Towards a Theory of Lifespan Personality Trait Development

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Abstract

The lifespan development of personality traits has evolved from a niche topic to a core subject of psychological science. Looking back at 20 years of research, I review the personality development literature against three criteria for strong psychological theories. Overall, the field has come a long way in refining our theoretical understanding of lifespan personality trait development. Major accomplishments include the establishment of evidence-based trait measures, the identification of robust patterns of trait stability and change, and the documentation of both environmental and genetic contributions to lifespan personality development. These insights put the field in the position to make transformative advances towards stronger and more precise theories. However, there are still several open questions. I discuss ideas to overcome existing obstacles to the development of strong lifespan personality theories and close with an overall evaluation of the theoretical status of the field.

Keywords: Big Five, Longitudinal, Genes, Life Events, Traits, Causality

1. Introduction

Traditionally, personality traits have been conceptualized as highly stable, genetically determined individual differences that are largely immune to environmental influences (e.g., McCrae et al., 2000). Two decades ago, Caspi and colleagues (2005) were among the first to challenge this view in their widely cited *Annual Review* article on personality development. Since then, the lifespan development of personality traits has evolved from a niche topic to a core subject of personality science (Costa et al., 2019; Roberts & Yoon, 2022; Robins et al., 2024). Spurred by the promise of lifelong plasticity proclaimed by the early works on personality development (e.g., Roberts & DelVecchio, 2000; Robins et al., 2001), a large body of research has amassed substantial evidence that personality traits can and do change across the lifespan (Bleidorn et al., 2022; Specht et al., 2014; Graham et al., 2020).

Much of this research has been exploratory, descriptive, and data-driven, often designed to show that personality traits *can* change throughout the lifespan (Lucas & Donnellan, 2011; Roberts et al., 2006; Anusic & Schimmack; 2016). In contrast, there has been considerably less theoretical work on the causes and process of personality trait change (Hopwood et al., 2021; Wagner et al., 2021). Notable exceptions include a handful of influential theoretical works that have inspired ongoing research efforts to uncover the nature and sources of lifespan personality trait development (e.g., McAdams & Olson, 2010; McCrae & Costa, 2008; Roberts & Wood, 2006; Wrzus & Roberts, 2018).

After 20 years of research on lifespan personality trait development, it seems appropriate to reflect on the theoretical status of this area. What have we learned and what questions need to be answered before we can refine our theoretical models? In this article, I

review the current state of the personality development literature against three criteria for strong psychological theories. In doing so, I weigh major accomplishments against lingering challenges, discuss ideas to overcome important obstacles to the development of strong theories, and close with an overall evaluation of the theoretical status of lifespan personality trait development[1].

2. What Are the Ingredients of a Strong Theory of Lifespan Personality Development?

Generally speaking, the strength of a theory is measured by its explanatory power, predictive accuracy, and ability to withstand empirical testing and scrutiny (Popper, 1934/2002). A strong theory of lifespan personality development should thus explain a wide range of developmental personality phenomena and offer a comprehensive and coherent framework for understanding how and why traits change or remain stable across the lifespan. A strong theory should also make testable and falsifiable predictions about observations including those that have not been made yet. It should be supported by rigorous and reproducible empirical evidence. Examples of strong scientific theories include the theory of evolution in biology, the theory of relativity in physics, and the germ theory in medicine.

Psychological theories rarely reach the status of strong scientific theories when evaluated by these standards (Eronen & Bringmann, 20121; Meehl, 1978). In recent years, several scholars have called attention to the fact that the theoretical foundations of psychology are fragile with few existing theories that stand the test of time and rigorous empirical scrutiny

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[1] I will focus on changes from adolescence to old age (see, e.g., Shiner et al., 2022, for a review on personality assessment and development in children) and broad personality trait dimensions (see, e.g., McAdams & Olson, 2010, for developmental research on personality variables beyond traits).

(e.g., Eronen, 2020; Oberauer & Lewandowsky, 2019). The field of personality psychology is no

exception in this regard (Leising et al., 2022). Despite several commendable theoretical

attempts to explain how or why personality traits change (e.g., Hennecke et al., 2014; Geukes

et al., 2018; McCrae & Costa, 2008; Roberts et al., 2005; Wrzus & Roberts, 2018), there are

currently few theories of lifespan personality development that would meet the very high

standards of a strong theory.

Why is it so difficult to develop specific and falsifiable theories in psychology? Eronen

and Bringmann (2021) discuss three requirements for the development of strong psychological

theories: 1) clearly defined constructs and valid measures to test theoretical principles, 2)

robust and specific empirical phenomena that constrain theories, and 3) the specification and

examination of the causal relationships between the relevant psychological variables. In the

next sections, I will review the current state of the personality development literature against

these three criteria to evaluate theoretical progress in this area and discuss ideas for future

research towards stronger theories of lifespan personality development (see Table 1 for a

summary of this review).

3. Validity of the Constructs and Measures in Lifespan Personality Development Research

Clearly defined constructs and valid measures are critical to test and falsify psychological

theories (Loevinger, 1957), to enable communication and promote collaboration in the

scientific community (Mõttus et al., 2020), and to increase the likelihood that a theory can be

generalized to different populations, settings, and contexts beyond the specific conditions

under which it was initially developed (Thalmayer et al., 2020). Considering the importance of

valid constructs and measures in psychological theory development, how does the personality

development literature fare?

3.1. Hierarchical Trait Models as Theoretical Building Blocks

To date, most research on personality trait development is organized around

hierarchical trait models, with most studies focusing on the Big Five taxonomy of personality

traits: Neuroticism/Emotional Stability, Extraversion, Openness to Experience, Agreeableness,

and Conscientiousness (John, 2021). Although there are many potential broader and narrower

traits to consider (Ashton & Lee, 2007; Thalmayer & Saucier, 2014), there are several

advantages to the Big Five model.

First, the Big Five represent a useful balance between conceptual breadth and

descriptive fidelity. Each of the Big Five domains can be considered a broad, inclusive group of

interrelated traits that are organized in an explicitly hierarchical structure with broader traits at

the higher levels (e.g., Conscientiousness) and narrower traits (e.g., punctual) at the lower

levels (Schwaba et al., 2020).

Second, decades of research have produced psychometrically sound and well-validated

measures. These have been found to predict important outcomes in various life outcomes, such

as academic achievement, job performance, interpersonal relationships, and mental health

(Jokela et al., 2014; Soto, 2019; Roberts et al., 2007; Wright & Jackson, 2023).

