration (BP), $\hat{\gamma}_{03}$	0.01	[-0.07, 0.10]	0.30	.762	0.00	[-0.08, 0.08]	0.05	.961
Call Duration (WP), $\hat{\gamma}_{10}$	0.01	[-0.02, 0.04]	0.48	.634	0.03	[0.00, 0.07]	1.76	.079
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	-3.90	$<$ .001	0.11	[0.03, 0.20]	2.67	.008
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-13.05	$<$ .001	0.19	[0.15, 0.23]	9.67	$<$ .001
Call Duration (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.01	[-0.09, 0.08]	-0.16	.873	0.04	[-0.04, 0.12]	0.92	.361
Call Duration (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.02	[-0.01, 0.06]	1.26	.207	-0.03	[-0.07, 0.00]	-1.75	.081
Call Duration (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.01	[-0.03, 0.04]	0.48	.631	0.00	[-0.04, 0.04]	-0.16	.872

Table S21 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Call Duration (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.00	[-0.03, 0.03]	0.01	.995	0.00	[-0.05, 0.04]	-0.21	.835

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire to be alone added and restricted to assessments when in momentary contact (2571 episodes, 299 participants). Third, a model with added interaction terms of call duration and desire to be alone. CI = confidence interval, BP = between-person effect, WP = within-person effect, Call Duration = duration of all calls in an episode, Desire Alone = desire to be alone.

Table S22

Fixed Effects of Call Duration and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	68.94	$<$ .001	2.09	[1.96, 2.22]	32.17	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.09, 0.04]	-0.72	.469	-0.09	[-0.15, -0.04]	-3.23	.001
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.12]	-0.63	.527	-0.18	[-0.35, 0.00]	-2.00	.046
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.41	.001	-0.01	[-0.01, 0.00]	-1.85	.065
Call Duration (BP), $\hat{\gamma}_{03}$	0.02	[-0.06, 0.10]	0.46	.646	-0.01	[-0.09, 0.07]	-0.23	.818
Call Duration (WP), $\hat{\gamma}_{10}$	0.01	[-0.01, 0.03]	0.94	.347	0.01	[-0.01, 0.03]	1.25	.210
Adding Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	58.87	$<$ .001	2.10	[1.96, 2.25]	28.18	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.05]	-0.76	.446	-0.07	[-0.15, 0.01]	-1.72	.086
Female, $\hat{\gamma}_{01}$	-0.10	[-0.30, 0.11]	-0.91	.363	-0.15	[-0.35, 0.05]	-1.50	.135
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.39	.001	-0.01	[-0.01, 0.00]	-1.91	.057
Call Duration (BP), $\hat{\gamma}_{03}$	-0.01	[-0.12, 0.09]	-0.26	.792	-0.02	[-0.12, 0.08]	-0.32	.749
Call Duration (WP), $\hat{\gamma}_{10}$	0.03	[0.00, 0.06]	1.72	.086	0.01	[-0.02, 0.04]	0.80	.425
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.05, 0.25]	2.82	.005	-0.06	[-0.16, 0.04]	-1.20	.233
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.12	$<$ .001	-0.04	[-0.07, -0.01]	-2.33	.020
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.57	[4.42, 4.72]	59.35	$<$ .001	2.09	[1.94, 2.24]	27.96	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	-0.74	.458	-0.07	[-0.15, 0.01]	-1.78	.075
Female, $\hat{\gamma}_{01}$	-0.12	[-0.32, 0.09]	-1.12	.264	-0.13	[-0.33, 0.07]	-1.29	.198
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.70	$<$ .001	-0.01	[-0.01, 0.00]	-1.96	.050
Call Duration (BP), $\hat{\gamma}_{03}$	0.03	[-0.08, 0.13]	0.48	.629	-0.04	[-0.14, 0.07]	-0.73	.463
Call Duration (WP), $\hat{\gamma}_{10}$	0.03	[-0.01, 0.07]	1.54	.124	0.02	[-0.02, 0.06]	0.99	.324
Desire Contact (BP), $\hat{\gamma}_{04}$	0.14	[0.04, 0.25]	2.72	.007	-0.06	[-0.16, 0.04]	-1.18	.240
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.23	$<$ .001	-0.05	[-0.09, -0.01]	-2.24	.025
Call Duration (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	-0.12	[-0.22, -0.02]	-2.36	.019	0.07	[-0.02, 0.17]	1.46	.145
Call Duration (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.01	[-0.04, 0.06]	0.33	.740	0.01	[-0.04, 0.05]	0.30	.765
Call Duration (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.01	[-0.04, 0.05]	0.32	.746	-0.01	[-0.05, 0.03]	-0.63	.527

Table S22 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Call Duration (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.01	[-0.05, 0.07]	0.39	.694	0.01	[-0.05, 0.08]	0.45	.654

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire for social contact added and restricted to assessments when not in momentary contact (1934 episodes, 292 participants). Third, a model with added interaction terms of call duration and desire for social contact. CI = confidence interval, Call Duration = duration of all calls in an episode, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Table S23

Fixed Effects of Communication App Usage Frequency and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	69.14	$<$ .001	2.10	[1.97, 2.22]	32.44	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.09, 0.04]	-0.77	.439	-0.09	[-0.15, -0.03]	-3.12	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.54	.587	-0.19	[-0.36, -0.02]	-2.17	.031
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.78	$<$ .001	-0.01	[-0.01, 0.00]	-1.84	.066
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.05	[-0.04, 0.14]	1.01	.313	0.05	[-0.04, 0.14]	1.11	.270
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.02]	-0.07	.944	0.02	[0.00, 0.04]	1.60	.109
Adding Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.89]	70.81	$<$ .001	2.02	[1.89, 2.14]	31.36	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.01	[-0.09, 0.06]	-0.32	.750	-0.09	[-0.16, -0.03]	-2.70	.007
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.70	.486	-0.11	[-0.28, 0.05]	-1.32	.188
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.57	$<$ .001	0.00	[-0.01, 0.00]	-1.51	.133
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.03	[-0.06, 0.12]	0.75	.456	0.05	[-0.04, 0.13]	1.12	.262
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.03]	-0.07	.947	0.02	[-0.01, 0.05]	1.14	.255
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.08]	-3.82	$<$ .001	0.12	[0.03, 0.20]	2.77	.006
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-13.04	$<$ .001	0.19	[0.15, 0.23]	9.43	$<$ .001
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	70.62	$<$ .001	2.02	[1.89, 2.14]	31.33	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	-0.32	.748	-0.09	[-0.16, -0.03]	-2.73	.006
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.72	.473	-0.10	[-0.27, 0.06]	-1.21	.228
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.51	.001	0.00	[-0.01, 0.00]	-1.47	.142
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.03	[-0.06, 0.12]	0.62	.534	0.06	[-0.03, 0.15]	1.29	.197
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.03]	-0.14	.886	0.02	[-0.01, 0.05]	1.17	.241
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	-3.87	$<$ .001	0.12	[0.04, 0.21]	2.89	.004
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-13.03	$<$ .001	0.19	[0.15, 0.23]	9.52	$<$ .001
Comm. Freq. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.03	[-0.12, 0.07]	-0.54	.586	0.05	[-0.04, 0.14]	1.13	.261
Comm. Freq. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.00	[-0.04, 0.04]	-0.10	.922	0.01	[-0.03, 0.05]	0.54	.590

Table S23 continued

Parameter	Positive Affect (PA)				Negative Affect (NA)			
	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Comm. Freq. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	-0.01	[-0.05, 0.02]	-0.74	.461	0.01	[-0.02, 0.04]	0.42	.671
Comm. Freq. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.01	[-0.03, 0.04]	0.42	.671	0.01	[-0.02, 0.04]	0.49	.622

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire to be alone added and restricted to assessments when in momentary contact (2571 episodes, 299 participants). Third, a model with added interaction terms of communication app usage frequency and desire to be alone. CI = confidence interval, BP = between-person effect, WP = within-person effect, Comm. Freq. = number of usage sessions of communication apps in an episode, Desire Alone = desire to be alone.

Table S24

Fixed Effects of Communication App Usage Frequency and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	69.14	$<$ .001	2.10	[1.97, 2.22]	32.44	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.09, 0.04]	-0.77	.439	-0.09	[-0.15, -0.03]	-3.12	.002
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.54	.587	-0.19	[-0.36, -0.02]	-2.17	.031
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.78	$<$ .001	-0.01	[-0.01, 0.00]	-1.84	.066
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.05	[-0.04, 0.14]	1.01	.313	0.05	[-0.04, 0.14]	1.11	.270
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.02]	-0.07	.944	0.02	[0.00, 0.04]	1.60	.109
Adding Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	58.95	$<$ .001	2.11	[1.97, 2.26]	28.50	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.05]	-0.79	.431	-0.07	[-0.15, 0.01]	-1.83	.068
Female, $\hat{\gamma}_{01}$	-0.10	[-0.31, 0.11]	-0.94	.349	-0.16	[-0.36, 0.04]	-1.59	.112
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.55	$<$ .001	-0.01	[-0.01, 0.00]	-1.75	.081
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.05	[-0.06, 0.15]	0.86	.389	0.06	[-0.04, 0.16]	1.09	.275
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.03]	0.00	$>$ .999	0.04	[0.00, 0.07]	2.03	.042
Desire Contact (BP), $\hat{\gamma}_{04}$	0.14	[0.04, 0.25]	2.71	.007	-0.07	[-0.17, 0.03]	-1.30	.195
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.18	$<$ .001	-0.05	[-0.09, -0.01]	-2.49	.013
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	58.71	$<$ .001	2.12	[1.98, 2.27]	28.68	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.03	[-0.12, 0.05]	-0.73	.467	-0.08	[-0.16, 0.00]	-1.93	.054
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	-0.89	.375	-0.17	[-0.37, 0.03]	-1.71	.089
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.57	$<$ .001	-0.01	[-0.01, 0.00]	-1.76	.079
Comm. Freq. (BP), $\hat{\gamma}_{03}$	0.05	[-0.06, 0.15]	0.86	.390	0.06	[-0.04, 0.17]	1.24	.215
Comm. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.03, 0.03]	-0.02	.985	0.04	[0.00, 0.07]	2.17	.030
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	2.74	.007	-0.07	[-0.17, 0.03]	-1.46	.146
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.16	$<$ .001	-0.05	[-0.09, -0.01]	-2.56	.011
Comm. Freq. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.00	[-0.10, 0.11]	0.09	.929	-0.05	[-0.15, 0.05]	-0.99	.325
Comm. Freq. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	-0.01	[-0.06, 0.04]	-0.49	.627	0.01	[-0.02, 0.05]	0.74	.460

Table S24 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	*t*	*p*	$\hat{\gamma}$	95% CI	*t*	*p*
Comm. Freq. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.02	[-0.02, 0.05]	1.04	.300	-0.01	[-0.05, 0.02]	-0.71	.477
Comm. Freq. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	-0.02	[-0.05, 0.02]	-0.96	.337	-0.02	[-0.05, 0.01]	-1.17	.244

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire for social contact added and restricted to assessments when not in momentary contact (1934 episodes, 292 participants). Third, a model with added interaction terms of communication app usage frequency and desire for social contact. CI = confidence interval, Comm. Freq. = number of usage sessions of communication apps in an episode, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Table S25

Fixed Effects of Communication App Usage Duration and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	68.95	$<$ .001	2.09	[1.97, 2.22]	32.34	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.09, 0.04]	-0.75	.451	-0.09	[-0.15, -0.04]	-3.21	.001
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.59	.554	-0.19	[-0.36, -0.01]	-2.10	.037
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.45	.001	-0.01	[-0.01, 0.00]	-1.88	.061
Comm. Dur. (BP), $\hat{\gamma}_{03}$	0.00	[-0.09, 0.09]	0.06	.949	0.06	[-0.03, 0.14]	1.33	.184
Comm. Dur. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.03, 0.02]	-0.63	.529	0.02	[0.00, 0.05]	1.81	.071
Adding Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.89]	70.73	$<$ .001	2.02	[1.90, 2.15]	31.47	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.01	[-0.09, 0.06]	-0.32	.747	-0.10	[-0.16, -0.03]	-2.82	.005
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.70	.485	-0.12	[-0.28, 0.05]	-1.38	.168
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.50	.001	0.00	[-0.01, 0.00]	-1.59	.114
Comm. Dur. (BP), $\hat{\gamma}_{03}$	-0.01	[-0.10, 0.07]	-0.31	.759	0.08	[-0.01, 0.16]	1.84	.067
Comm. Dur. (WP), $\hat{\gamma}_{10}$	0.01	[-0.02, 0.04]	0.91	.361	0.03	[0.00, 0.06]	1.97	.049
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.18	[-0.26, -0.09]	-3.94	$<$ .001	0.12	[0.03, 0.20]	2.72	.007
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-13.03	$<$ .001	0.19	[0.15, 0.23]	9.44	$<$ .001
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.76	[4.63, 4.89]	70.83	$<$ .001	2.02	[1.90, 2.15]	31.52	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	-0.34	.730	-0.10	[-0.16, -0.03]	-2.87	.004
Female, $\hat{\gamma}_{01}$	-0.08	[-0.26, 0.10]	-0.87	.387	-0.11	[-0.28, 0.06]	-1.28	.203
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.47	.001	0.00	[-0.01, 0.00]	-1.48	.139
Comm. Dur. (BP), $\hat{\gamma}_{03}$	0.00	[-0.09, 0.09]	0.04	.968	0.06	[-0.02, 0.15]	1.40	.163
Comm. Dur. (WP), $\hat{\gamma}_{10}$	0.02	[-0.02, 0.05]	0.91	.362	0.03	[-0.01, 0.07]	1.63	.102
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.18	[-0.26, -0.09]	-3.94	$<$ .001	0.12	[0.04, 0.21]	2.87	.004
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-12.85	$<$ .001	0.19	[0.15, 0.23]	9.37	$<$ .001
Comm. Dur. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.03	[-0.12, 0.06]	-0.58	.565	0.06	[-0.02, 0.15]	1.43	.153
Comm. Dur. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.02	[-0.02, 0.06]	1.08	.282	-0.02	[-0.05, 0.02]	-0.86	.392

Table S25 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Comm. Dur. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.00	[-0.03, 0.04]	0.20	.842	0.00	[-0.04, 0.03]	-0.19	.849
Comm. Dur. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.01	[-0.03, 0.05]	0.63	.526	-0.01	[-0.05, 0.04]	-0.31	.754

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire to be alone added and restricted to assessments when in momentary contact (2571 episodes, 299 participants). Third, a model with added interaction terms of communication app usage duration and desire to be alone. CI = confidence interval, BP = between-person effect, WP = within-person effect, Comm. Dur. = duration of all usage sessions of communication apps in an episode, Desire Alone = desire to be alone.

Table S26

Fixed Effects of Communication App Usage Duration and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.53, 4.79]	68.95	< .001	2.09	[1.97, 2.22]	32.34	< .001
Weekend, $\hat{\gamma}_{20}$	-0.02	[-0.09, 0.04]	-0.75	.451	-0.09	[-0.15, -0.04]	-3.21	.001
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.59	.554	-0.19	[-0.36, -0.01]	-2.10	.037
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.45	.001	-0.01	[-0.01, 0.00]	-1.88	.061
Comm. Dur. (BP), $\hat{\gamma}_{03}$	0.00	[-0.09, 0.09]	0.06	.949	0.06	[-0.03, 0.14]	1.33	.184
Comm. Dur. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.03, 0.02]	-0.63	.529	0.02	[0.00, 0.05]	1.81	.071
Adding Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	58.87	< .001	2.11	[1.96, 2.25]	28.36	< .001
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.05]	-0.70	.481	-0.08	[-0.16, 0.00]	-1.85	.065
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	-0.90	.369	-0.16	[-0.35, 0.04]	-1.53	.128
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.40	.001	-0.01	[-0.01, 0.00]	-1.81	.071
Comm. Dur. (BP), $\hat{\gamma}_{03}$	0.03	[-0.07, 0.13]	0.58	.560	0.05	[-0.05, 0.14]	0.93	.355
Comm. Dur. (WP), $\hat{\gamma}_{10}$	0.00	[-0.04, 0.03]	-0.19	.848	0.02	[-0.01, 0.06]	1.24	.214
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	2.77	.006	-0.07	[-0.17, 0.03]	-1.29	.197
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.17	< .001	-0.05	[-0.09, -0.01]	-2.35	.019
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.54	[4.39, 4.70]	58.76	< .001	2.12	[1.97, 2.26]	28.76	< .001
Weekend, $\hat{\gamma}_{40}$	-0.02	[-0.11, 0.06]	-0.56	.576	-0.09	[-0.17, -0.01]	-2.14	.033
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.12]	-0.86	.389	-0.16	[-0.36, 0.04]	-1.57	.117
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.42	.001	-0.01	[-0.01, 0.00]	-1.85	.066
Comm. Dur. (BP), $\hat{\gamma}_{03}$	0.02	[-0.08, 0.12]	0.37	.713	0.07	[-0.03, 0.16]	1.35	.178
Comm. Dur. (WP), $\hat{\gamma}_{10}$	0.01	[-0.03, 0.04]	0.32	.751	0.03	[-0.01, 0.07]	1.40	.161
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	2.80	.005	-0.08	[-0.18, 0.02]	-1.53	.126
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.11	< .001	-0.05	[-0.08, -0.01]	-2.23	.026
Comm. Dur. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.00	[-0.11, 0.12]	0.05	.957	-0.09	[-0.19, 0.02]	-1.53	.128
Comm. Dur. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.03	[-0.02, 0.07]	1.05	.294	0.01	[-0.03, 0.05]	0.65	.514

Table S26 continued

Parameter	Positive Affect (PA)				Negative Affect (NA)			
	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Comm. Dur. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.00	[-0.04, 0.03]	-0.27	.789	0.00	[-0.04, 0.03]	-0.22	.827
Comm. Dur. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.01	[-0.03, 0.06]	0.65	.513	-0.02	[-0.07, 0.03]	-0.66	.508

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire for social contact added and restricted to assessments when not in momentary contact (1934 episodes, 292 participants). Third, a model with added interaction terms of communication app usage duration and desire for social contact. CI = confidence interval, Comm. Dur. = duration of all usage sessions of communication apps in an episode, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Table S27

Fixed Effects of Social Media App Usage Frequency and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.65	[4.52, 4.78]	69.46	$<$ .001	2.09	[1.96, 2.21]	32.37	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.09, 0.04]	-0.78	.437	-0.09	[-0.15, -0.04]	-3.19	.001
Female, $\hat{\gamma}_{01}$	-0.03	[-0.21, 0.15]	-0.33	.744	-0.17	[-0.34, 0.00]	-1.94	.054
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.20	.002	0.00	[-0.01, 0.00]	-1.40	.162
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.01	[-0.10, 0.07]	-0.32	.750	0.08	[0.00, 0.17]	1.86	.063
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.04, 0.02]	-0.70	.484	-0.01	[-0.03, 0.02]	-0.42	.677
Adding Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	70.74	$<$ .001	2.01	[1.89, 2.14]	31.33	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.01	[-0.09, 0.06]	-0.33	.741	-0.09	[-0.16, -0.03]	-2.75	.006
Female, $\hat{\gamma}_{01}$	-0.06	[-0.23, 0.12]	-0.64	.520	-0.10	[-0.27, 0.06]	-1.23	.221
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.22	.001	0.00	[-0.01, 0.00]	-1.33	.185
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.01	[-0.10, 0.08]	-0.31	.758	0.06	[-0.02, 0.15]	1.45	.147
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.05, 0.04]	-0.26	.792	-0.01	[-0.05, 0.03]	-0.37	.710
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.18	[-0.27, -0.09]	-4.03	$<$ .001	0.12	[0.03, 0.20]	2.71	.007
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-12.98	$<$ .001	0.19	[0.15, 0.23]	9.33	$<$ .001
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	70.73	$<$ .001	2.01	[1.89, 2.14]	31.32	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.01	[-0.09, 0.06]	-0.37	.711	-0.09	[-0.15, -0.02]	-2.63	.009
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.11]	-0.68	.495	-0.11	[-0.28, 0.05]	-1.32	.189
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.22	.001	0.00	[-0.01, 0.00]	-1.23	.218
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.02	[-0.11, 0.07]	-0.33	.740	0.07	[-0.02, 0.16]	1.62	.106
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	0.00	[-0.05, 0.04]	-0.12	.907	-0.01	[-0.05, 0.03]	-0.52	.602
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.08]	-3.82	$<$ .001	0.10	[0.02, 0.19]	2.41	.017
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-12.92	$<$ .001	0.19	[0.15, 0.23]	9.51	$<$ .001
SocMed. Freq. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.03	[-0.15, 0.09]	-0.48	.634	-0.06	[-0.17, 0.06]	-0.96	.339
SocMed. Freq. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	-0.01	[-0.04, 0.03]	-0.27	.790	0.03	[-0.01, 0.07]	1.58	.115

Table S27 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
SocMed. Freq. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.04	[-0.01, 0.09]	1.38	.168	-0.01	[-0.06, 0.03]	-0.56	.573
SocMed. Freq. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.00	[-0.03, 0.04]	0.29	.772	0.00	[-0.04, 0.04]	0.00	.997

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire to be alone added and restricted to assessments when in momentary contact (2571 episodes, 299 participants). Third, a model with added interaction terms of social media app usage frequency and desire to be alone. CI = confidence interval, BP = between-person effect, WP = within-person effect, SocMed. Freq. = number of usage sessions of social media apps in an episode, Desire Alone = desire to be alone.