Third, there is some evidence for the generalizability of the Big Five across samples and

measures, which allows researchers to harmonize, compare, and integrate their findings across

studies (John, 2021). The broad acceptance of this trait model is illustrated by the fact that the

Big Five serve as an organizing framework for virtually all existing meta-analyses and review articles on personality trait development (e.g., Bleidorn et al., 2022; Briley & Tucker-Drob, 2014; Caspi et al., 2005; Roberts et al., 2006).

Fourth, Big Five self-report questionnaires are easy to use and cost-effective, which make them attractive for use in several nationally representative panel studies (e.g., the German Socio-Economic Panel, SOEP, Goebel et al., 2019). The repeated assessment in such panel studies enables large-scale cohort-sequential research on the patterns and correlates of personality trait change across time and age (Graham et al., 2020; Seifert et al., 2023).

Overall, there is broad agreement that the Big Five provide a useful level of analysis within the personality trait hierarchy and that widely-adopted Big Five measures offer advantages such as cost-effectiveness, comparability across studies, and strong predictive validity evidence. Nevertheless, the excessive reliance on Big Five self-report data is not without problems, particularly with regard to the assessment of lifespan personality development.

3.2. Challenges in the Assessment of Lifespan Personality Development

The widespread use of Big Five self-report scales has several limitations that constrain the conclusions that can be drawn from existing research on personality trait development (Hopwood et al., 2022; Rauthmann, 2022). First, all Big Five scales have been developed in cross-sectional data to capture the *relatively stable* structure of individual differences in personality traits. Whether these measures are also suited to assess within-person changes in personality traits has been largely untested. A recent exception is a study by Beck and Jackson (2022) who used an idiographic approach to examine periods during which a person's structure

of personality variables changed over time. They found that about 20% of participants experienced at least one significant change in their personality constellation and that these changes were highly unique to an individuals' life trajectory. These findings emphasize that different conceptualizations of personality trait change beyond traditional nomothetic Big Five approaches can reveal novel insights about the process of personality development (Wright & Zimmermann, 2019).

A second critical issue of Big Five measures concerns their largely untested measurement invariance across age, cohorts, and cultures. Measurement invariance refers to the consistency of the measurement properties of a scale across different groups or at different time points. In the context of developmental research, measurement invariance over time is crucial, and its absence can pose several significant challenges. Specifically, measurement invariance ensures that observed differences in personality traits reflect true developmental changes rather than differences in how the constructs were measured at different ages. A lack of measurement invariance makes it difficult to determine whether observed differences across time or between age groups and cohorts reflect true developmental changes, measurement artifacts, or group differences that reflect something other than developmental processes. For example, can we compare the Extraversion score of a 16-year-old with the Extraversion score of a 75-year-old? There still is little systematic evidence about the degree to which established Big Five measures can be compared across different age groups (Olaru et al., 2019; Seifert et al., 2023). A related problem concerns the limited evidence for measurement invariance of existing trait measures across samples from different ethnic and cultural backgrounds (Thalmayer et al., 2021, but see e.g., Ringwald et al., 2023). Most research on personality trait development relied

on samples from Western educated, industrialized, rich, and democratic countries (WEIRD, Henrich et al., 2010) in Western Europe and North America, regions that comprise only 15% of the world population. There is growing evidence that the Big Five are not ideally suited to capture personality differences in non-WEIRD cultures (Thalmayer et al., 2020), emphasizing the need to develop and validate personality trait measures across a larger set of cultures to ensure that observed differences or similarities in developmental patterns are not due to variations in the measurement instruments across different cultural contexts.

Third, Big Five self-report scales heavily depend on an individual's self-perception and may thus deviate from other assessment approaches targeting factors like typical behaviors or social reputations beyond the person's awareness. It is possible that people do not update their self-perception despite noticeable changes in their behavior or reputation. Likewise, people may think that their personality has changed even though there is no behavioral evidence. To date, few longitudinal studies have used behavioral or peer report measures to complement Big Five self-report scales. However, these studies allow the cautious conclusion that self-report measures of personality change tend to converge with peer report measures of personality change (Lenhausen et al., 2022; Oltmanns et al., 2020).

Fourth, a related concern involves the potential effects of reference-group effects. Specifically, researchers may overestimate or underestimate change in personality traits to the degree that people compare themselves with certain reference groups when responding to self-report items. Just as cross-cultural differences are difficult to find when everyone compares their traits to people within their culture (Heine et al., 2002), age-graded differences in personality would be hard to detect if people tend to updates their norms as they age. For

example, people tend to get less open to experiences across midlife, but they may compare

themselves to other equally conservative middle-aged adults rather than their younger selves

when rating their personality. Recent research suggests that people indeed rely on same-age

peers as a reference group when filling out Big Five questionnaires (Lenhausen et al., 2023),

implying that both longitudinal and cross-sectional age differences in personality traits may be

underestimated when measured with standard Big Five self-report questionnaires.

Finally, there is little clarity about the lower-order structure of personality traits (Mõttus

& Rozgonjuk, 2021). As such, established Big Five questionnaires differ substantially in their

number of lower-order trait scales. How many and which lower-order facet traits are needed to

capture more specific individual differences in personality across the lifespan? Recent empirical

efforts to solve this problem have made little progress in answering this question, suggesting

that questions about the lower-order structure of personality may be better addressed through

theoretical considerations about e.g., relevant manifestations of broader trait dimensions in

certain age groups (Brandt et al., 2023; Schwaba et al., 2020).

3.3. Towards More Valid Constructs and Measures of Lifespan Personality Development

Overall, the predominant use of Big Five self-report measures in research on personality

development provides a solid foundation upon which to build stronger evidence and stronger

theories. It offers a widely accepted framework that combines conceptual breadth and

descriptive fidelity. Decades of research have produced well-validated measures,

demonstrating predictive validity across various life outcomes. The broad acceptance of the Big

Five model facilitates cross-study comparability and accumulation of findings. Additionally, the

ease and cost-effectiveness of Big Five self-report questionnaires have made them attractive for

large-scale panel studies, enabling extensive research on personality trait change across time and age in large representative studies. However, it is also clear that the totality of personality variation is not captured by Big Five self-report data, and existing measures may not be optimized for studying personality development. Future research that goes beyond this popular assessment model and common measures could strengthen the evidence for patterns of consistency and change across the lifespan documented using self-report measures.

First, scholars need to learn more about the construct validity of existing Big Five measures when applied to developmental questions. Are existing measures suited to capture within-person change? Do they the capture the same trait constructs across different age groups and cohorts? Are these measures invariant across samples from different ethnic and cultural groups or do we need alternative measures? These questions need to be addressed in an iterative validation process that requires extensive longitudinal research across age groups, cohorts, and cultures (Hopwood et al., 2022; Olaru et al., 2023; Thalmayer et al., 2020).

Second, future research should explore new assessment tools and strategies beyond self-report that are specifically tailored to the assessment of personality change over time. Viable methods include informant reports, experience-sampling methods, narratives, behavioral tasks, digital footprints, mobile sensing, or biological markers (e.g., Back & Egloff, 2009; Harari et al., 2017 Stachl et al.,2021). A broader portfolio of personality change measures would not only enhance the reliability of personality change but may also lead to new insights about the nature and process of personality change to the extent that there are systematic discrepancies between different types of assessment methods (Bleidorn et al., 2020).

Third, developmental research on broad domain traits should be complemented by

longitudinal research on lower-order traits. Knowledge about development at lower levels of

the personality hierarchy is needed to refine our understanding of the lifespan trajectories of

different trait domains as different facets may change at different rates at different ages and in

response to different genetic or environmental triggers (Mõttus et al., 2020; Ringwald et al.,

2023).

In summary, it is hard to overemphasize the importance of clearly defined constructs

and valid measures as the basis for psychological theories (Loevinger, 1957). Owing to decades

of rigorous research on the Big Five (John, 2021) research on personality trait development is

based on a well-defined and broadly validated set of broad personality trait measures. Yet,

more conceptual and empirical work is needed to examine the validity and generalizability of

the Big Five model and measures in developmental contexts and samples from non-WERID

cultures. Critically, this construct validation work should be seen as an important and valuable

part of research on personality development instead of just a hurdle that needs be crossed

(Eronen & Bringmann, 2021), as clearly defined constructs and valid measures are

indispensable to specify psychological phenomena, draw causal inferences, and, thus, develop

stronger theories of personality development.

4. How Robust are the Phenomena in Lifespan Personality Development?

Valid constructs and measures are also critical for the second criterion of strong theories

– a robust description of psychological phenomena that constrain theories. Phenomena refer to

the relatively stable features of the real world that can be derived from data (Haig, 2013). For

example, the trajectory of age-graded changes in Extraversion is a phenomenon that can be

derived from longitudinal data. Theories are then needed to explain how the phenomena come about (Eronen & Bringmann, 2021). Available psychological theories are often too vague to make precise predictions regarding relevant phenomena (Leising et al., 2022). At the same time, phenomena are often not sufficiently described to impose constraints on the possible theories.

The history of medical theory provides a striking example for the importance of robust and specific phenomena. Before the acceptance of germ theory in the 19th century, there was a prevailing belief in miasma theory which states that diseases, and particularly epidemics, are caused by "bad air" or noxious vapors arising from decomposing organic matter. Miasma theory, originally advanced by Hippocrates, had been based on centuries of observations. It survived over 2,000 years partly because it was extremely difficult to come up with a theory that would have fit the observed phenomena better or equally well. It took over 2,000 years of observations, data collection, and experiments to challenge the prevailing belief in "bad air" as the primary cause of diseases. In the 19th century, when John Snow, Louis Pasteur, and Robert Koch developed the idea, based on their own and others' research, that diseases are caused by microorganisms such as bacteria and viruses, the space of possible theories was strongly constrained by the observed phenomena. The slow transition from miasma to germ theory highlights the critical role of precise and comprehensive descriptions of the relevant phenomena for the development of strong theories.

In the personality development literature, the relevant phenomena are the patterns of personality trait development across the lifespan. A comprehensive understanding of these patterns requires an examination of different indices of stability and change. Indeed, one

reason for the long-lasting confusion over whether personality traits are stable or changeable

resulted from the fact that researchers have failed to clarify what type of stability or change

they mean when using such terms (Bleidorn et al., 2019; Specht et al., 2014). Three indices have

emerged as particularly relevant for the description of lifespan personality development: rank-

order consistency, mean-level change, and individual differences in change (see, Figure 1). A

comprehensive understanding of the phenomenon of personality trait development requires a

thorough, robust, and generalizable description of these different indices as they provide

complementary but non-overlapping information (Roberts et al., 2008).

Figure 1. Indices of personality development, illustrated in a hypothetical sample of four individuals whose personality was assessed at two time points. The different panels illustrate (*a*) rank-order stability with no mean-level change and no individual differences in change, (*b*) mean-level change with rank-order stability and no individual differences in change, (*c*) individual differences in change with rank-order stability and no mean-level change, and (*d*) individual differences in change with no rank-order stability and no mean-level change.
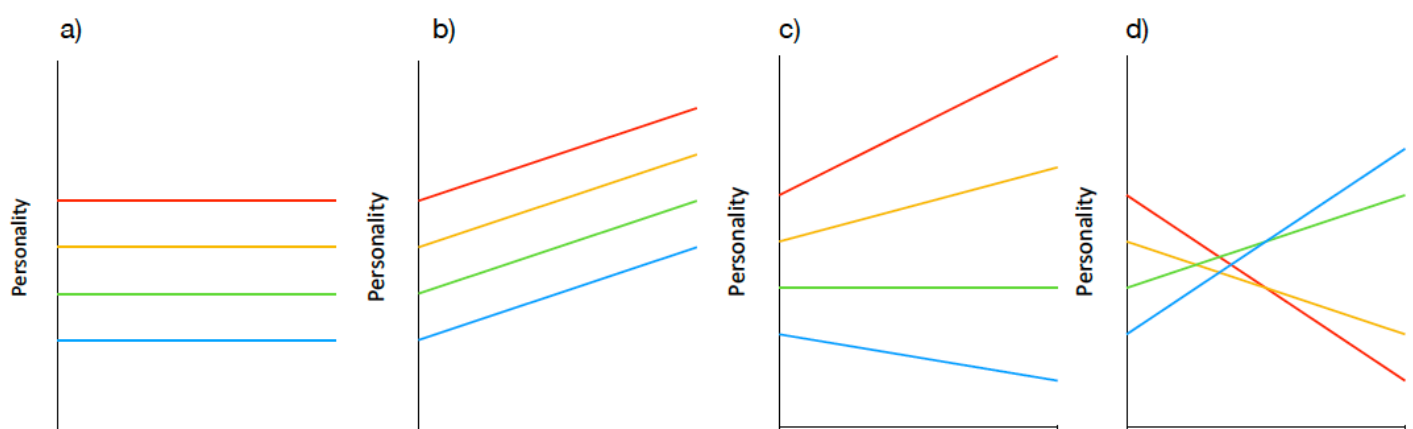
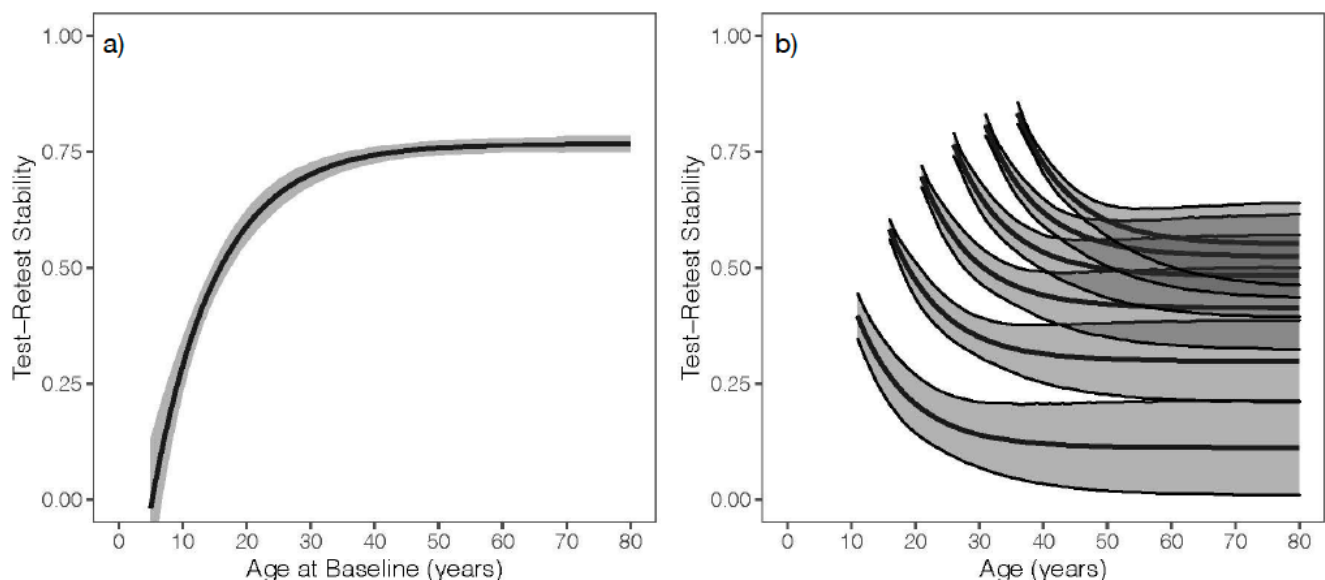**4.1. Rank-order Stability of Personality Traits**