Table S28

Fixed Effects of Social Media App Usage Frequency and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.65	[4.52, 4.78]	69.46	< .001	2.09	[1.96, 2.21]	32.37	< .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.09, 0.04]	-0.78	.437	-0.09	[-0.15, -0.04]	-3.19	.001
Female, $\hat{\gamma}_{01}$	-0.03	[-0.21, 0.15]	-0.33	.744	-0.17	[-0.34, 0.00]	-1.94	.054
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.20	.002	0.00	[-0.01, 0.00]	-1.40	.162
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.01	[-0.10, 0.07]	-0.32	.750	0.08	[0.00, 0.17]	1.86	.063
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.04, 0.02]	-0.70	.484	-0.01	[-0.03, 0.02]	-0.42	.677
Adding Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	58.93	< .001	2.10	[1.96, 2.25]	28.31	< .001
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.05]	-0.79	.428	-0.07	[-0.15, 0.01]	-1.72	.086
Female, $\hat{\gamma}_{01}$	-0.10	[-0.31, 0.11]	-0.93	.353	-0.15	[-0.35, 0.05]	-1.43	.155
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.30	.001	-0.01	[-0.01, 0.00]	-1.55	.121
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.02	[-0.12, 0.09]	-0.32	.753	0.09	[-0.01, 0.20]	1.79	.074
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	-0.02	[-0.05, 0.01]	-1.05	.293	0.00	[-0.03, 0.03]	0.24	.811
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.05, 0.25]	2.83	.005	-0.06	[-0.16, 0.04]	-1.23	.221
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.17	< .001	-0.04	[-0.07, -0.01]	-2.31	.021
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	59.53	< .001	2.10	[1.96, 2.24]	28.76	< .001
Weekend, $\hat{\gamma}_{40}$	-0.04	[-0.12, 0.04]	-0.92	.356	-0.07	[-0.15, 0.00]	-1.84	.066
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	-0.90	.368	-0.13	[-0.32, 0.07]	-1.28	.203
Age, $\hat{\gamma}_{02}$	0.01	[0.01, 0.02]	3.57	< .001	-0.01	[-0.01, 0.00]	-1.75	.080
SocMed. Freq. (BP), $\hat{\gamma}_{03}$	-0.02	[-0.13, 0.08]	-0.45	.654	0.10	[0.00, 0.20]	1.90	.059
SocMed. Freq. (WP), $\hat{\gamma}_{10}$	-0.02	[-0.05, 0.02]	-1.00	.318	0.00	[-0.04, 0.04]	0.00	.997
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	2.77	.006	-0.07	[-0.17, 0.03]	-1.33	.184
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.25	< .001	-0.05	[-0.08, -0.01]	-2.38	.017
SocMed. Freq. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.07	[-0.06, 0.20]	1.01	.314	-0.12	[-0.25, 0.00]	-1.90	.059
SocMed. Freq. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.02	[-0.03, 0.07]	0.85	.395	-0.02	[-0.06, 0.02]	-1.00	.318

Table S28 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
SocMed. Freq. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.01	[-0.03, 0.05]	0.33	.740	0.02	[-0.02, 0.06]	1.17	.243
SocMed. Freq. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.03	[-0.02, 0.07]	1.15	.249	-0.04	[-0.09, 0.01]	-1.74	.082

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire for social contact added and restricted to assessments when not in momentary contact (1934 episodes, 292 participants). Third, a model with added interaction terms of social media app usage frequency and desire for social contact. CI = confidence interval, SocMed. Freq. = number of usage sessions of social media apps in an episode, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Table S29

Fixed Effects of Social Media App Usage Duration and Desire to be Alone on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.52, 4.79]	69.43	< .001	2.09	[1.97, 2.22]	32.47	< .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.09, 0.04]	-0.76	.445	-0.09	[-0.15, -0.04]	-3.26	.001
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.56	.575	-0.18	[-0.36, -0.01]	-2.10	.037
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.10	.002	0.00	[-0.01, 0.00]	-1.55	.121
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.10	[-0.19, -0.01]	-2.29	.023	0.08	[0.00, 0.17]	1.87	.062
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	0.00	[-0.02, 0.02]	-0.12	.908	0.00	[-0.02, 0.02]	-0.19	.849
Adding Desire to be Alone								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	70.66	< .001	2.02	[1.89, 2.15]	31.40	< .001
Weekend, $\hat{\gamma}_{30}$	-0.02	[-0.09, 0.06]	-0.41	.684	-0.10	[-0.16, -0.03]	-2.88	.004
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.12]	-0.61	.543	-0.11	[-0.28, 0.06]	-1.32	.188
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.28	.001	0.00	[-0.01, 0.00]	-1.40	.163
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.07	[-0.16, 0.02]	-1.62	.105	0.05	[-0.04, 0.13]	1.06	.292
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.05, 0.03]	-0.67	.505	0.01	[-0.03, 0.04]	0.30	.767
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.18	[-0.26, -0.09]	-3.95	< .001	0.12	[0.03, 0.20]	2.73	.007
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-13.06	< .001	0.19	[0.15, 0.23]	9.37	< .001
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.75	[4.62, 4.88]	70.74	< .001	2.02	[1.89, 2.15]	31.37	< .001
Weekend, $\hat{\gamma}_{40}$	-0.02	[-0.09, 0.06]	-0.45	.655	-0.09	[-0.16, -0.03]	-2.79	.005
Female, $\hat{\gamma}_{01}$	-0.06	[-0.24, 0.12]	-0.67	.502	-0.12	[-0.28, 0.05]	-1.38	.170
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.28	.001	0.00	[-0.01, 0.00]	-1.43	.153
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.08	[-0.17, 0.01]	-1.65	.100	0.06	[-0.03, 0.15]	1.33	.185
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.06, 0.03]	-0.70	.485	0.00	[-0.04, 0.04]	-0.06	.949
Desire Alone (BP), $\hat{\gamma}_{04}$	-0.17	[-0.26, -0.09]	-3.89	< .001	0.11	[0.03, 0.20]	2.61	.010
Desire Alone (WP), $\hat{\gamma}_{20}$	-0.26	[-0.30, -0.22]	-12.97	< .001	0.19	[0.15, 0.23]	9.43	< .001
SocMed. Dur. (BP) * Desire Alone (BP), $\hat{\gamma}_{05}$	-0.05	[-0.15, 0.05]	-0.94	.347	-0.02	[-0.12, 0.07]	-0.45	.655
SocMed. Dur. (BP) * Desire Alone (WP), $\hat{\gamma}_{21}$	0.00	[-0.04, 0.04]	-0.15	.884	0.03	[-0.01, 0.06]	1.37	.172
SocMed. Dur. (WP) * Desire Alone (BP), $\hat{\gamma}_{11}$	0.04	[-0.01, 0.08]	1.60	.111	-0.01	[-0.05, 0.03]	-0.41	.679

Table S29 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
SocMed. Dur. (WP) * Desire Alone (WP), $\hat{\gamma}_{30}$	0.01	[-0.02, 0.04]	0.81	.415	-0.01	[-0.05, 0.02]	-0.66	.506

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire to be alone added and restricted to assessments when in momentary contact (2571 episodes, 299 participants). Third, a model with added interaction terms of social media app usage duration and desire to be alone. CI = confidence interval, BP = between-person effect, WP = within-person effect, SocMed. Dur. = duration of all usage sessions of social media apps in an episode, Desire Alone = desire to be alone.

Table S30

Fixed Effects of Social Media App Usage Duration and Desire for Social Contact on Momentary Affect (Model Building Strategy).

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
Unrestricted Sample								
Intercept, $\hat{\gamma}_{00}$	4.66	[4.52, 4.79]	69.43	$<$ .001	2.09	[1.97, 2.22]	32.47	$<$ .001
Weekend, $\hat{\gamma}_{20}$	-0.03	[-0.09, 0.04]	-0.76	.445	-0.09	[-0.15, -0.04]	-3.26	.001
Female, $\hat{\gamma}_{01}$	-0.05	[-0.23, 0.13]	-0.56	.575	-0.18	[-0.36, -0.01]	-2.10	.037
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.10	.002	0.00	[-0.01, 0.00]	-1.55	.121
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.10	[-0.19, -0.01]	-2.29	.023	0.08	[0.00, 0.17]	1.87	.062
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	0.00	[-0.02, 0.02]	-0.12	.908	0.00	[-0.02, 0.02]	-0.19	.849
Adding Desire for Social Contact								
Intercept, $\hat{\gamma}_{00}$	4.55	[4.40, 4.70]	59.41	$<$ .001	2.11	[1.97, 2.25]	28.52	$<$ .001
Weekend, $\hat{\gamma}_{30}$	-0.03	[-0.12, 0.05]	-0.77	.441	-0.08	[-0.16, 0.00]	-1.98	.047
Female, $\hat{\gamma}_{01}$	-0.10	[-0.31, 0.10]	-0.98	.328	-0.14	[-0.34, 0.06]	-1.38	.168
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.19	.002	-0.01	[-0.01, 0.00]	-1.55	.123
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.14	[-0.25, -0.03]	-2.47	.014	0.14	[0.04, 0.25]	2.65	.009
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	-0.02	[-0.05, 0.02]	-1.00	.319	0.00	[-0.03, 0.03]	0.20	.845
Desire Contact (BP), $\hat{\gamma}_{04}$	0.15	[0.04, 0.25]	2.79	.006	-0.06	[-0.16, 0.04]	-1.15	.251
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.18]	5.15	$<$ .001	-0.05	[-0.09, -0.01]	-2.38	.017
Adding Interaction Terms								
Intercept, $\hat{\gamma}_{00}$	4.54	[4.39, 4.69]	59.45	$<$ .001	2.12	[1.97, 2.26]	28.78	$<$ .001
Weekend, $\hat{\gamma}_{40}$	-0.04	[-0.12, 0.05]	-0.84	.399	-0.07	[-0.15, 0.00]	-1.84	.065
Female, $\hat{\gamma}_{01}$	-0.09	[-0.30, 0.11]	-0.89	.376	-0.16	[-0.36, 0.03]	-1.63	.105
Age, $\hat{\gamma}_{02}$	0.01	[0.00, 0.02]	3.31	.001	-0.01	[-0.01, 0.00]	-1.62	.106
SocMed. Dur. (BP), $\hat{\gamma}_{03}$	-0.15	[-0.26, -0.04]	-2.65	.009	0.14	[0.04, 0.25]	2.62	.009
SocMed. Dur. (WP), $\hat{\gamma}_{10}$	-0.01	[-0.05, 0.02]	-0.92	.357	0.00	[-0.02, 0.03]	0.30	.764
Desire Contact (BP), $\hat{\gamma}_{04}$	0.14	[0.04, 0.25]	2.75	.006	-0.06	[-0.16, 0.04]	-1.16	.245
Desire Contact (WP), $\hat{\gamma}_{20}$	0.13	[0.08, 0.17]	5.16	$<$ .001	-0.04	[-0.08, -0.01]	-2.23	.026
SocMed. Dur. (BP) * Desire Contact (BP), $\hat{\gamma}_{05}$	0.04	[-0.07, 0.15]	0.67	.506	-0.05	[-0.16, 0.05]	-0.98	.328
SocMed. Dur. (BP) * Desire Contact (WP), $\hat{\gamma}_{21}$	0.01	[-0.04, 0.07]	0.50	.617	0.00	[-0.04, 0.04]	-0.11	.913

Table S30 continued

	Positive Affect (PA)				Negative Affect (NA)			
Parameter	$\hat{\gamma}$	95% CI	t	p	$\hat{\gamma}$	95% CI	t	p
SocMed. Dur. (WP) * Desire Contact (BP), $\hat{\gamma}_{11}$	0.00	[-0.03, 0.03]	-0.17	.862	0.02	[-0.01, 0.05]	1.53	.127
SocMed. Dur. (WP) * Desire Contact (WP), $\hat{\gamma}_{30}$	0.02	[-0.01, 0.06]	1.15	.251	-0.03	[-0.06, 0.01]	-1.54	.124

Note. Three models were computed for each of the two affect outcomes (PA, NA): First, the basic model (4524 episodes, 306 participants). Second, a model with desire for social contact added and restricted to assessments when not in momentary contact (1934 episodes, 292 participants). Third, a model with added interaction terms of social media app usage duration and desire for social contact. CI = confidence interval, SocMed. Dur. = duration of all usage sessions of social media apps in an episode, BP = between-person effect, WP = within-person effect, Desire Contact = desire for social contact.

Supplementary Figures

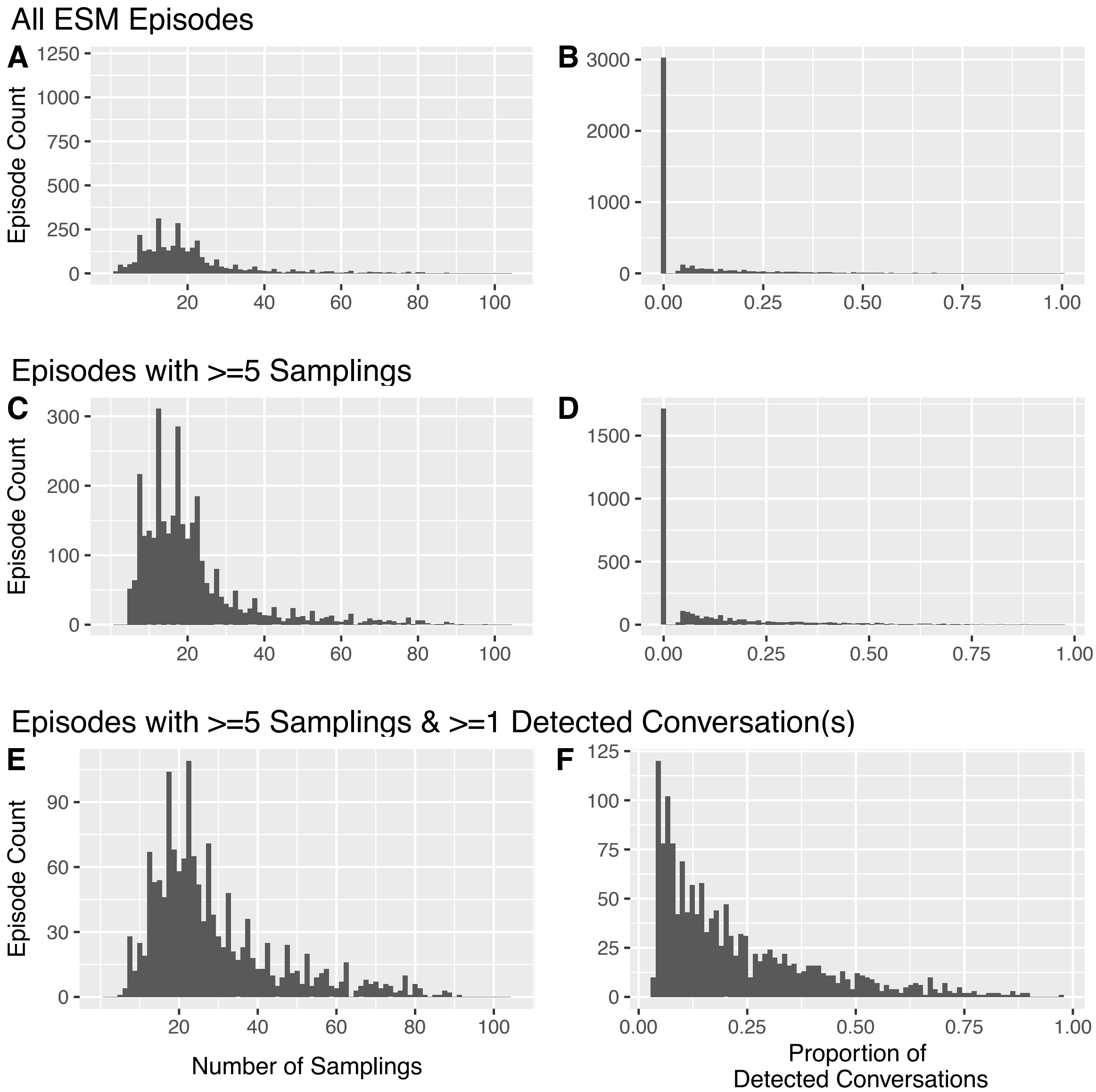

Figure S1

Distribution of the Number of Samplings (by the AWARE Conversations Plugin) and the Proportion of Detected Conversation.