The rank-order stability of traits, typically estimated as a test-retest correlation across

two assessments, indicates the degree to which the relative ordering of individuals on that trait

is maintained over time. For example, an investigation of the rank-order stability of

extraversion can answer the question whether children who are relatively extraverted

compared to others develop into relatively extraverted adults.

Several meta-analyses have examined the rank-order stability of traits across the

lifespan (e.g., Bleidorn et al., 2022; Roberts & Del Vecchio, 2000). All of these studies found that

personality traits are at least somewhat stable, with rank-order stabilities ranging between r =

.40 to .60, depending on the age of the sample and the time lag between assessments.

Moreover, no study to date has found a perfect rank-order stability, suggesting that personality

traits remain open to change across the lifespan (Roberts & Nickel, 2017). In addition to these

broad observations, existing research converged on three conclusions about the lifespan

patterns of personality rank-order stability, while highlighting several open questions.

First, throughout childhood and adolescence, but particularly during the transition to

young adulthood, traits become increasingly stable with peak levels around age 25 and more

glacial increases throughout the remainder of lifespan (see Figure 2 a), Bleidorn et al., 2022).

These age-graded increases in rank-order stability are summarized by the *cumulative continuity*

principle of personality development (Kandler, 2010; Roberts et al., 2008) or the "first law of

personality development" (Roberts & Nickel, 2017, p. 161).

Second, the rank-order stability of traits decreases as time intervals between assessments increase. Notably, these decreases are not continuous or linear, but attenuate over longer time lags, and plateau at modest values around r = .20, even over very long lags of over 50 years (see Figure 2b, Bleidorn et al., 2022). This suggests that, despite time-related rank-order changes in traits, it is possible to predict individual differences in personality even over extended periods of time, supporting the proposition of an enduring or "core" quality to personality traits that remains stable across the lifespan (Damian et al., 2019).

Figure 2. Lifespan trends for rank-order stability and time-based decay of rank-order stability. (*a*) The trend of increasing rank-order stability across the lifespan. (*b*) The time-based decay of rank-order stability, with trend lines reflecting the expected decrease in rank-order stability for varying time intervals with ages at baseline of 10, 15, 20, 25, 30, and 35 years. Figure adapted with permission from Bleidorn et al. (2022); copyright 2022 American Psychological Association.

Third, there is little evidence for differences in the rank-order stability of personality across different Big Five domains, genders, or assessment methods (e.g., self- vs. other report). Overall, these findings suggest that the rank-order stability estimates are highly robust and

generalizable across various potential moderators (Bleidorn et al., 2022). However, there are

some caveats to this conclusion. Perhaps most important, the vast majority of studies have

focused on younger samples from WEIRD cultures. As such, we still know very little about the

pattern of rank-order stability in older samples and samples from non-WEIRD cultures.

Although there is some evidence for decreasing rates of rank-order stability after age 60, even

the most recent meta-analysis on this topic does not provide a clear answer about rank-order

stability in old adulthood, because of the low data coverage for this life stage.

4.2. Mean-level Change in Personality Traits

Whereas rank-order stability indicates the degree to which people experience more or

less change relative to one another, mean-level change reflects the degree to which a trait

decreases or increases in a sample, on average. This type of change is perhaps the most

commonly held conception of personality change, as it refers to absolute increases or decreases

in personality traits over time and age. For instance, the question of whether people become

more conscientious over the course of adolescence would fall under the domain of mean-level

change (Bleidorn et al., 2019).

Existing meta-analyses also converged on several conclusions about the normative

patterns of mean-level personality change across the lifespan (Bleidorn et al., 2022; Roberts et

al., 2006). First, as with rank-order stability, mean-level changes in personality traits are most

pronounced in adolescence and young adulthood, with peak levels of change around age 20 to

30 and smaller rates of change for the remainder of the lifespan.

Second, there are some notable differences among trait domains, with the most striking changes occurring for Emotional Stability and Conscientiousness. Emotional Stability appears to undergo constant increases through the entire lifespan with only a small drop in the rate of change after age 20. Conscientiousness exhibits the largest shifts across the lifespan, with significant increases in adolescence and young adulthood, peak levels around age 60, and decreases throughout the remainder of life. Agreeableness showed a similar, yet less pronounced pattern (Bleidorn et al., 2022). This pattern of increasing levels in Emotional Stability, Agreeableness, and Conscientiousness has been referred to as the *maturity principle of personality developmen*t (Roberts & Mroczek, 2008). The mean-level patterns of Extraversion and Openness are less pronounced, with small increases in young adulthood, and gradual decreases throughout the remainder of the lifespan.

Third, consistent with rank-order stability findings, mean-level changes in personality traits increase with longer time intervals between assessments, suggesting that trait changes may be lasting. Historically, personality traits have been often conceptualized as set points around which people were thought to fluctuate in response to certain experiences, before eventually returning to their personal set point (e.g., Ormel et al., 2017). Strict set-point models would imply a null association between time and personality mean-level change, because any change would represent short-term fluctuations that disappear as people shift back to their set point. The positive link between time and mean-level change speaks against such a strict set-point model and provides evidence for lasting trait change.

Finally, there is little evidence that mean-level changes in personality vary as a function of measurement method, gender, or other potential moderators. However, as with the studies

on rank-order stability, there is little longitudinal research on older samples and virtually no longitudinal research that would permit a test of the cross-cultural generalizability of mean-level change across samples from non-WEIRD cultures.

4.3. Individual-level Change in Personality Traits

Investigations into individual-level change in personality traits – typically assessed as standard deviation of or variance in change – focus on patterns of personality development at the level of the person. Questions about individual differences in change ask how closely individuals conform to vs. deviate from the overall population trends of mean-level change, accounting for the fact that some people show more or less pronounced changes in their personality traits than the average trends. For example, although most young adults experience moderate increases in emotional stability, some may deviate from this trend and decrease in this trait. It is essential to understand both average population trends and individual deviations from these norms to identify the factors that drive these changes (Roberts & Mroczek, 2008).

In recent years, more studies have also reported the individual-level change (Borghuis et al., 2020; Haehner et al., 2023a). These studies provide some evidence to suggest that, like the other types of change, individual-level change in traits is also most pronounced in young adulthood (Schwaba & Bleidorn, 2018). However, meta-analytic evidence on this type of change is still missing. This is surprising given the empirical, theoretical, and practical relevance of individual-level change across the lifespan question. Perhaps most important, it is essential to quantify and characterize individual deviations from the average changes in traits to identify the factors that cause these deviations from the norm (see, Section 5).

4.4. Open Questions About Developmental Personality Phenomena

The long persistence of miasma theory had to do with several blind spots in the observation of the spread of diseases, including a lacking understanding of microscopic life and failed observations of waterborne diseases such as cholera and typhoid. To advance theory development, we need to identify the most important blind spots in our understanding of the lifespan development of personality traits. An implicit problem of blind spots, of course, is that we might not be able to identify or articulate them because critical information or tools might be missing (like the microscope in the history of germ theory). It is thus likely that the following list presents an incomplete picture of open questions in the investigation of lifespan development of personality traits.

A first open question concerns the lifespan progression of individual differences in personality change trajectories. This is important, because a reliable assessment of individual-level personality change is not only required for a comprehensive understanding of the patterns of change, but is also critical for examinations of causal influences on personality trait change (Haehner et al., 2023b). During which life stages and for what reasons are individual differences in personality trait change more or less pronounced?

A second question concerns the generalizability of existing findings to samples from non-WEIRD countries and less affluent backgrounds. The vast majority of existing longitudinal personality research relied on samples from Northern Europe and North America, whereas longitudinal studies in samples from non-WEIRD cultures are extremely rare (Thalmayer et al., 2021). Moreover, existing studies have often failed to report the ethnic composition of the

sample, precluding researchers from examining the role of ethnic background in personality trait development.

Third, despite a notable increase in studies that have focused on personality trait change in older adults (Kandler et al., 2015; Krämer et al., 2023; Wagner et al., 2016), there still is considerably less research on late versus young and middle adulthood (Bleidorn & Hopwood, 2023). The scarcity of longitudinal data in this life stage complicates the interpretation of meta-analytic estimations of lifespan development, because we cannot distinguish reliable change patterns from noise in the data (Bleidorn et al., 2022).

Fourth, there still is little knowledge about the timescale at which changes in traits unfold. Most existing longitudinal studies to date have been designed under the premise that personality traits do not change at all or at least not quickly. Consequently, the average interval between personality assessments ranges between 4 and 5 years (Bleidorn et al., 2022). However, recent research showed that personality traits can change more quickly, at least in contrast to prior expectations (Roberts et al., 2017), suggesting that we may overlook critical parts of the personality change process, because we tend to assess personality too infrequently (Bleidorn et al., 2020; Rauthmann, 2017). Indeed, long intervals between personality assessments may lead to an overestimation of personality stability and a misrepresentation of the underlying change process (Hopwood et al., 2022). A related problem concerns the overreliance on data from two-wave studies that are not suited to identify the varieties of shapes and forms of individual change trajectories. As such, we still know little about the pace and shape of changes over time (Luhmann et al., 2014).

4.5. Towards More Robust Phenomena in Lifespan Personality Development

How robust are the phenomena in research on personality trait development? Overall, the past decades of longitudinal research have produced broad evidence for the patterns of personality rank-order stability and mean-level change, especially during young adulthood, which appears to be the most critical life stage for personality trait development. It is during this life stage that trait differences stabilize and trait levels develop towards a more mature personality profile. The strong and robust evidence for the normative patterns of personality development in young adulthood has led to the articulation and consolidation of key theoretical principles. Indeed, the *cumulative continuity principle* and the *maturity principle* are widely referred to as laws of personality trait development (Caspi et al., 2005; Roberts & Nickel, 2017).

Future work can build upon these broad and abstract principles to generate more precise theories about how personality changes. There are three broad directions for future research on lifespan personality development. First, more descriptive longitudinal research on underrepresented samples is needed to complement the current findings on mostly affluent, younger samples from WEIRD countries. That is, more research on culturally and ethnically diverse samples from various sociodemographic backgrounds across all age groups, and particularly old adulthood, is needed to probe the generalizability of existing evidence on personality trait development (Atherton et al., 2022).

Second, future research is needed to quantify and integrate findings on individual differences in change across the lifespan. With a sufficient number of studies across different time intervals and age groups, these data could then be meta-analytically integrated to provide a more comprehensive picture of this type of change across the lifespan. A meta-analytic

perspective would also allow to identify life stages during which individual differences in change are particularly large or small, offering relevant information about periods during which internal or external causes of personality trait change may be particularly potent (Haehner et al., 2024).