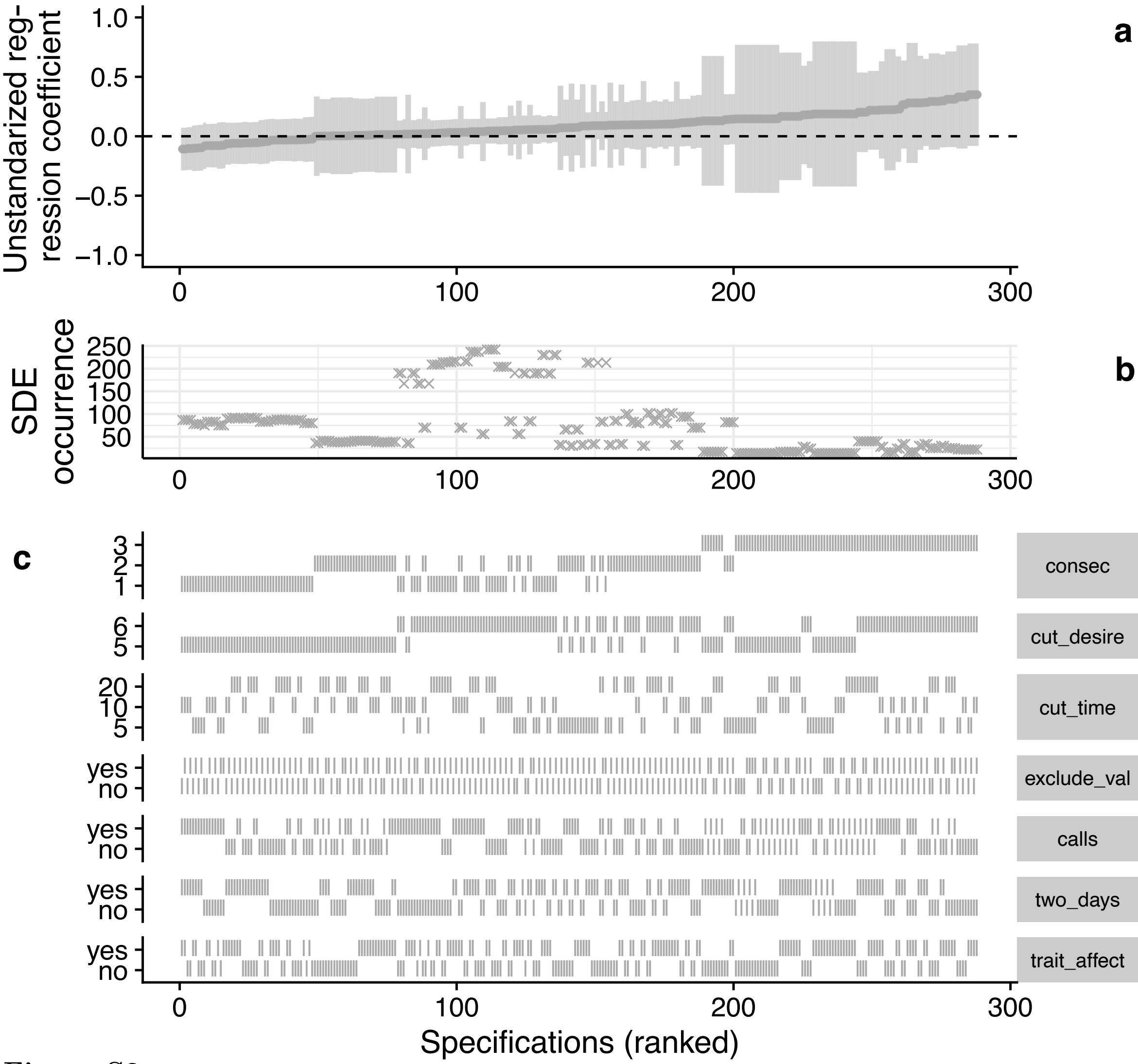

Figure S2

Specification Curve Analysis for the Effect of Social Deprivation Episodes on Positive Affect. consec *(Options: 1, 2, 3) = minimum number of consecutive ESM assessments necessary for coding SDE;* cut_desire *(Options: 5, 6) = momentary social desire cutoff values of 5 vs. 6;* cut_time *(Options: 5, 10, 20) = minimum duration of contact that are included in the coding (in min);* exclude_val *(Options: no, yes) = exclude contact from coding of episodes based on pleasantness (below 3 for SDE);* calls *(Options: no, yes) = include calls and video calls as social contact;* two_days *(Options: no, yes) = allow episodes to span two days;* trait_affect *(Options: no, yes) = include trait-level affect as a level-2 variable. See the description in the* Supplemental Material *for details of the specifications coding.*

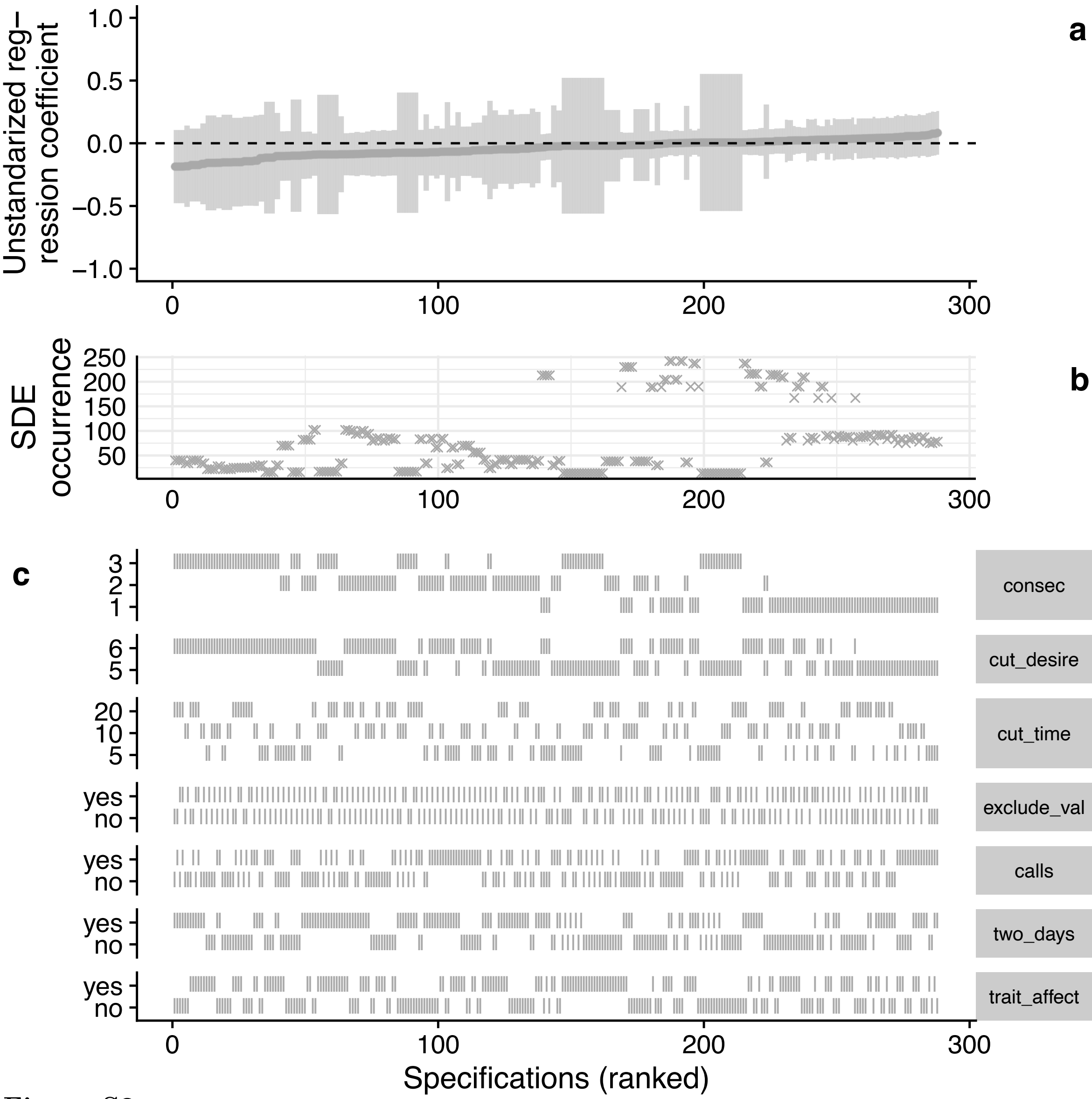

Figure S3

Specification Curve Analysis for the Effect of Social Deprivation Episodes on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

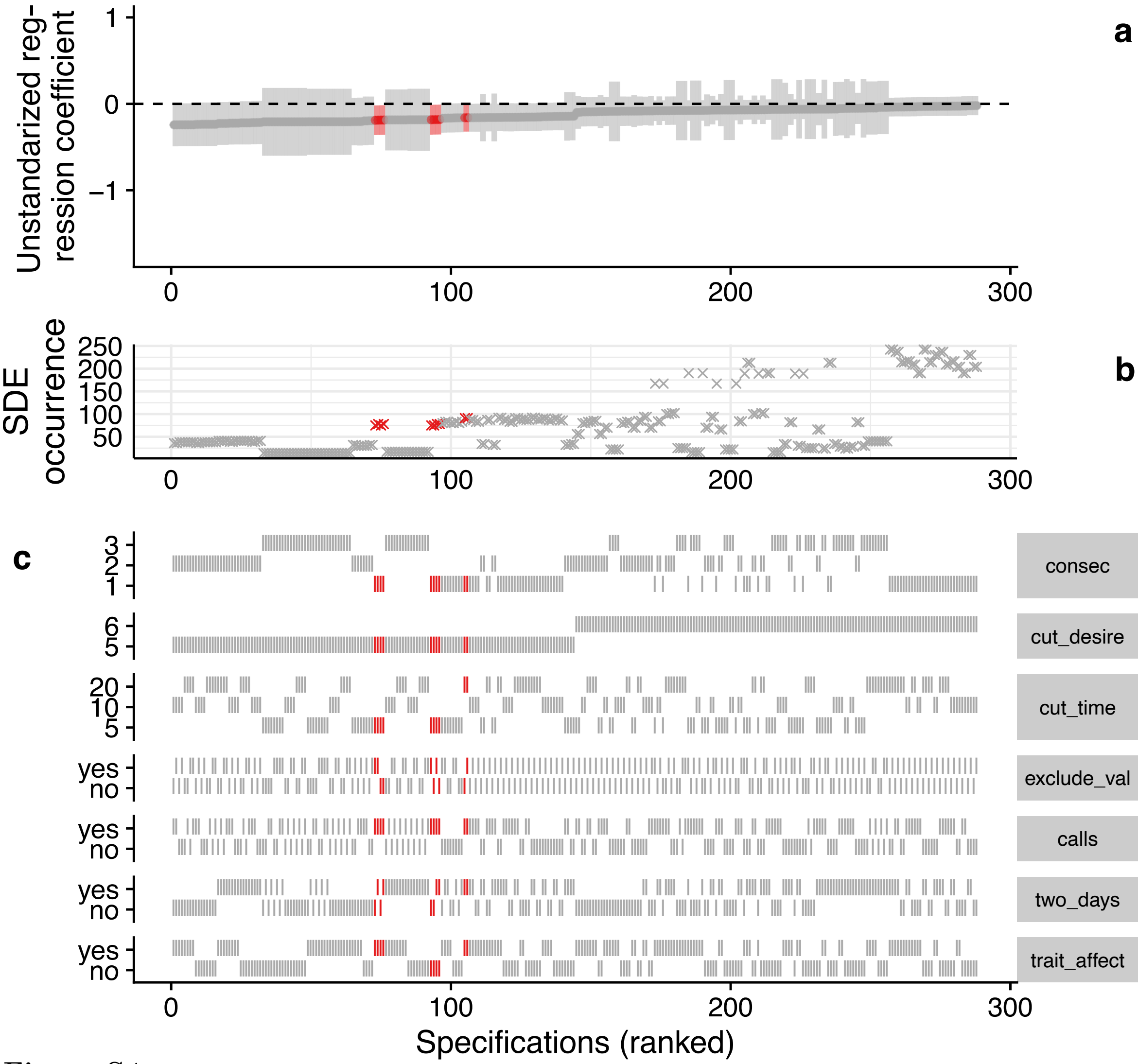

Figure S4

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Extraversion on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

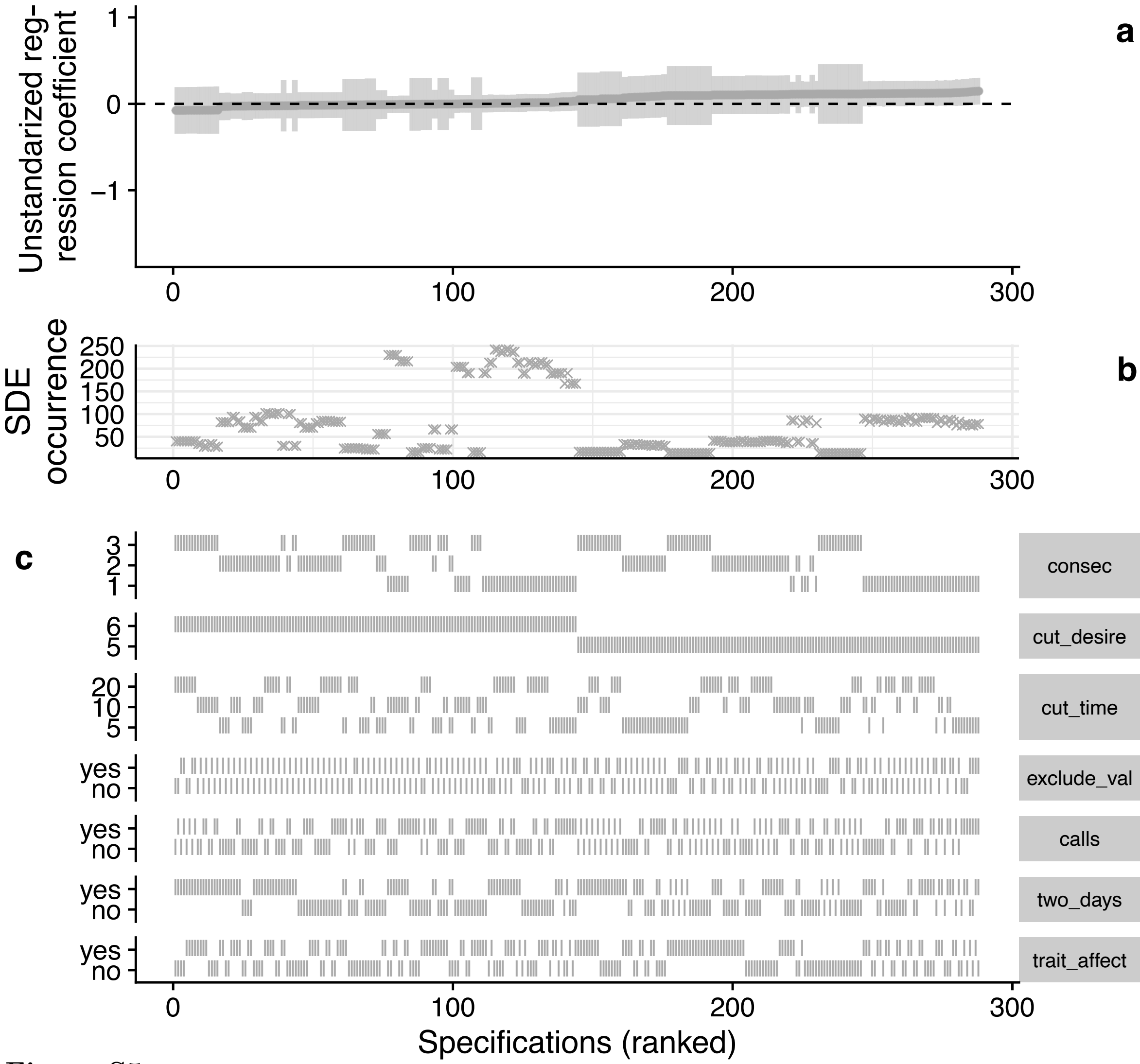

Figure S5

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Extraversion on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

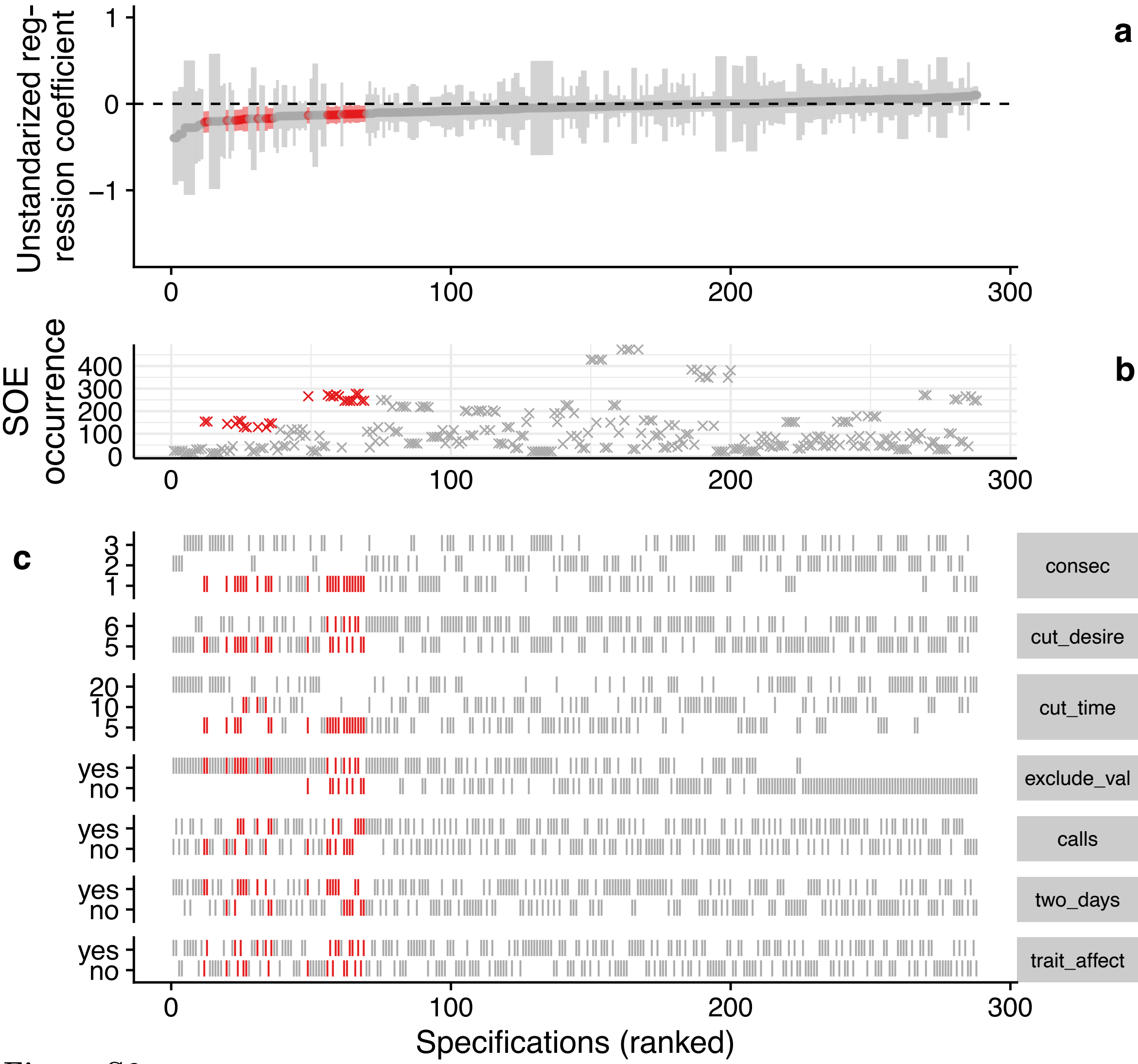

Figure S6

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Extraversion on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