Third, given that the timescale and shape of personality change processes are largely unknown, there should be an emphasis on more frequent assessments with sufficiently short lags between assessments to explore potential changes in traits with sufficiently high temporal resolution. Multiple assessments of personality traits would also be needed to identify nonlinear or discontinuous change trajectories, that may be particularly relevant before and after the experience of biological or environmental change mechanisms (e.g., Denissen et al., 2019).

In summary, there is robust evidence for the normative development of personality traits, especially among young adults from affluent backgrounds and Western samples. The empirical description of the course of personality traits has led to the articulation of well-established theoretical principles and stimulated broad research efforts to refine our understanding of the causes and process of personality trait change during that life stage (e.g., Bleidorn et al., 2013; Jackson et al., 2012). In contrast, more descriptive research is needed to constrain theories of late life personality development, advance our understanding of individual differences in personality change, and probe the cross-cultural generalizability of existing findings.

5. What Causes Change in Personality Traits?

The third criterion for strong theories is that they identify causal relationships between variables (Eronen, 2020; Eronen & Bringmann, 2021). For example, in germ theory, the primary causal effect is the transmission of diseases from one organism to another through various means, including direct contact, airborne particles, contaminated water or food, and vectors such as insects. It was the identification of this primary cause that ultimately enabled germ theory to explain, predict, and treat a plethora of different diseases including the recent example of the COVID-19 pandemic.

Naturally, a core goal of lifespan personality development research is to identify the causes of personality trait stability and change. An understanding of the most common causes of personality change would not only allow researchers to explain the developmental process, it would also provide key insights into the ways to purposefully manipulate and change personality traits (Grosz et al., 2020; Stieger et al., 2021). The problem, however, is that discovering these causal relationships has proven difficult.

5.1. Genetic and Environmental Contributions to Lifespan Personality Development

At a broad level, a key question concerns the broader class of causes that shape the development of personality traits: Is it genes or features of the environment that best explain the observed patterns of lifespan personality trait development? Answering this question is critical to help researchers isolate the group of causes that drive changes in traits.

Personality traits have long been considered highly heritable dispositions that follow intrinsic paths of development, essentially independent of environmental influences (McCrae et

al., 2000). According to this perspective, the observed lifespan patterns of both trait stability

and change are thought to reflect genetic maturation processes, whereas environmental

impacts should be negligible (McCrae & Costa, 2008). Others have emphasized the role of

environmental causes of personality trait developmental, in addition to biological influences

(e.g., Roberts et al., 2005). From this perspective, environmental factors contribute to both

personality stability and change to the extent that they either stabilize or modify an individual's

patterns of thoughts, feelings, and behavior.

The cumulative behavioral genetic evidence supports the conclusion that both genetic

and environmental factors contribute to both stability and change in personality traits (Tucker-

Drob & Briley, 2019). Like all psychological traits (Polderman et al., 2015), personality trait

differences are shaped by genetic contributions throughout the lifespan. However,

environmental factors appear to play an equal, or perhaps, even more important role in the

explanation of personality trait stability and change. Specifically, meta-analytic evidence

suggests that genetic influences contribute to personality trait stability at a consistent/similar

rate throughout the lifespan, while environmental influences increase substantially with age,

such that by midlife genetic and environmental effects contribute almost equally to personality

stability (Briley & Tucker-Drob, 2014). Similarly, longitudinal twin studies suggest that genetic

and environmental effects contribute almost equally to individual differences in personality

trait change throughout the lifespan (Bleidorn et al., 2009; Hopwood et al., 2011).

Although it is now well established that both genes and environments play a role in

personality trait development, questions arise about *how* genetic and environmental factors

combine to shape individual differences in personality trait stability and change. The answer to

this question is not straightforward, as genes and environments correlate and interact in different ways to produce unique patterns of causal influences that may shape the observed lifespan changes in personality traits (Tucker-Drob & Briley, 2017).

Gene-environment correlation (rGE) refers to the association between an individual's genes and their exposure to certain environments (Scarr & McCartney, 1983). There are different types of rGE. Passive rGE occurs when biological parents create a rearing environment that is correlated with their offspring's genetic predispositions. In active and evocative rGE, individuals select and evoke different environments on the basis of their genetically influenced preferences, motivations, and traits. Theory and evidence show that, beginning in early adulthood, people become more likely to shape and select their environments in accordance with their inherent genetic tendencies, resulting in an increased importance of evocative and active rGE throughout the adult lifespan (Tucker-Drob & Briley, 2017). These types of rGEs may explain the observed increases in personality stability and contribute to the maintenance of consistent genetic effects throughout the lifespan (Bleidorn et al., 2014).

Gene-by-environment interaction occurs when genetic variation in a phenotype is differentially expressed in different environments (Johnson, 2007). Again, the impact of unique environments that are not shared with other family members increases as people leave their parental home and become more independent and agentic (Bouchard & Loehlin, 2001). These effects of gene-by-environment interactions make genetically-related individuals less similar to each other which may explain the observed lifespan increases in environmental effects on personality traits (Briley & Tucker-Drob, 2014).

In summary, behavioral genetic research demonstrates the net contributions of genes

and environments to personality development. The hard part, now that we know that both

genetic and environmental factors are likely to be involved, is figuring out which genes, which

environmental factors, and which transactions between the two are relevant causal personality

development mechanisms.

5.2. Identifying Specific Environmental and Genetic Causes of Personality Development

Over the past two decades, a large number of studies have explored various

environmental causes of personality trait change, with a particular focus on major life events

(e.g., Jackson et al., 2012; Krämer et al., 2023; Sutin et al., 2010; Wright & Jackson, 2024). The

hypothesis that life events, like marriage, childbirth, or retirement, can change a person's

personality is consistent with lay beliefs and theoretical accounts of personality development

that propose behavioral, affective, and cognitive adaptations to environmental changes as

critical change mechanisms (Roberts et al., 2005; Wrzus & Roberts, 2018). The focus on life

events as drivers of personality development was further spurred by the availability of large-

scale panel studies that made it possible to examine the presumably small effects of life events

on trait change in large samples with sufficient power (Denissen et al., 2019; Specht et al.,

2011; van Scheppingen et al., 2016). Bühler et al. (2023) recently meta-analyzed the results of

this literature and found that certain life events are indeed associated with mean-level changes

in personality traits. For example, people who enter a new relationship tend to become more

conscientious, first-time parents tend to decrease in extraversion, and college graduates seem

to increase in emotional stability. Across life events, effects were small, albeit similar in

magnitude to the effects of life events on mental health or well-being (Luhmann et al., 2012).

Overall, these results provided some evidence that life events play a role in personality development. However, the effects were less consistent and smaller than expected, leading some scholars to conclude that life events do not have much of an impact on personality change (e.g., Roberts & Bonner, 2024).