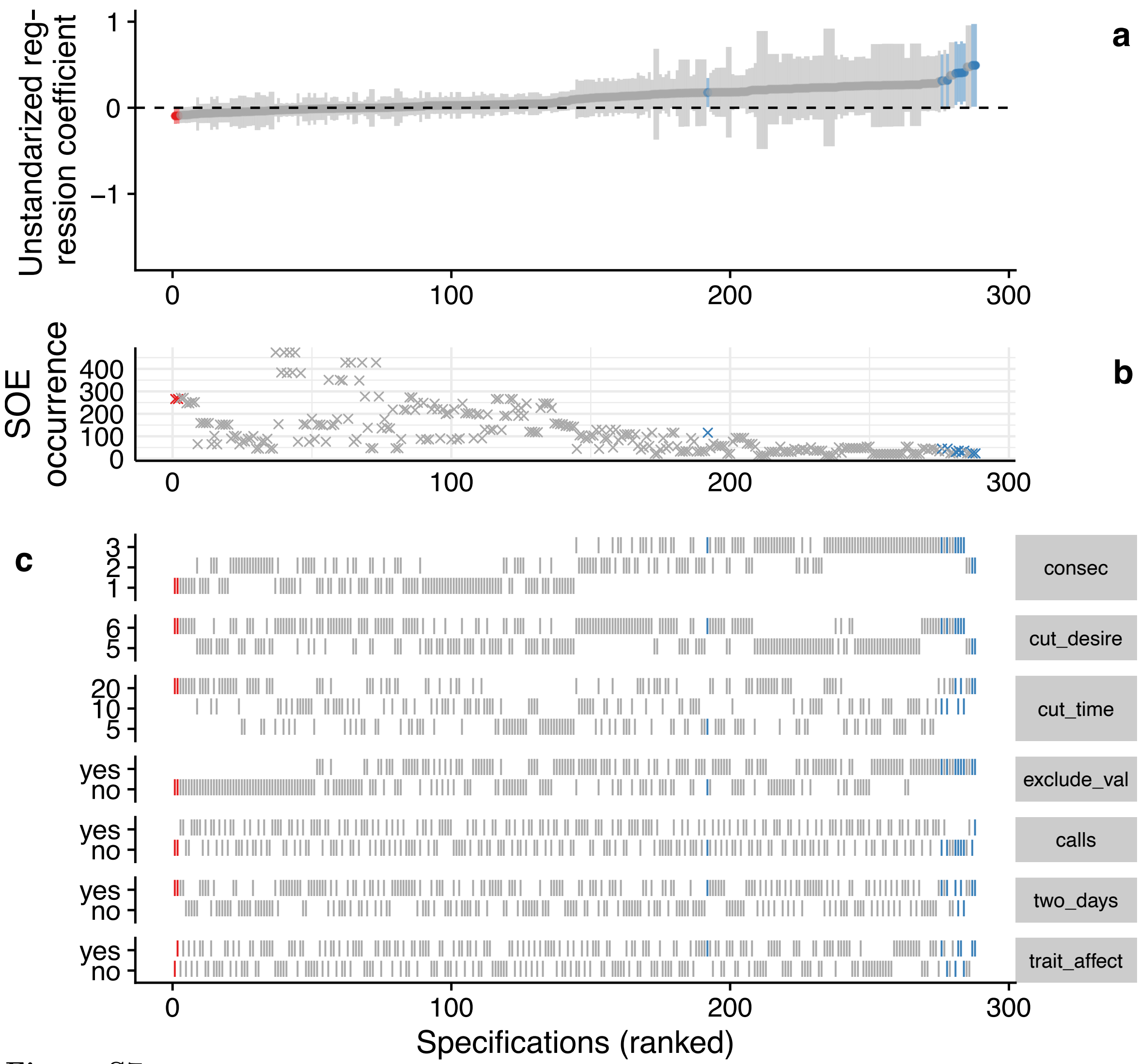

Figure S7

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Extraversion on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

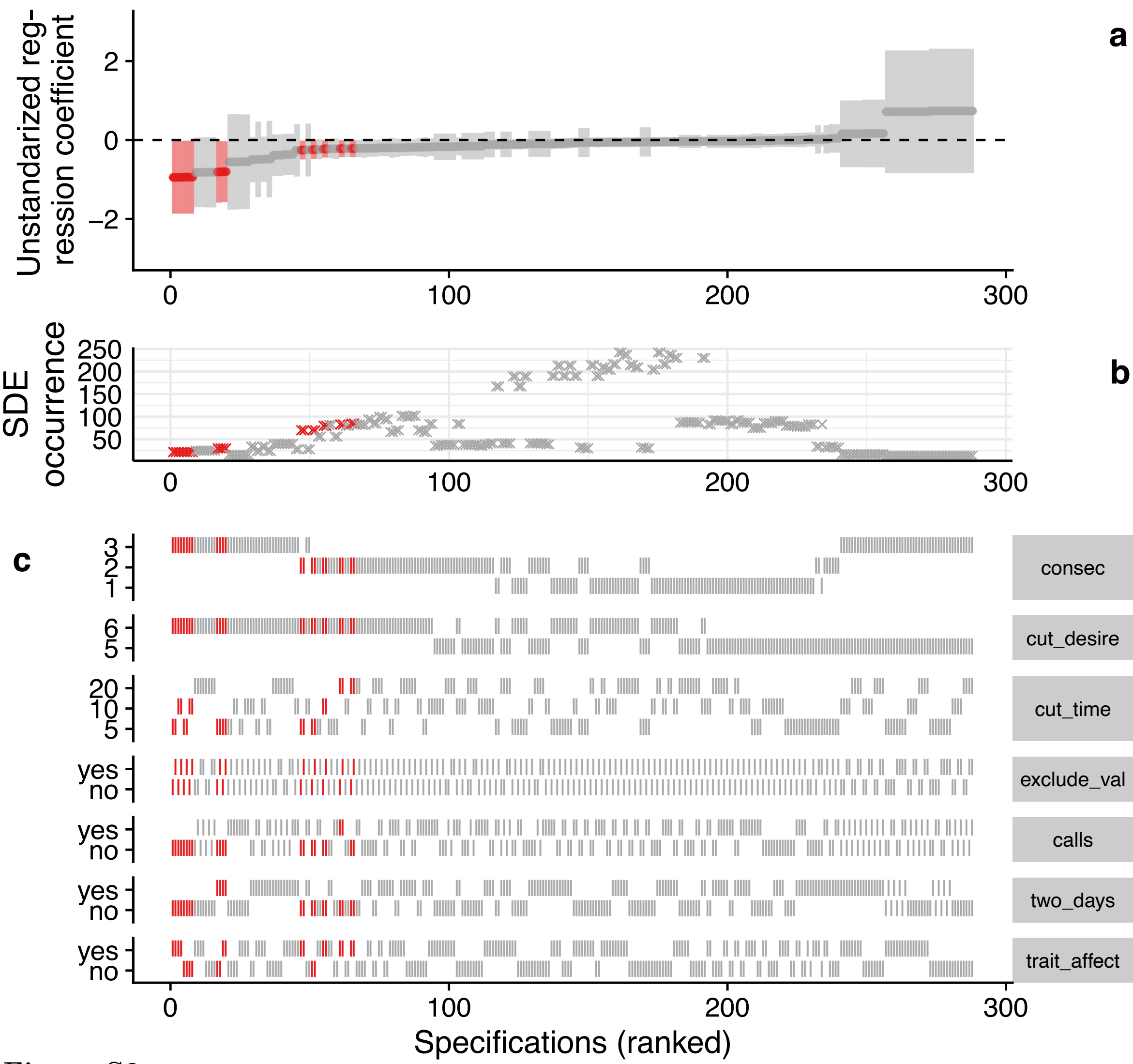

Figure S8

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Affiliation Motive on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

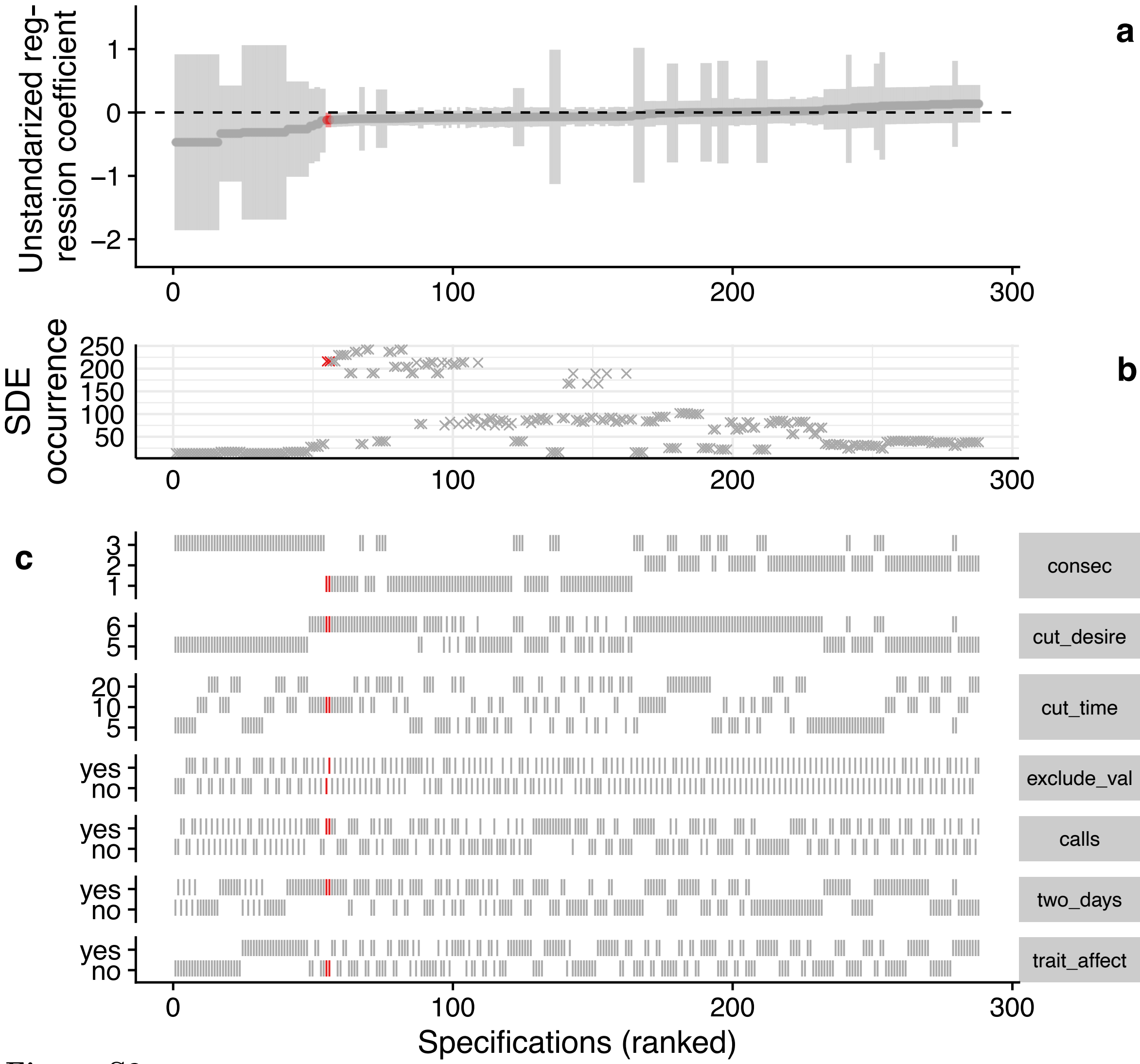

Figure S9

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Affiliation Motive on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

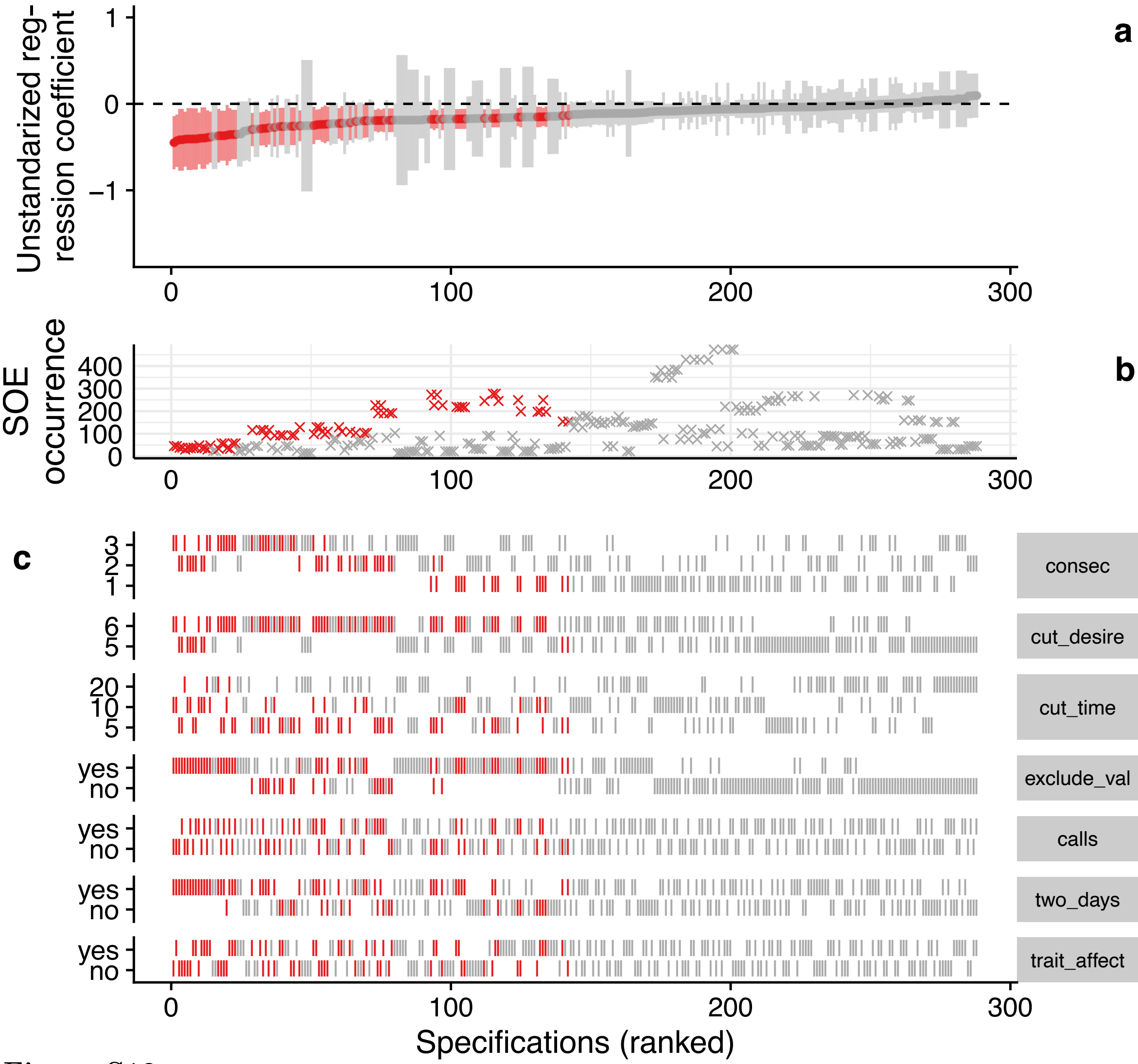

Figure S10

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Affiliation Motive on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

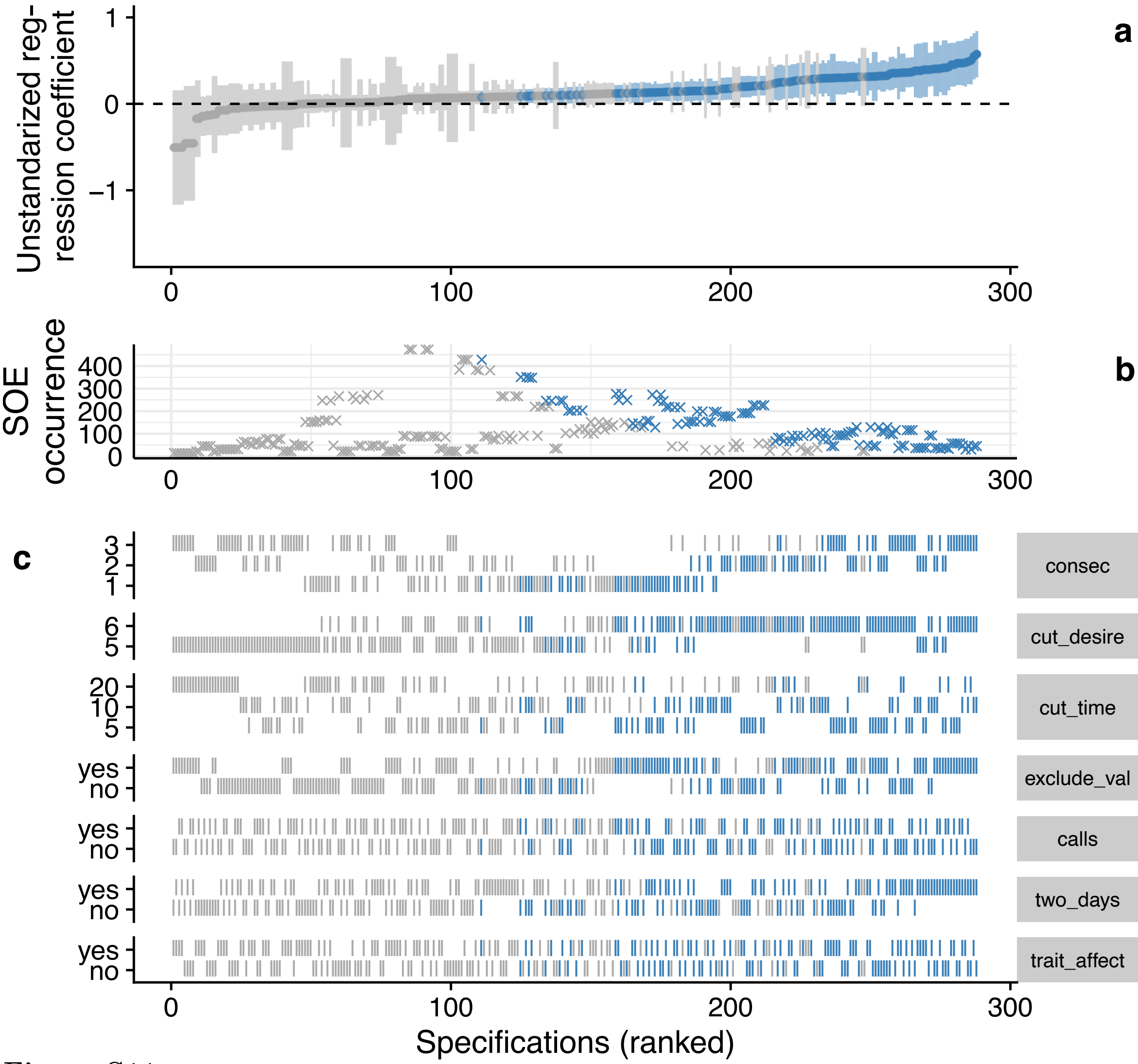

Figure S11

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Affiliation Motive on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

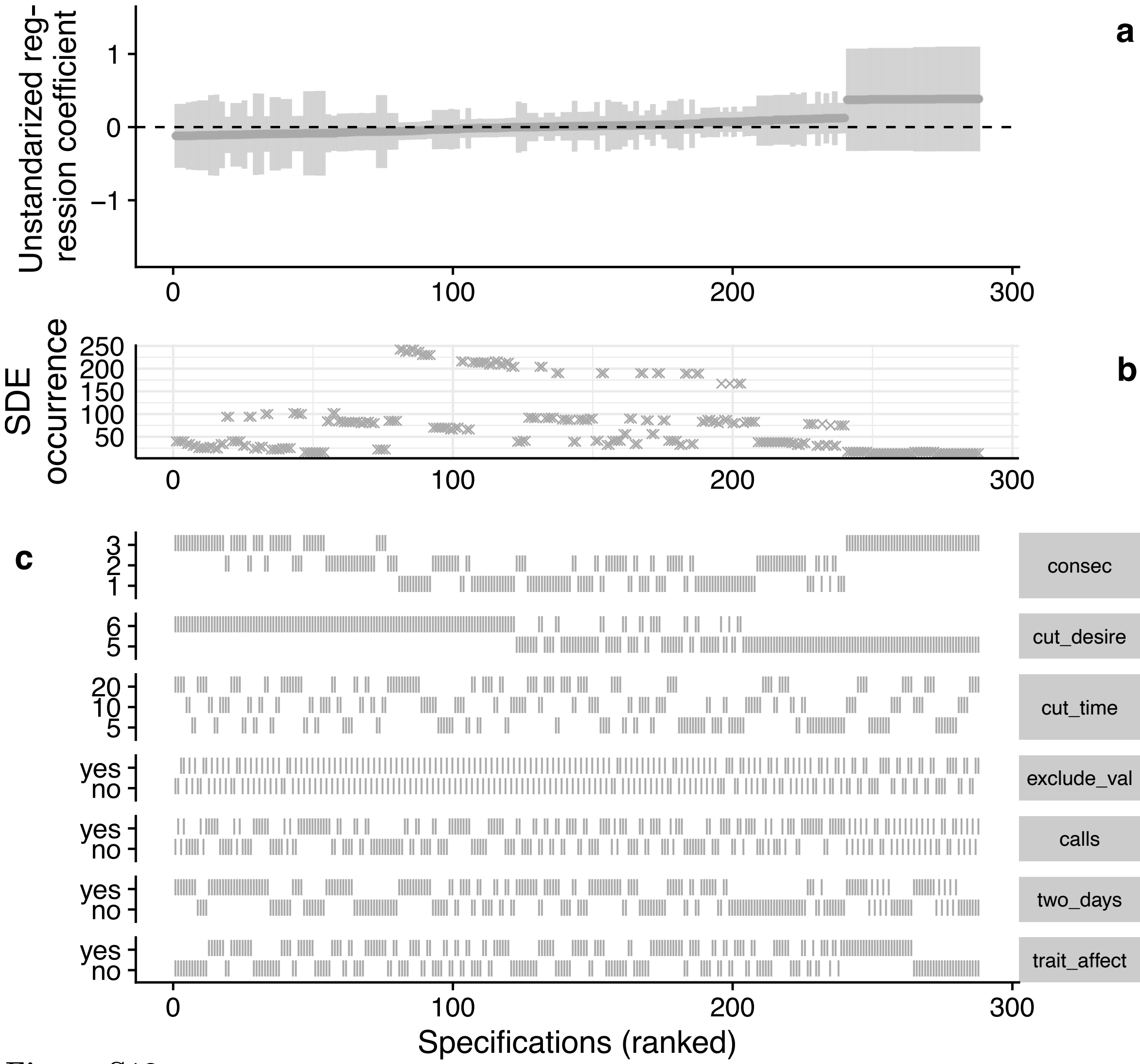

Figure S12

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Neuroticism on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

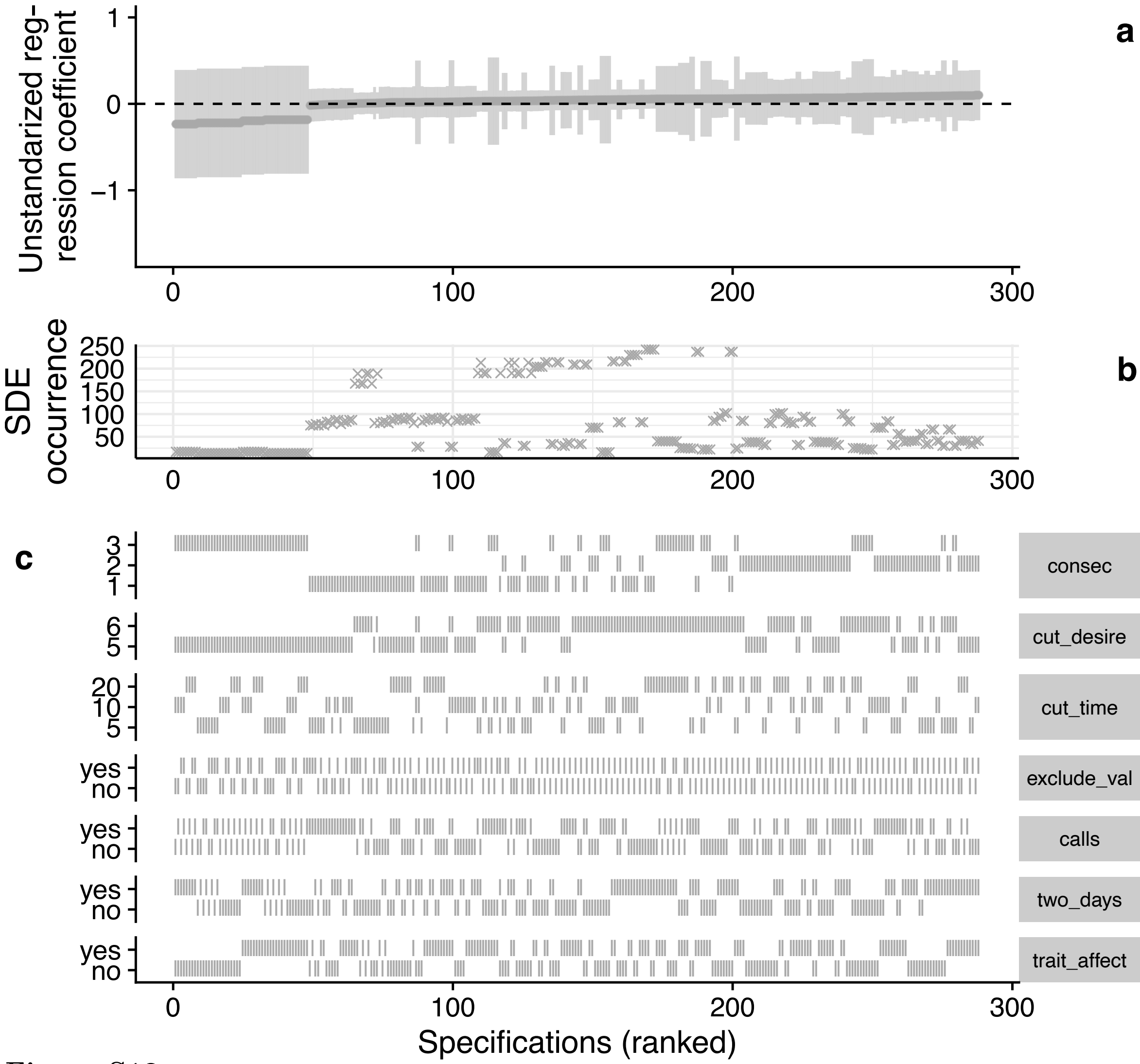

Figure S13

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Neuroticism on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

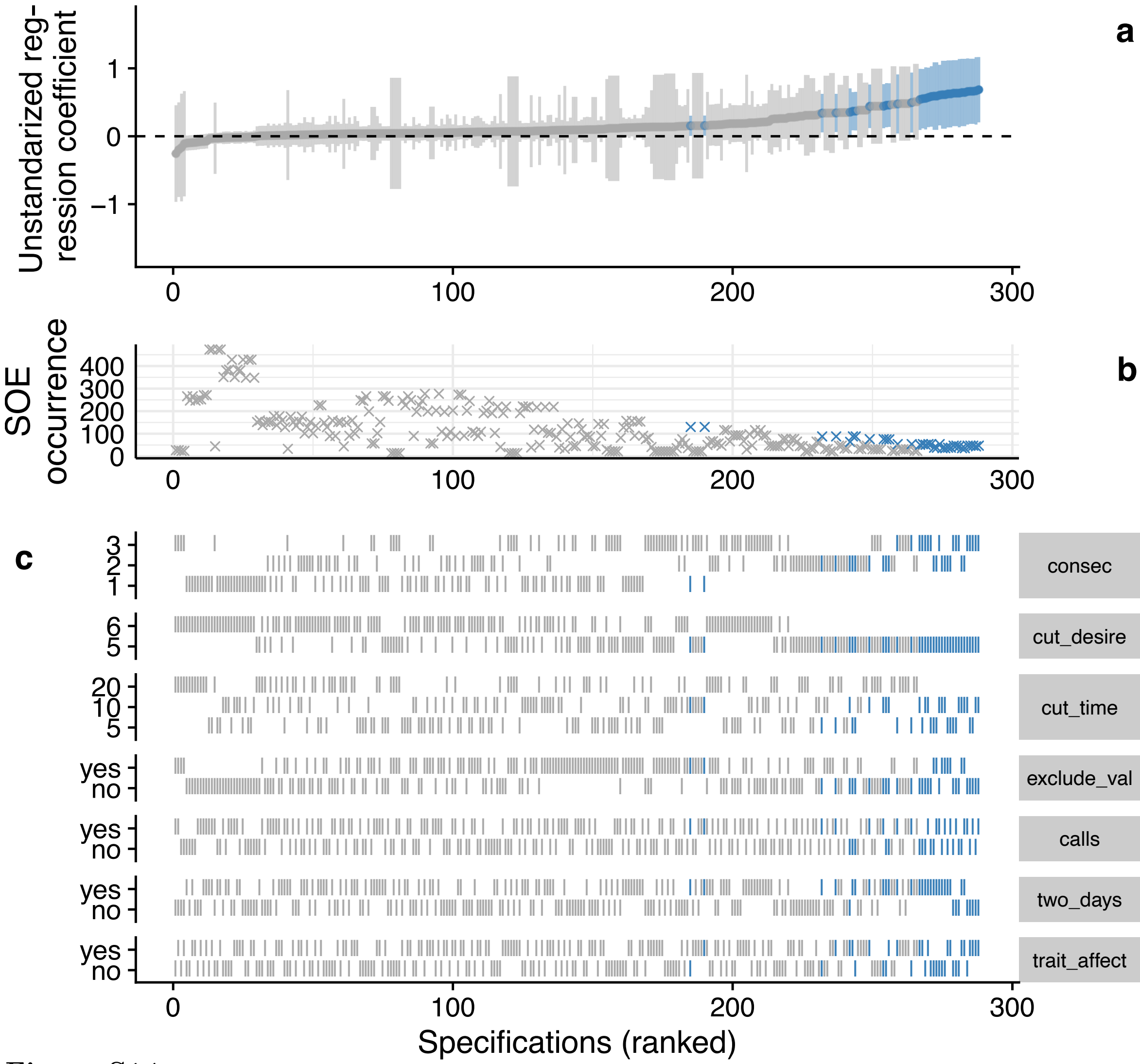

Figure S14

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Neuroticism on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

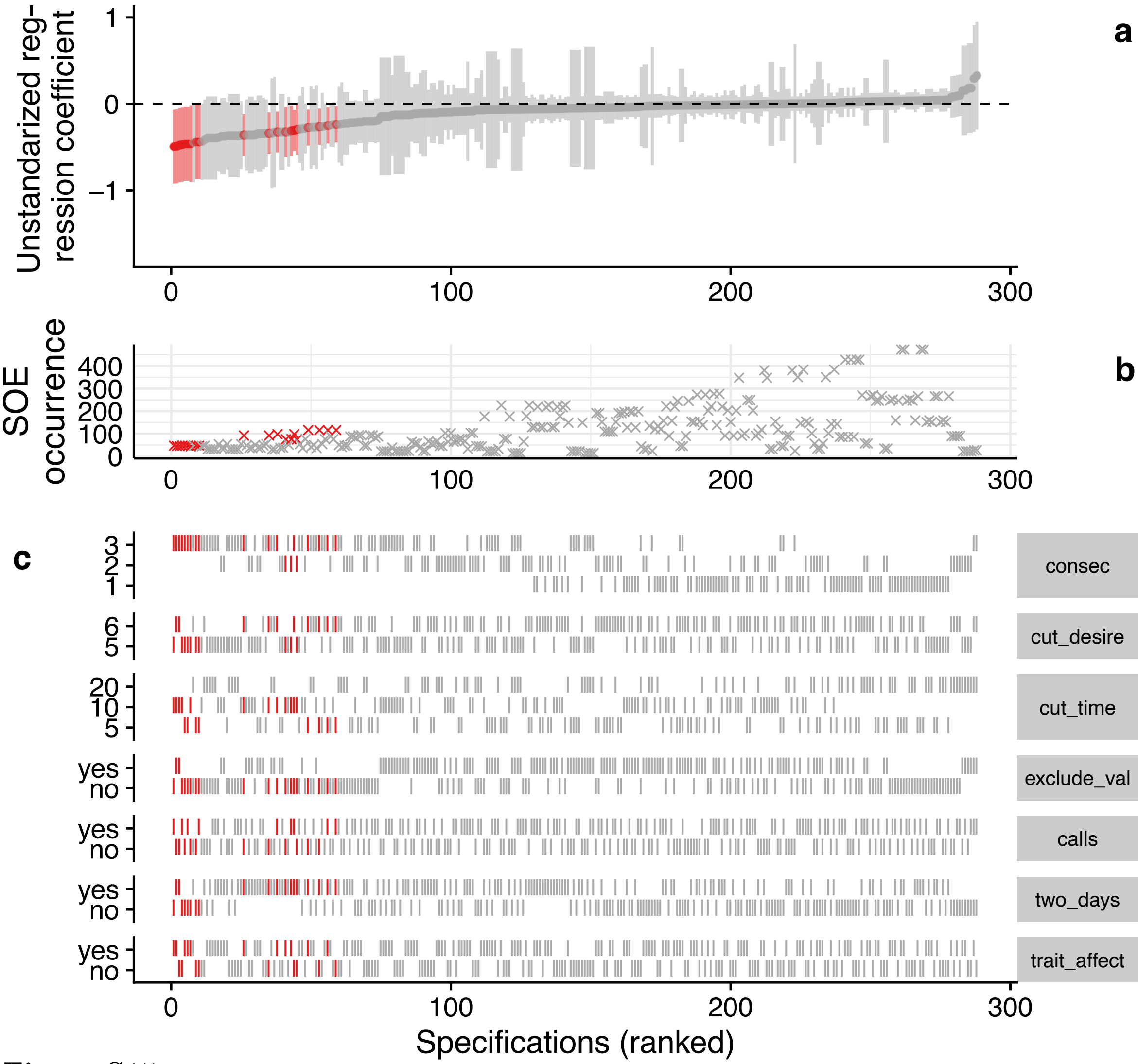

Figure S15

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Neuroticism on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