One argument has been that, life events — operationalized as demographic shifts — are less relevant than the experiences that emerge from life in explaining the normative patterns of lifespan personality development (Roberts & Yoon, 2022). For example, continuous experiences at work (Le et al., 2014) have been linked with changes in maturity-related personality traits. Specifically, those traits that predict certain workplace conditions and experiences often seemed to be accentuated by those conditions, supporting a corresponsive principle of personality development (Roberts & Nickel, 2017).

Consistent with this notion, researchers have also begun to focus on individual differences in personality change in response to life events (Haehner et al., 2023a; Rakshani et al., 2022). This line of research aims to identify the biological, psychological, social, and situational moderators that shape the ways in which people react to major life events. Thus far, few moderators have been identified that reliably explain why people differ in their reactions to life events; however, recent research suggests that the subjective perception of life events may shape their effects on personality change (Haehner et al., 2023b; Schwaba et al., 2023). For example, some people may experience a divorce as negative and stressful, whereas others may perceive this experience as positive and liberating, potentially leading to different personality changes (Bleidorn et al., 2021). However, a more comprehensive analysis of a theoretically derived set of moderators of event-related personality change is still missing.

Genetic propensities may expose individuals to different types of life events and shape their idiosyncratic life experiences (Caspi et al., 2005; Kandler et al., 2012). There are great hopes that Genome-Wide Association Studies (GWAS) of personality might offer new insights into the ways genes modify people's personality trajectory across the lifespan and their responses to life events. GWAS analyze the entire genome of individuals to identify genetic markers that may be linked to personality traits. To do this, researchers collect genetic data from large samples of individuals and compare their genomes of those with different personality traits. By examining millions of genetic variants across the genome, researchers can then identify specific genetic markers that show a statistical association with certain personality traits (Lo et al., 2017). To date, there is only one GWAS on Neuroticism that has a large enough sample size (N >150,000) to detect small genetic effects with sufficient power, while well-powered GWAS for the other Big Five traits are still in preparation (Schwaba, 2023). With such personality GWAS around the corner, the field will be well positioned to test the moderating effects of polygenic personality scores on the selection into and reaction to certain life events.

5.3. Why is it so Difficult to Establish Causal Effects on Personality Change?

Both methodological and conceptual problems have precluded major breakthroughs in our understanding of causal effects on personality traits. An obvious dilemma for personality psychologists is that the declared "gold standard" for causal inference – randomized experiments – is mostly unethical, impractical, or downright impossible. For instance, randomly assigning couples to either have a child or remain childless is not ethical or feasible. So, how can we identify the causal effect of childbirth on personality change? To address the constraints of observational data and approach causal inferences, personality researchers have used

prospective longitudinal data (e.g., Denissen et al., 2019), analyzed moderator variables (e.g.,

Haehner et al., 2023a), controlled for individual third variable confounds (e.g., Specht et al.,

2011), used comprehensive matching approaches to control for multiple confounders (e.g.,

Krämer et al., 2023), or quasi-experimental designs (e.g., Schwaba et al., 2021).

Causal inferences based on observational data require personality researchers to

formulate specific hypotheses and make precise predictions about all relevant variables

involved in the causal process (Rohrer, 2018). The broad hypothesis that major life events or

ongoing life experiences cause trait changes through adaptations in people's thoughts, feelings,

and behaviors may have been too vague to guide research on the specific causal mechanisms

involved in the personality change process.

Similarly, the idea that a particular combination of gene variants (i.e., a polygenic score)

has causal effects on our personality is not accurate. The relationship between genetic variants

and traits is complex. Polygenic scores should be used as tools for understanding genetic

contributions to traits rather than as indicators of direct causation. Again, establishing

causation would require personality researchers to articulate and test the specific biological

pathways underlying the observed associations between genes and traits (De Young et al.,

2021).

5.4. Towards Stronger Causal Inferences in Lifespan Personality Development

Personality researchers have begun to develop causal theories of personality

development that offer general principles to explain trait changes over time or in response to

environmental experiences (e.g., Wrzus & Roberts, 2018). Yet, current theories and existing

research need to be refined to provide all necessary information about the specific causal

determinants, moderators, confounders, and change mechanisms involved in the change

process of different traits (Rohrer, 2018). Moreover, an understanding of the temporal process

at which changes in traits unfold in response to biological changes or environmental triggers

would be required to specify causal change models (Hopwood et al., 2022).

A fundamental barrier to advancements in this literature has been the misalignment

between the presumably complex causal change processes and the common study in this area

in which certain environmental experiences or genetic variants are correlated with changes in

personality traits. To overcome this barrier, it will be critical to develop more precise models of

personality trait change that specify all relevant variables and change mechanisms involved in

the causal change process (Baumert et al., 2017; Jayawickreme et al., 2021; Wright et al., 2024).

Such theoretical models of personality development may be articulated in a more formalized

manner in which all (known) input and output variables are connected with one another by

mathematical or formal-logical operations (e.g., Glöckner & Betsch, 2011; Leising et al., 2022).

To probe these models, personality researchers may benefit from adding computational

modeling techniques to their methodological portfolio (Haslbeck et al. 2022). Computational

models require a precise articulation of the directionality of the expected causal effect (e.g.,

increase or decrease in a trait level), the expected magnitude of the effect (i.e., the effect size),

the anticipated timescale of an effect (e.g., the amount of time after which a certain mean-level

change in a trait can be expected), and the shape of change (e.g., gradual change versus non-

linear step-wise changes in a trait). Thus, a core advantage of computational models over

traditional variable-based approaches is that they not only specify the size and direction of an

effect but also articulate how that effect unfolds over time and in context (Riley et al., 2016).

For example, a more comprehensive formalized model of event-related change in emotional

stability would require a specification of the expected magnitude (e.g., small) and direction of

an effect (e.g., negative), the amount of time after which a meaningful change in emotional

stability can be anticipated (e.g., weeks), the shape of change (e.g., linear change), as well as

relevant mediating (e.g., increased daily negative affect) and moderators (e.g., lower baseline

levels of emotional stability) of that effect. Ideally, these theoretical models should then be

tested with rigorous empirical designs that allow for causal inferences and account for the

idiographic nature of personality processes to capture the dynamic, multi-determined

personality change processes at both the individual and population level.

Quasi-experimental designs and randomized controlled intervention also offer

promising ways to strengthen causal inferences. Quasi-experimental designs exploit the

variation in theoretically relevant causal factors that are outside the person's influence but are

not controlled by research protocols (e.g., Schwaba et al., 2021). For example, research on

personality trait change in response to unemployment could be complemented with data on

economic recessions and business closings that originate outside people's own actions and thus

are less likely to be confounded by third variables (Akee et al., 2018).