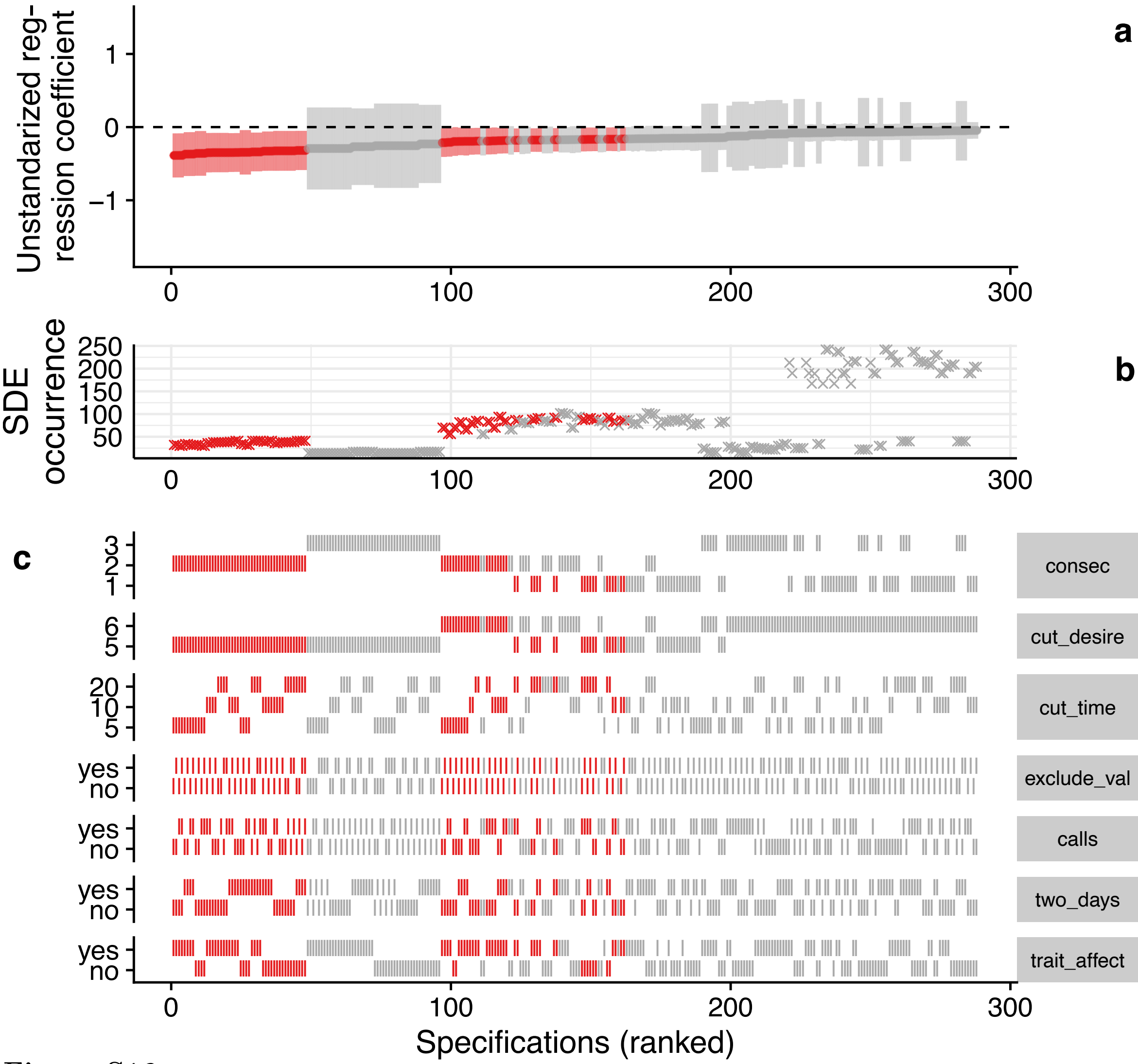

Figure S16

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Sociability on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

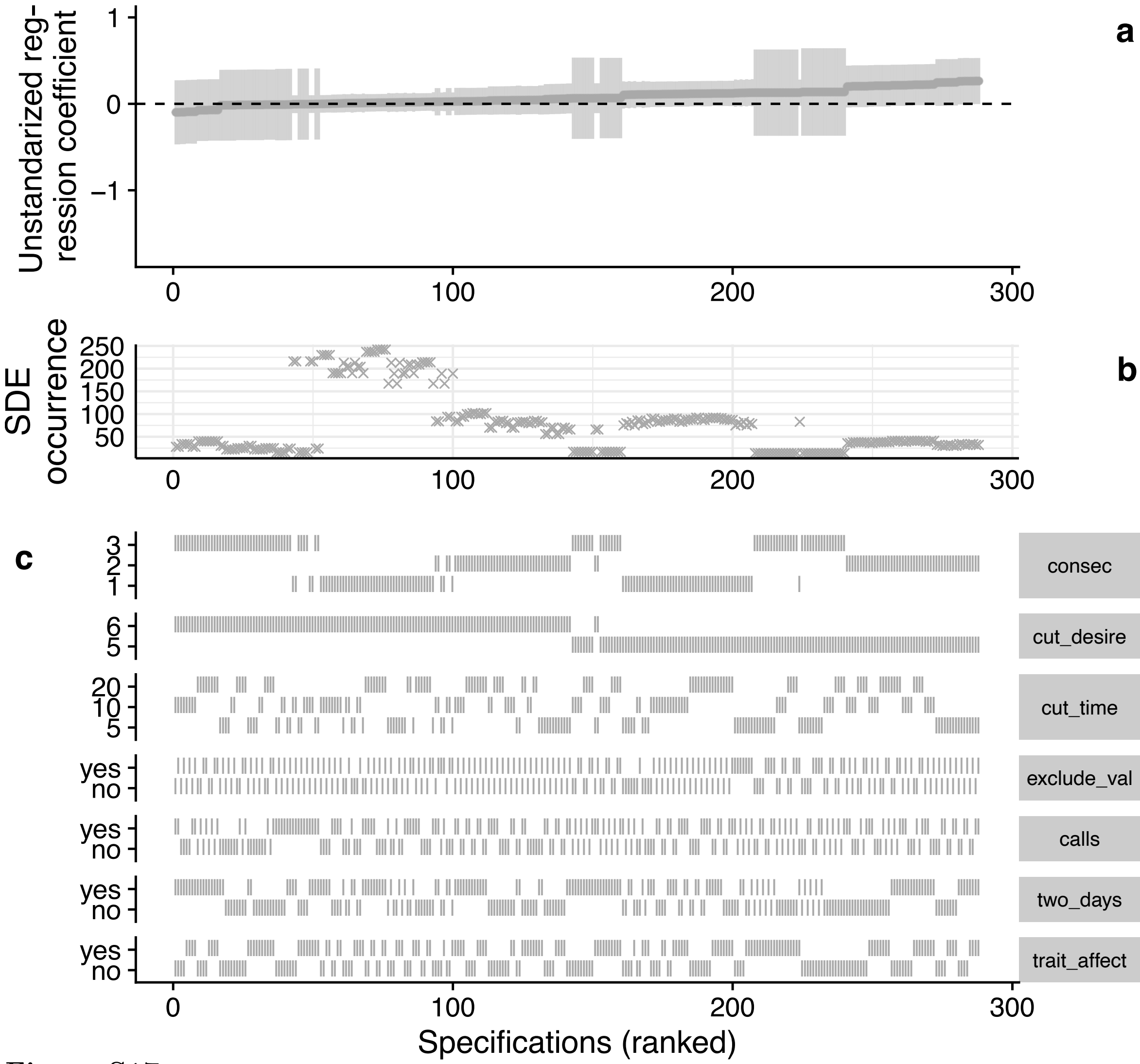

Figure S17

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Sociability on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

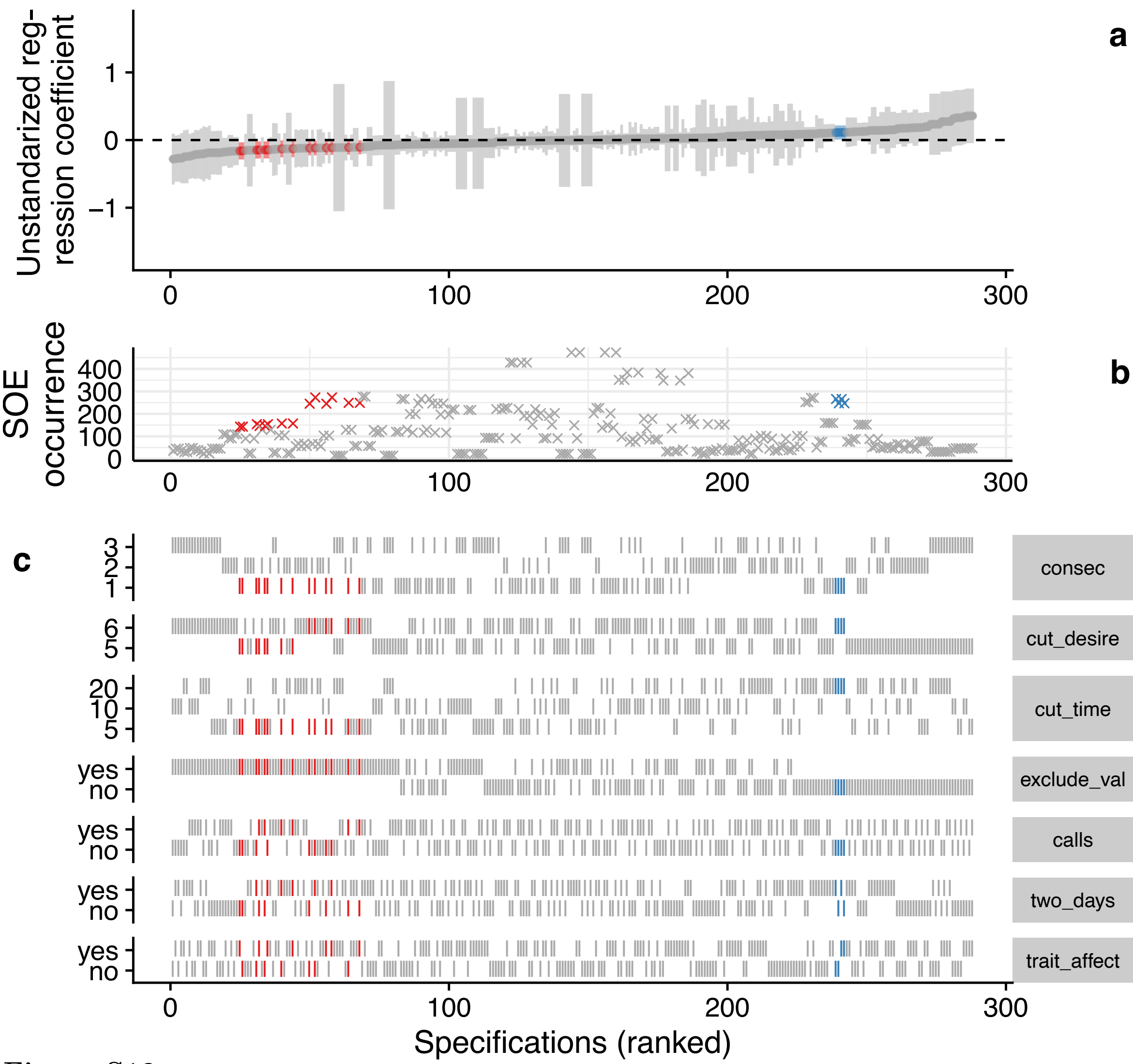

Figure S18

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Sociability on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

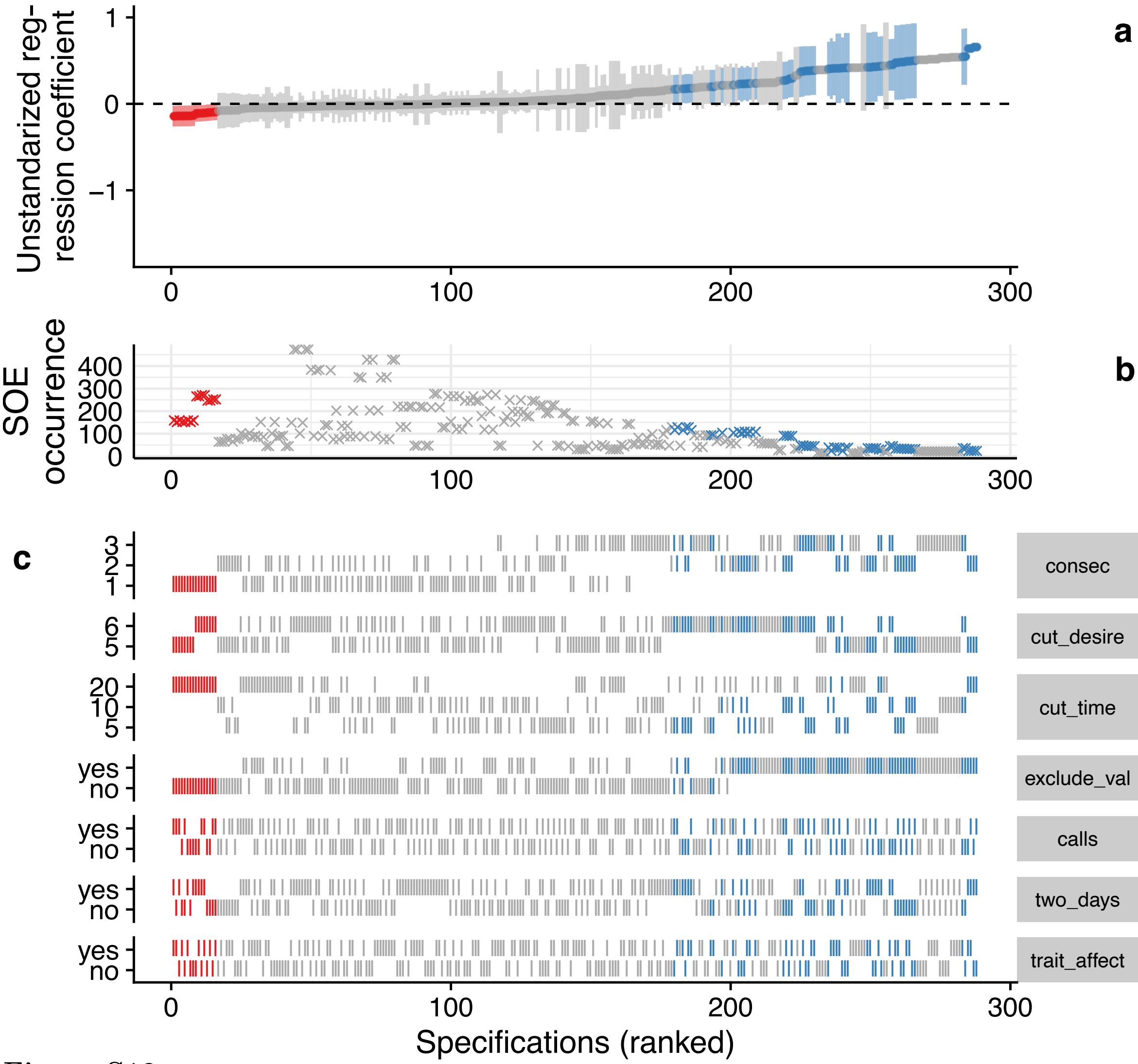

Figure S19

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Sociability on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

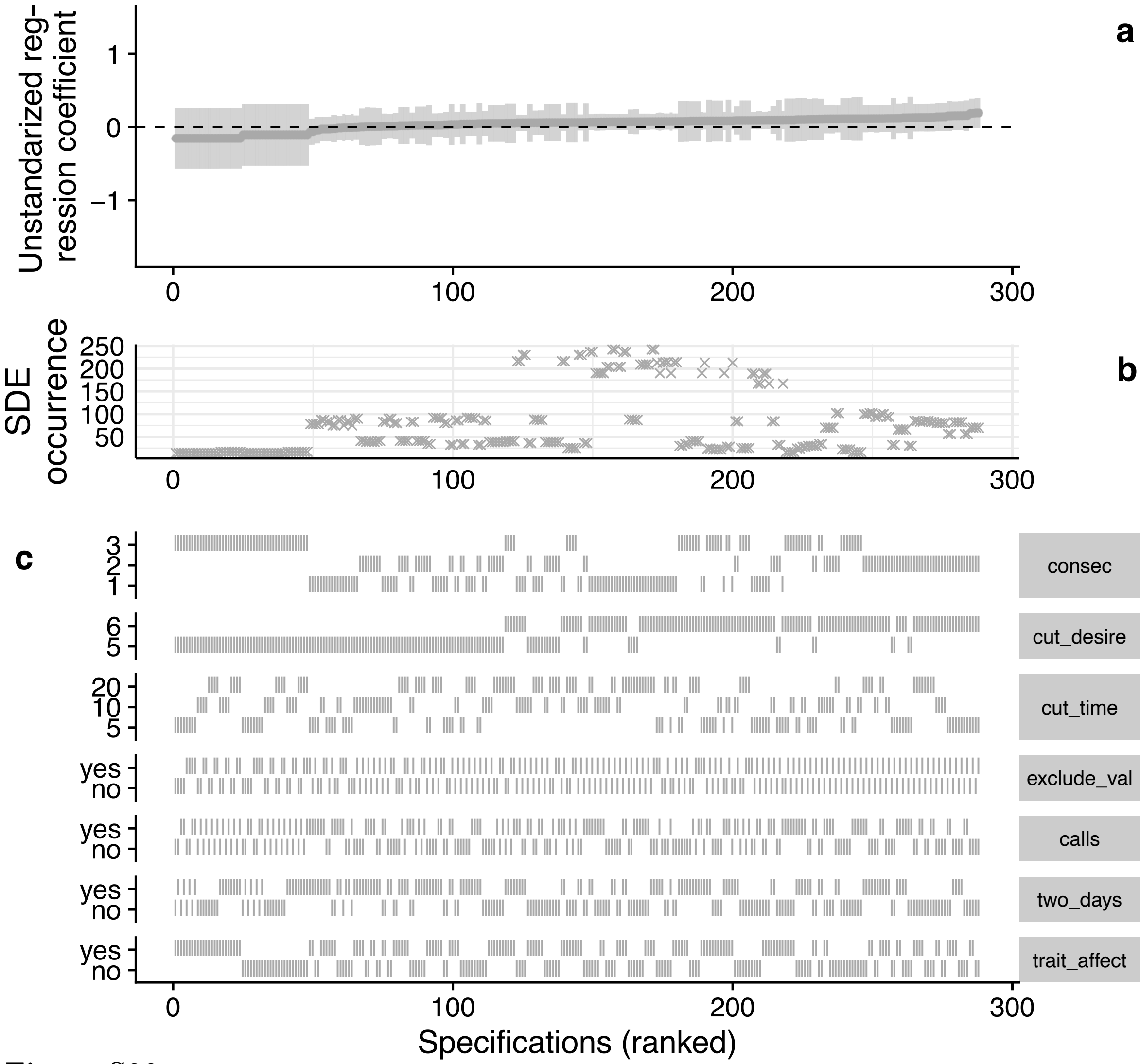

Figure S20

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Need to be Alone on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