Randomized controlled intervention designs trials are routinely used in clinical

psychology and medical sciences to test the effects of treatment protocols on outcome

variables. Research on personality interventions, on the other hand, has only recently taken

root in personality science (Allemand & Flückiger, 2017; Roberts et al., 2017; Hudson & Fraley,

2015). This fairly young literature suggests that personality traits can be changed through active

interventions (e.g., Stieger et al., 2021). However, more research is needed to isolate the causal

effects of specific change mechanisms relevant for the observed lifespan patterns of personality

trait development (Bleidorn et al., 2020). Recent advances in internet and smartphone

technology have made digital interventions a particularly viable method for causal research on

personality change. First, the highly standardized nature of digital interventions allows for the

manipulation of specific change mechanisms while controlling for others, providing researchers

with an experimental paradigm to identify specific causal mechanisms involved in personality

change (Moshe et al., 2021). Second, the ability to include large sample sizes allows researchers

to conduct sufficiently powered trials, and third, the ability to individualize the timing and

dosage of specific intervention components allows researchers to detect intraindividual change

mechanisms (Nahum-Shani et al., 2018). Digital intervention data thus have the potential to

reveal the processes and causal mechanisms involved in personality change at both the

individual and population level.

In summary, both genetic and environmental factors play a role in personality trait

development. In addition to main effects, complex patterns of gene-environment correlations

and gene-by-environment interactions give rise to observed patterns of trait stability and

change across the lifespan. A more difficult question to answer is which specific environmental

and genetic factors are most relevant in shaping the development of personality traits.

Longitudinal research indicates that individual differences in life experiences and subjective

perceptions of life events may be critical moderators of change. Methodological advancements

in causality research together with innovations in personality interventions, genetics, and

computational modeling promise to shed more light on the causal processes driving personality development in future research.

6. Towards Stronger Theories of Lifespan Personality Development

Once a niche topic, personality trait development has become one of the most widely studied phenomena in personality psychology and beyond. The purpose of this paper was to evaluate the theoretical progress in lifespan personality development by reviewing the current state of the literature against three criteria of strong psychological theories (Eronen & Bringman, 2021): 1) clearly defined constructs and valid measures, 2) robust and specific phenomena, and 3) evidence for causal relationships.

The present review suggests that we have come a long way in refining our understanding of the patterns and sources of lifespan personality development. Table 1 summarizes the main conclusions of this review and lists ideas for future directions towards the development of stronger theories of lifespan personality development. Major accomplishments include the establishment of a well-defined set of evidence-based trait measures, the identification of robust patterns of trait stability and change, and the documentation of both environmental and genetic contributions to lifespan personality development. Existing evidence opens new questions, the answers to which could significantly advance the theoretical progress in this flourishing area of personality research. The rapidly accumulating evidence and new methodological innovations suggest that the field is well-poised to address these gaps and work towards strong theories of lifespan personality trait development.

Table 1. *Current State of Evidence, Obstacles, and Future Directions Towards Stronger Theories of Lifespan Personality Development*.

Criterion	State of Evidence	Obstacles	Future Directions
Construct Validity	• The Big Five traits balance conceptual breadth and descriptive fidelity, featuring a hierarchical structure • Decades of research provide broad validity evidence for Big Five domain scales • Big Five self-report questionnaires are cost-effective and easy to apply, enabling their use in large-scale, nationally representative panel studies of personality development • The wide use and general acceptance of Big Five scales facilitates scientific communication and meta-analytic progress	• The Big Five scales capture stable personality structures, but their ability to assess within-person changes is largely untested • The measurement invariance of Big Five scales across age, cohorts, and cultures is unclear, limiting the generalizability of current evidence • The predominant use of self-report questionnaires introduces bias including reference-group effects • In contrast to broad evidence for the structural and predictive validity of Big Five domain traits, there is less clarity about the lower-order structure of personality traits	• Examine the construct validity of existing Big Five measures in developmental contexts • Examine the measurement invariance of existing measures across age, cohorts, and cultures and develop strategies to address lack of invariance • Explore alternative assessment tools beyond self-report, tailored for assessing personality change over time • Examine the structure and development of traits at lower levels of the personality hierarchy
Robust Phenomena	• The rank-order stability increases from childhood to late adulthood, with particular strong increases in adolescence and young adulthood • Less than perfect rank-order stability implies lifelong plasticity of personality traits • The rank-order stability of traits decreases and mean-level change increases with increasing assessment intervals, hinting at lasting changes in trait levels • The rank-order stability plateaus at correlations of .20 over long	• Insufficient understanding of lifespan progression of individual-level personality change • Limited understanding of personality trait development in late adulthood • Little knowledge about timescale at which changes in traits unfold • Limited understanding of the shape of developmental trajectories of personality traits • Questionable generalizability of observed developmental patterns to samples from less affluent	• Quantify and integrate findings on individual-level change across the lifespan • Examine the rank-order stability, mean-level change, and individual-level change of traits in late adulthood • Scrutinize the shape and timeline of personality trait change over time in longitudinal studies with frequent and multiple trait assessments

	- intervals > 50 years, implying a stable core of personality - The mean-levels of maturity-related traits (Emotional stability, Agreeableness, and Conscientiousness) increase during adulthood, with particular strong increases in young adulthood - People differ in their individual personality trajectories throughout the lifespan, with the largest amounts of individual-level change in young adulthood	backgrounds and non-Western cultures	
Causal Relationships	- Strong evidence that both genetic and environmental factors play a causal role in personality trait development - In addition to main effects, complex patterns of gene-environment correlation and gene-by-environment interaction give rise to the observed patterns of lifespan personality development - Some evidence to suggest that life experiences drive personality development; however, likely in a more complex way than assumed	- Little evidence for specific genetic or environmental causes of personality development - Existing causal models of personality development are underspecified and lack critical information about the relevant variables involved in the causal process - The scarcity of sufficiently powered Genome-Wide-Association Studies of personality traits has precluded an examination of the causal role of genetic propensities - Predominant focus on main effects of individual environmental features does not capture the dynamic and interactive causal change processes	- Causal change models that specify the relationships between all relevant variables through mathematical or formal-logical operations would increase the precision and falsifiability of change models - Computational modeling may be used to specify when, why, and how causal effects on trait change unfold over time and in context - Quasi-experimental designs and intervention studies should be used to complement observational studies of naturally occurring personality development - Digital intervention strategies are particularly useful to test causal change processes at both the individual and population level

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