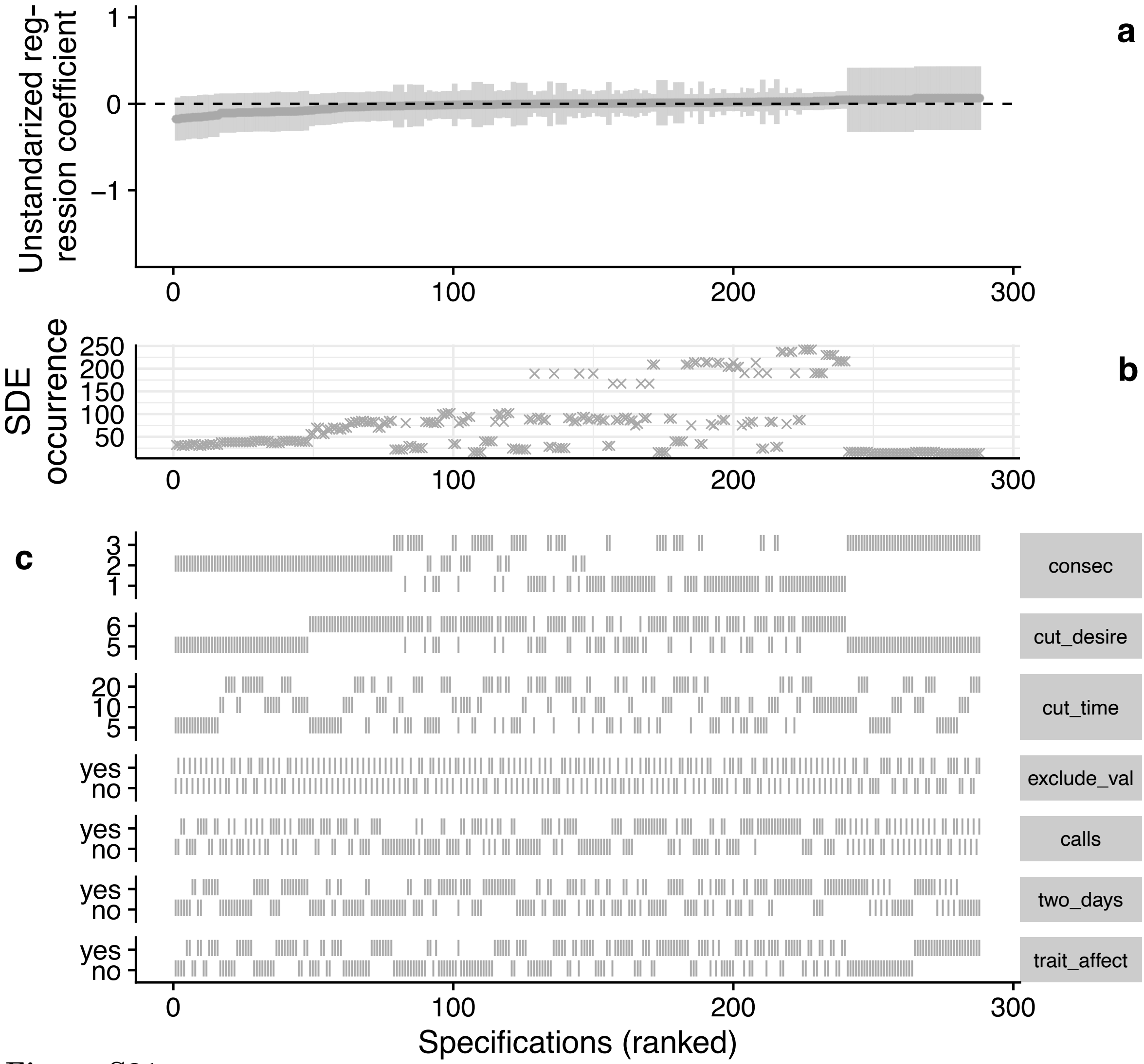

Figure S21

Specification Curve Analysis for the Moderation Effect of Social Deprivation Episodes by Need to be Alone on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

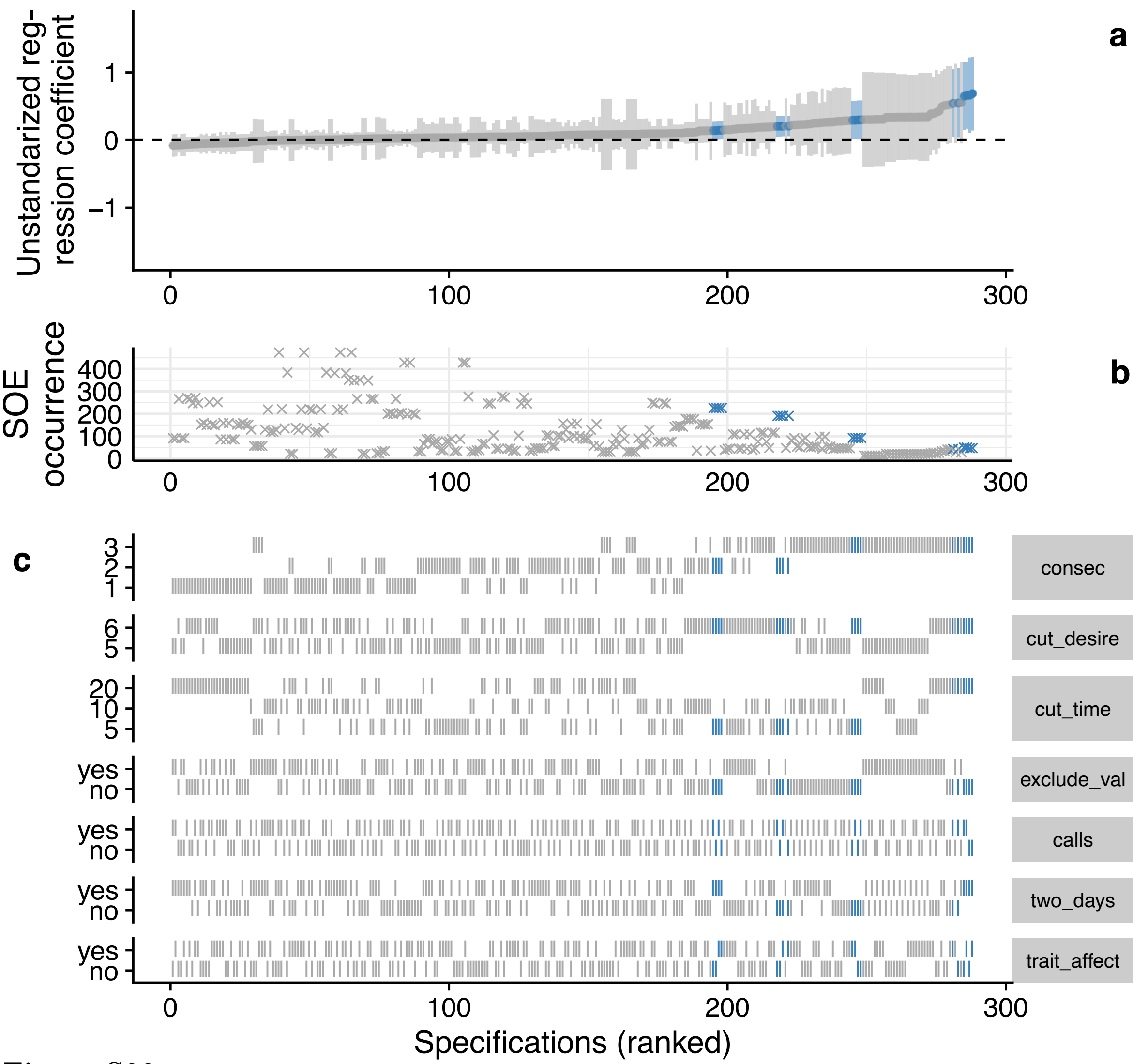

Figure S22

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Need to be Alone on Positive Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

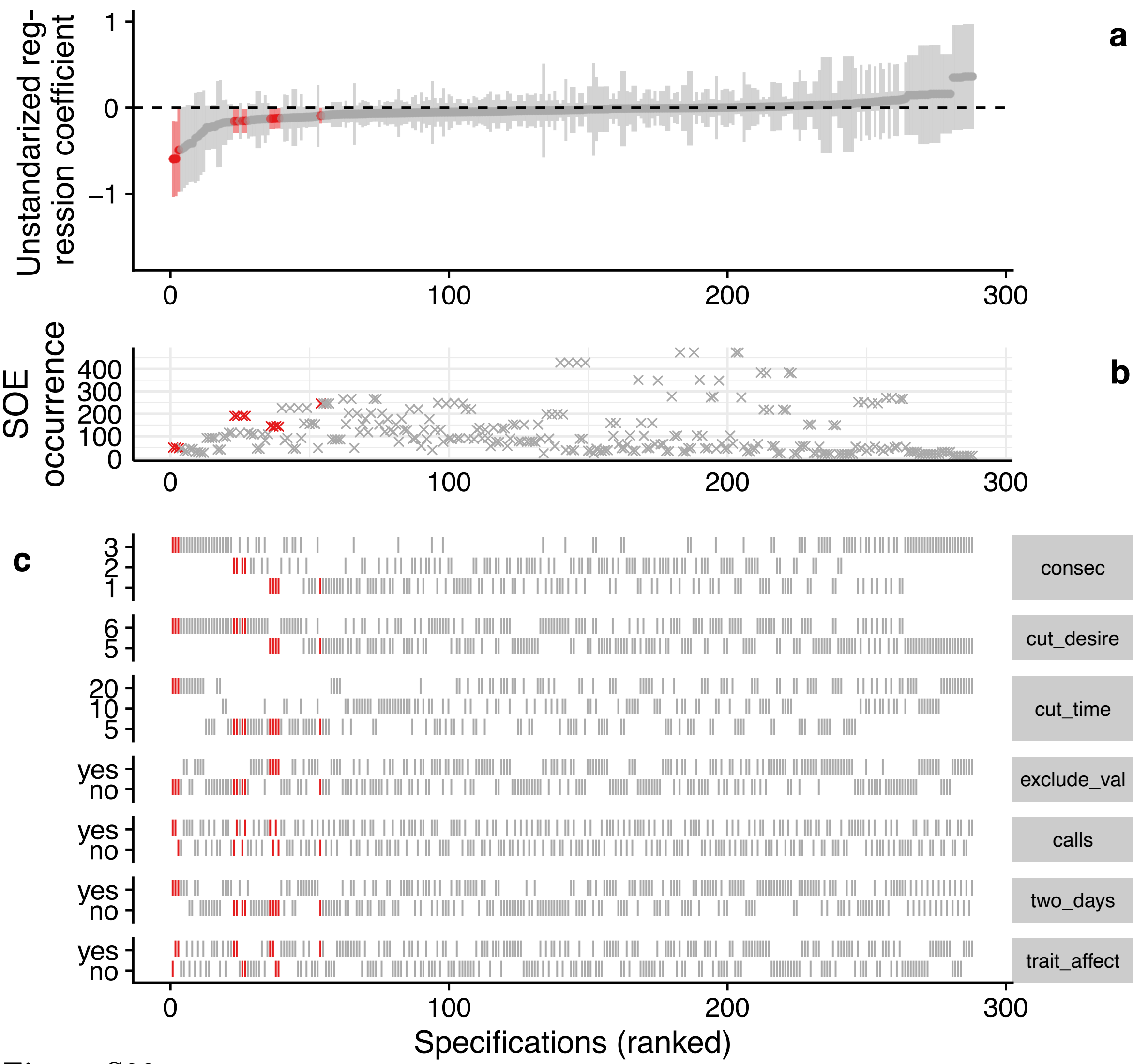

Figure S23

Specification Curve Analysis for the Moderation Effect of Social Oversatiation Episodes by Need to be Alone on Negative Affect. See Figure S2 and the description in the Supplemental Material *for details of the specifications coding.*

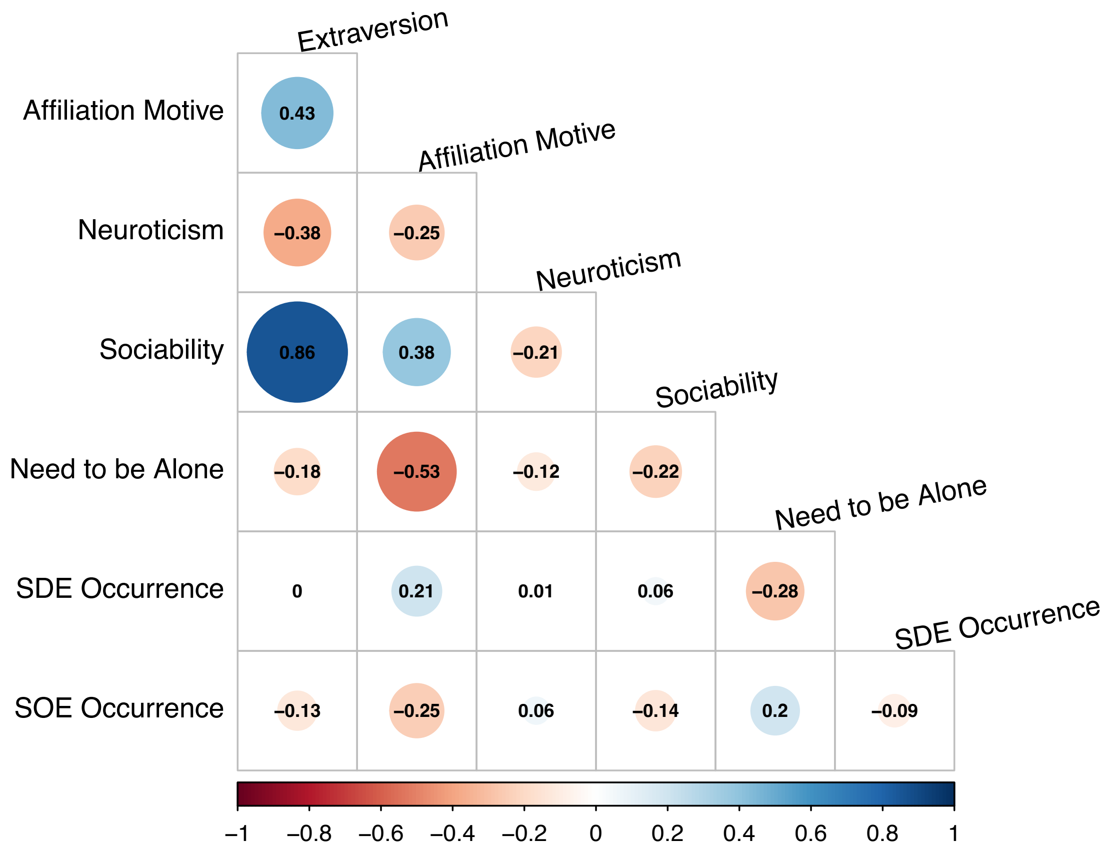

Figure S24

Raw correlation plots (Wei & Simko, 2017) between Social Deprivation Episode (SDE) and Social Oversatiation Episode (SOE) Occurrence and Social Traits (N = 306).

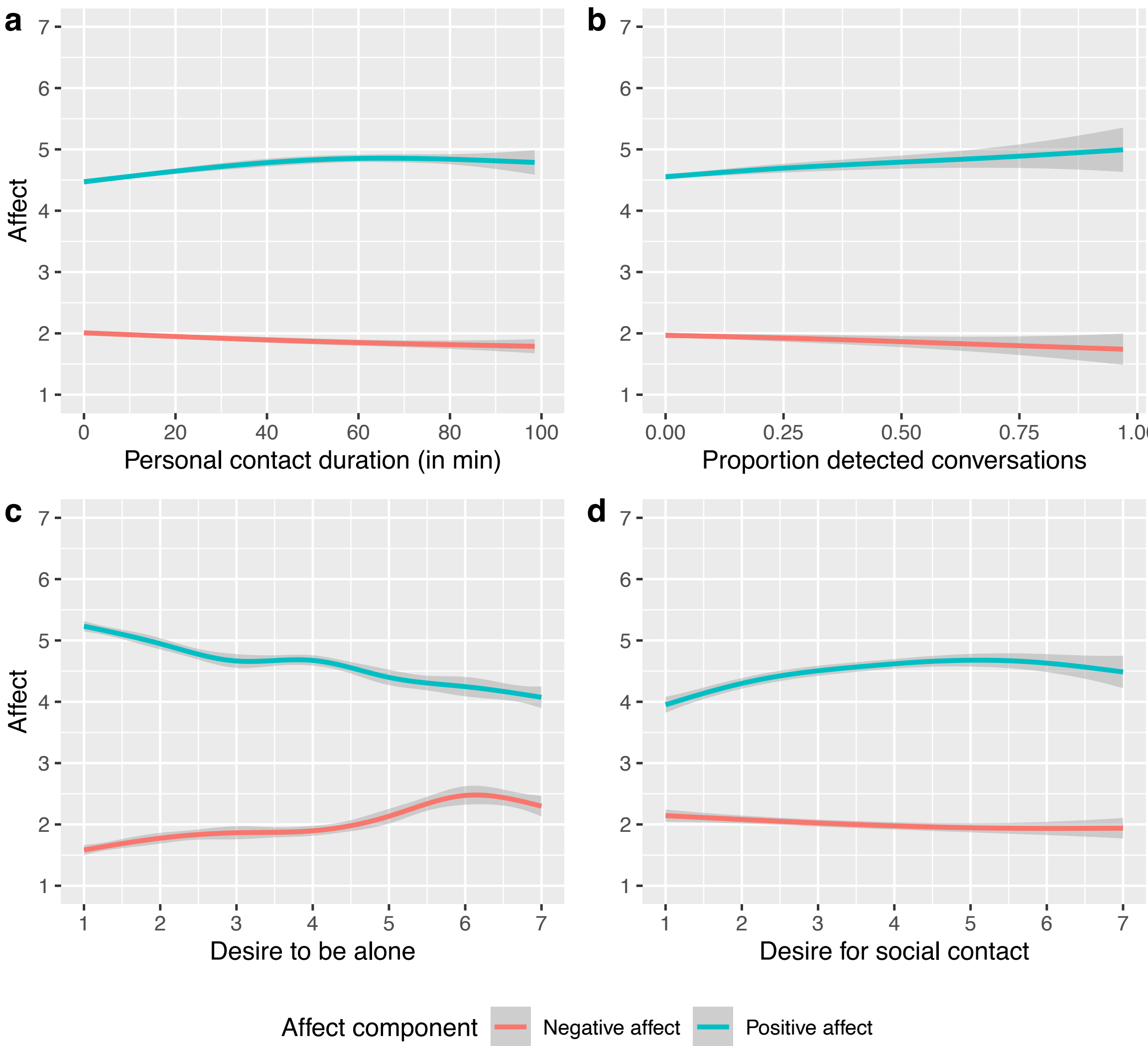

Figure S25

Smoothed Regression Lines (GAM) Showing the Relationships of Social Contact per ESM Episode (a, b) and Social Desire (c, d) with Affect Using the Uncentered Variables. Note that in the ESM questionnaires desire to be alone was administered when in personal contact with someone just before answering ($N_{episodes}$ = 2571), and desire for social contact when not in personal contact ($N_{episodes}$ = 1934). The proportion on detected conversations is computed on a slightly reduced sample of $N_{episodes}$ = 3198.

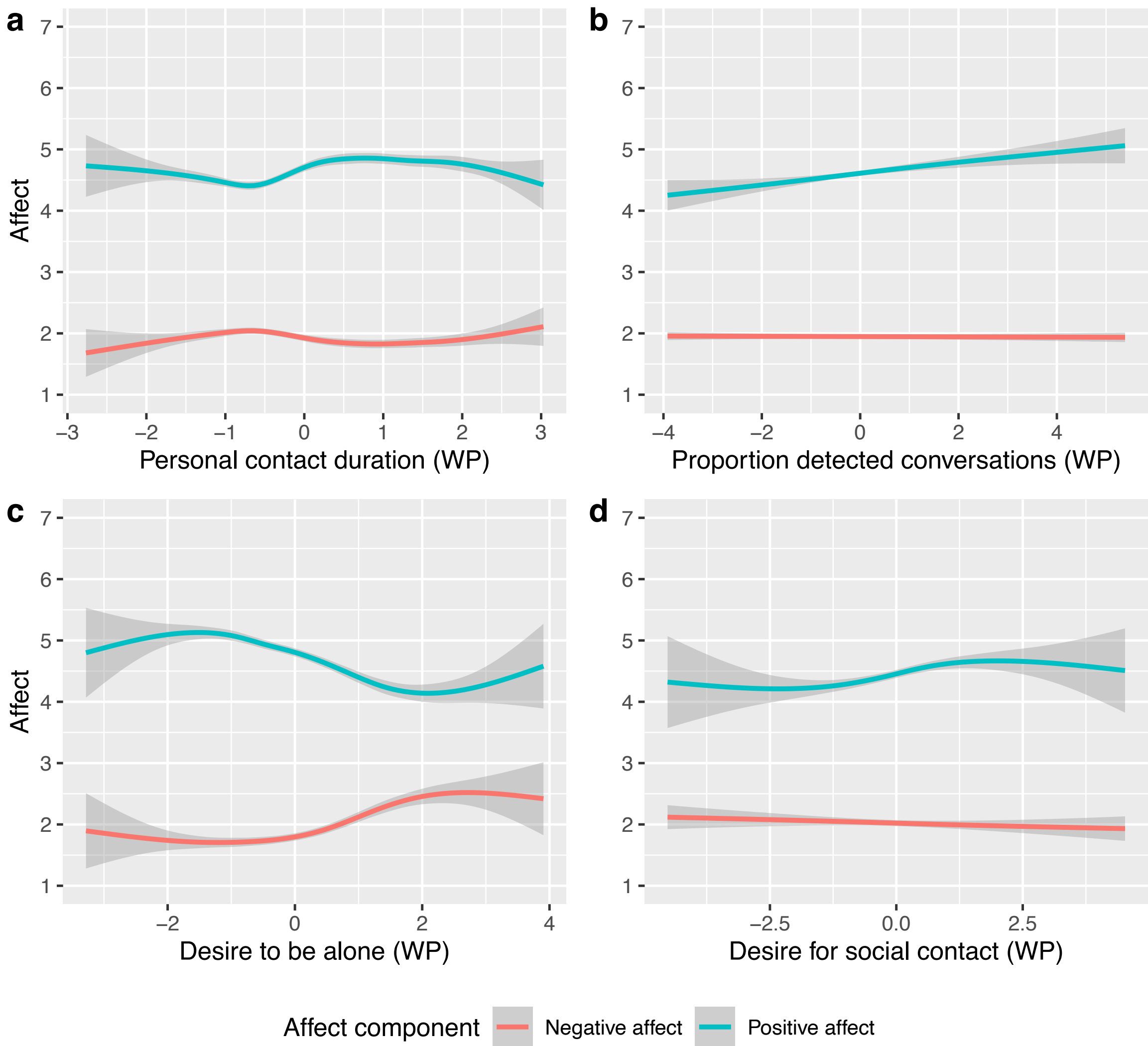

Figure S26

Smoothed Regression Lines (GAM) Showing the Relationships of Social Contact per ESM Episode (a, b) and Social Desire (c, d) with Affect Using the Person-Mean Centered Variables. Note that in the ESM questionnaires desire to be alone was administered when in personal contact with someone just before answering ($N_{episodes}$ = 2571), and desire for social contact when not in personal contact ($N_{episodes}$ = 1934). The proportion on detected conversations is computed on a slightly reduced sample of $N_{episodes}$ = 3198. WP = z-standardized within-person deviation from person-mean.

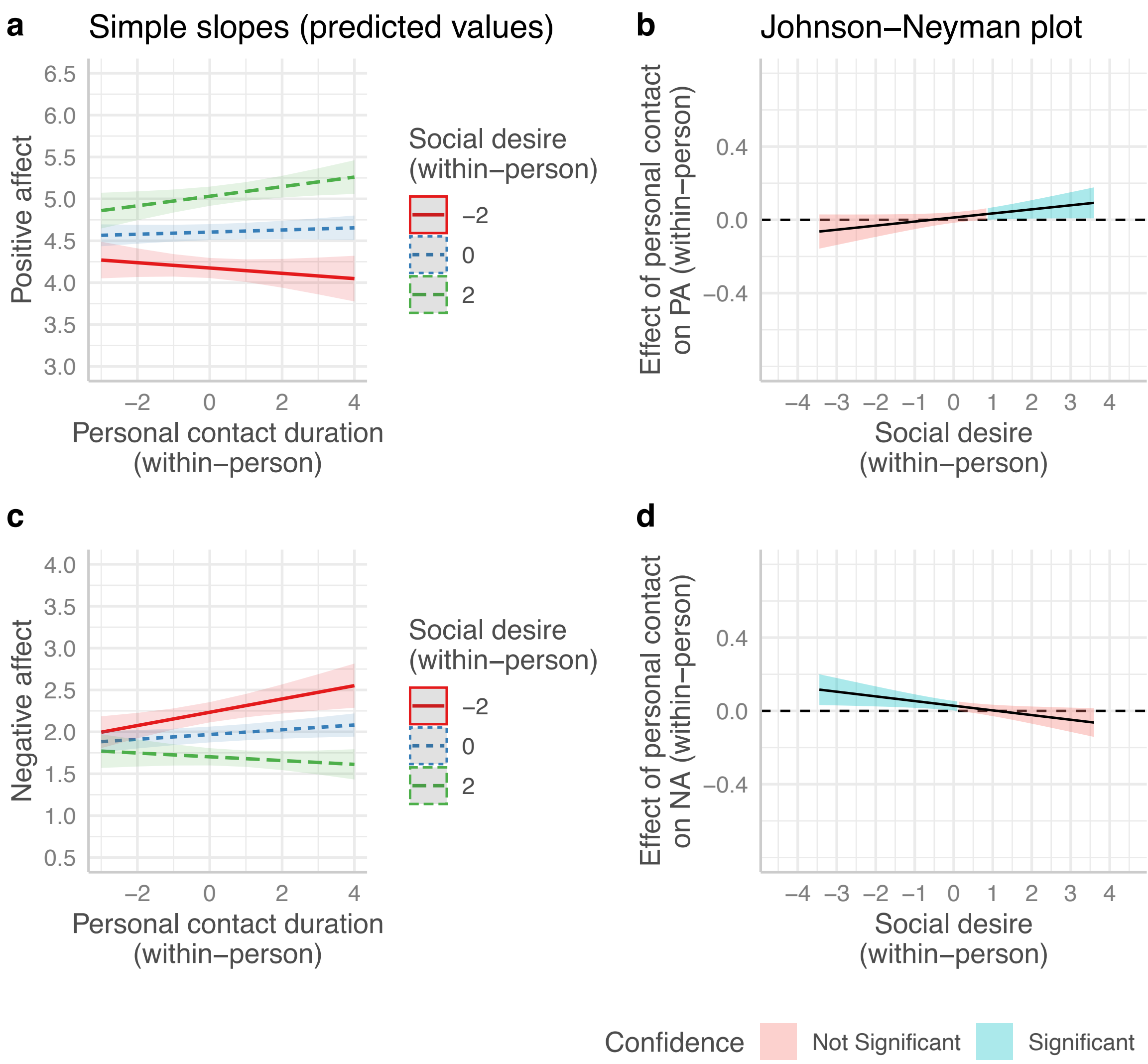

Figure S27

Simple-slopes plots (a, c) and Neyman-Johnson regions-of-significance plots (b, d) for within-person interaction effects (using the composite social desire variable) predicting positive affect (PA) and negative affect (NA). Note that the interaction effect for PA is overall nonsignificant. Confidence bands represent 95% confidence intervals. Variables presented on the X-axis are person-mean centered and standardized.

Complete Software and Session Information

We used R (Version 4.2.1; R Core Team, 2022) and the R-packages *bayestestR* (Version 0.12.1; Makowski et al., 2019), *correlation* (Version 0.8.2; Makowski et al., 2020b), *corrplot2021* (Wei & Simko, 2021), *cowplot* (Version 1.1.1; Wilke, 2020), *datawizard* (Version 0.5.1; Patil et al., 2022), *dplyr* (Version 1.0.9; Wickham, François, et al., 2022), *easystats* (Version 0.5.2; Lüdecke et al., 2022), *effectsize* (Version 0.7.0.5; Ben-Shachar et al., 2020), *forcats* (Version 0.5.1; Wickham, 2021), *ggplot2* (Version 3.3.6; Wickham, 2016), *insight* (Version 0.18.2; Lüdecke et al., 2019), *lme4* (Version 1.1.29; Bates et al., 2015), *lubridate* (Version 1.8.0; Grolemund & Wickham, 2011), *Matrix* (Version 1.4.1; Bates et al., 2022), *modelbased* (Version 0.8.5; Makowski et al., 2020a), *nlme* (Version 3.1.157; Pinheiro & Bates, 2000), *papaja* (Version 0.1.1; Aust & Barth, 2022), *parameters* (Version 0.18.2; Lüdecke et al., 2020), *performance* (Version 0.9.2; Lüdecke, Ben-Shachar, et al., 2021), *purrr* (Version 0.3.4; Henry & Wickham, 2020), *readr* (Version 2.1.2; Wickham, Hester, et al., 2022), *report* (Version 0.5.5; Makowski et al., 2021), *scales* (Version 1.2.0; Wickham & Seidel, 2022), *see* (Version 0.7.2; Lüdecke, Patil, et al., 2021), *sjPlot* (Version 2.8.10; Lüdecke, 2021), *specr* (Version 0.2.1; Masur & Scharkow, 2019), *stringr* (Version 1.4.0; Wickham, 2019), *tidyr* (Version 1.2.0; Wickham & Girlich, 2022), and *tinylabels* (Version 0.2.3; Barth, 2022) for data wrangling, analyses, and plots. We used *renv* to create a reproducible environment for this R-project (Version 0.15.5, Ushey, 2022).

The following is the output of R's *sessionInfo()* command, which shows information to aid analytic reproducibility of the analyses.

R version 4.2.1 (2022-06-23) Platform: x86_64-apple-darwin17.0 (64-bit) Running under: macOS Big Sur … 10.16

Matrix products: default BLAS: /Library/Frameworks/R.framework/Versions/4.2/Resources/lib/libRblas.0.dylib LAPACK:

/Library/Frameworks/R.framework/Versions/4.2/Resources/lib/libRlapack.dylib

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other attached packages: [1] scales_1.2.0 forcats_0.5.1 specr_0.2.1 sjPlot_2.8.10
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loaded via a namespace (and not attached): [1] splines_4.2.1 modelr_0.1.8 assertthat_0.2.1 renv_0.15.5
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References

Aust, F., & Barth, M. (2022). *papaja: Prepare reproducible APA journal articles with R Markdown*. https://github.com/crsh/papaja

Barth, M. (2022). *tinylabels: Lightweight variable labels*. https://cran.r-project.org/package=tinylabels

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Bates, D., Maechler, M., & Jagan, M. (2022). *Matrix: Sparse and dense matrix classes and methods*. https://CRAN.R-project.org/package=Matrix

Ben-Shachar, M. S., Lüdecke, D., & Makowski, D. (2020). effectsize: Estimation of effect size indices and standardized parameters. *Journal of Open Source Software*, *5*(56), 2815. https://doi.org/10.21105/joss.02815

Grolemund, G., & Wickham, H. (2011). Dates and times made easy with lubridate. *Journal of Statistical Software*, *40*(3), 1–25. https://www.jstatsoft.org/v40/i03/

Henry, L., & Wickham, H. (2020). *Purrr: Functional programming tools*. https://CRAN.R-project.org/package=purrr

Lüdecke, D. (2021). *sjPlot: Data visualization for statistics in social science*. https://CRAN.R-project.org/package=sjPlot

Lüdecke, D., Ben-Shachar, M. S., Patil, I., & Makowski, D. (2020). Extracting, computing and exploring the parameters of statistical models using R. *Journal of Open Source Software*, *5*(53), 2445. https://doi.org/10.21105/joss.02445

Lüdecke, D., Ben-Shachar, M. S., Patil, I., Waggoner, P., & Makowski, D. (2021). performance: An R package for assessment, comparison and testing of statistical models. *Journal of Open Source Software*, *6*(60), 3139. https://doi.org/10.21105/joss.03139

Lüdecke, D., Ben-Shachar, M. S., Patil, I., Wiernik, B. M., & Makowski, D. (2022).

Easystats: Framework for easy statistical modeling, visualization, and reporting. *CRAN*. https://easystats.github.io/easystats/

Lüdecke, D., Patil, I., Ben-Shachar, M. S., Wiernik, B. M., Waggoner, P., & Makowski, D. (2021). see: An R package for visualizing statistical models. *Journal of Open Source Software*, *6*(64), 3393. https://doi.org/10.21105/joss.03393

Lüdecke, D., Waggoner, P., & Makowski, D. (2019). insight: A unified interface to access information from model objects in R. *Journal of Open Source Software*, *4*(38), 1412. https://doi.org/10.21105/joss.01412

Makowski, D., Ben-Shachar, M. S., & Lüdecke, D. (2019). bayestestR: Describing effects and their uncertainty, existence and significance within the bayesian framework. *Journal of Open Source Software*, *4*(40), 1541. https://doi.org/10.21105/joss.01541

Makowski, D., Ben-Shachar, M. S., Patil, I., & Lüdecke, D. (2020a). Estimation of model-based predictions, contrasts and means. *CRAN*. https://github.com/easystats/modelbased

Makowski, D., Ben-Shachar, M. S., Patil, I., & Lüdecke, D. (2020b). Methods and algorithms for correlation analysis in r. *Journal of Open Source Software*, *5*(51), 2306. https://doi.org/10.21105/joss.02306

Makowski, D., Ben-Shachar, M. S., Patil, I., & Lüdecke, D. (2021). Automated results reporting as a practical tool to improve reproducibility and methodological best practices adoption. *CRAN*. https://github.com/easystats/report

Masur, P. K., & Scharkow, M. (2019). *Specr: Statistical functions for conducting specification curve analyses (version 0.2.1)*. https://github.com/masurp/specr

Patil, I., Makowski, D., Ben-Shachar, M. S., Wiernik, B. M., Bacher, E., & Lüdecke, D. (2022). Datawizard: An r package for easy data preparation and statistical transformations. *CRAN*. https://easystats.github.io/datawizard/

Pinheiro, J. C., & Bates, D. M. (2000). *Mixed-effects models in s and s-PLUS*. Springer. https://doi.org/10.1007/b98882

R Core Team. (2022). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing. https://www.R-project.org/

Simonsohn, U., Simmons, J. P., & Nelson, L. D. (2020). Specification curve analysis. *Nature Human Behaviour*, *4*(11), 1208–1214. https://doi.org/10.1038/s41562-020-0912-z

Ushey, K. (2022). *Renv: Project environments* [R package version 0.15.2]. https://rstudio.github.io/renv/

Wei, T., & Simko, V. (2017). *R package "corrplot": Visualization of a correlation matrix* [R package version 0.84]. https://github.com/taiyun/corrplot

Wei, T., & Simko, V. (2021). *R package 'corrplot': Visualization of a correlation matrix.* https://github.com/taiyun/corrplot

Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis.* Springer-Verlag New York. https://ggplot2.tidyverse.org

Wickham, H. (2019). *Stringr: Simple, consistent wrappers for common string operations.* https://CRAN.R-project.org/package=stringr

Wickham, H. (2021). *Forcats: Tools for working with categorical variables (factors).* https://CRAN.R-project.org/package=forcats

Wickham, H., François, R., Henry, L., & Müller, K. (2022). *Dplyr: A grammar of data manipulation.* https://CRAN.R-project.org/package=dplyr

Wickham, H., & Girlich, M. (2022). *Tidyr: Tidy messy data.* https://CRAN.R-project.org/package=tidyr

Wickham, H., Hester, J., & Bryan, J. (2022). *Readr: Read rectangular text data.* https://CRAN.R-project.org/package=readr

Wickham, H., & Seidel, D. (2022). *Scales: Scale functions for visualization.* https://CRAN.R-project.org/package=scales

Wilke, C. O. (2020). *Cowplot: Streamlined plot theme and plot annotations for 'ggplot2'.* https://CRAN.R-project.org/package=cowplot

Yaremych, H. E., Preacher, K. J., & Hedeker, D. (2021). Centering categorical predictors in multilevel models: Best practices and interpretation. *Psychological Methods*, No Pagination Specified–No Pagination Specified. https://doi.org/10.1037/met0000434

Appendix D

Individual Contribution to Empirical Studies

Authorship Roles Based on the CRediT Taxonomy (https://credit.niso.org/)

Study I

The authors made the following contributions. Michael D. Krämer: Conceptualization, Data Curation, Formal Analysis, Methodology, Visualization, Writing - Original Draft Preparation, Writing - Review & Editing; Manon A. van Scheppingen: Methodology, Writing - Review & Editing; William J. Chopik: Methodology, Writing - Review & Editing; David Richter: Supervision, Methodology, Writing - Review & Editing.

Study II - German Research Foundation (DFG) grants WR 160/2-1 & RI 2226/3-1

The authors made the following contributions. Michael D. Krämer: Conceptualization, Data Curation, Formal Analysis, Methodology, Visualization, Writing - Original Draft Preparation, Writing - Review & Editing; Yannick Roos: Conceptualization, Data Curation, Methodology, Writing - Review & Editing; David Richter: Conceptualization, Funding Acquisition, Supervision, Writing - Review & Editing; Cornelia Wrzus: Conceptualization, Funding Acquisition, Supervision, Methodology, Writing - Review & Editing.

Study III - German Research Foundation (DFG) grants WR 160/2-1 & RI 2226/3-1/2

The authors made the following contributions. Michael D. Krämer: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing - Original Draft, Writing - Review & Editing; Yannick Roos: Conceptualization, Data Curation, Investigation, Methodology, Writing - Review & Editing; Ramona Schoedel: Data Curation, Methodology, Software, Writing - Review & Editing; Cornelia Wrzus: Conceptualization, Funding Acquisition, Project Administration, Methodology, Writing - Review & Editing; David Richter: Conceptualization, Supervision, Funding Acquisition, Project Administration, Methodology, Writing - Review & Editing.

Appendix E

Curriculum Vitae

The CV is not contained in the online version of this dissertation due to data protection reasons.

The CV is not contained in the online version of this dissertation due to data protection reasons.

Appendix F

Eidesstattliche Erklärung

Eidesstattliche Erklärung

Hiermit erkläre ich, die vorliegende Dissertation selbstständig verfasst und ohne unerlaubte Hilfe angefertigt habe. Alle Hilfsmittel, die verwendet wurden, habe ich angegeben. Die Dissertation ist in keinem früheren Promotionsverfahren angenommen oder abgelehnt worden.

Berlin, 20.04.2023	< *removed* >
Ort, Datum	Unterschrift