AN EXPLORATION OF WHAT PEOPLE THINK CAUSES PERSONALITY CHANGE AND STABILITY

By

Andrew Rakhshani

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ABSTRACT

Theories of personality development and empirical work alike suggest that an individual's own views (i.e., lay theories) about personality development may influence that individual's actual personality development. Despite this, there has been little research describing and categorizing lay theories of personality development. The purpose of the present work is to examine general mechanisms of personality change and stability through analysis of lay theories and the different contexts in which specific mechanisms may be applicable or relevant to personality development. The present study used two large longitudinal samples of undergraduate students to answer the following research questions: (1) What mechanisms do students believe cause personality change or stability?; (2) Are students consistent in their proposed mechanisms across traits?; (3) Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?; (4) Do students report mechanisms at different rates when considering personality traits specifically versus personality defined broadly?; and (5) Is mean level personality trait change associated with specific mechanisms of change or stability? The present work examined up to 13 mechanisms (depending on how personality was conceptualized) students believe are responsible for personality change or stability. The results suggest that the relevance of a given mechanism for personality development depends on the specific big five trait being considered as well as whether future or past change is being considered.

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INTRODUCTION

What are the mechanisms behind personality trait development in adulthood? After decades of debates regarding the relative stability of personality traits, the longitudinal evidence suggests that personality traits continue to develop across the lifespan in somewhat predictable ways (Roberts & DelVecchio, 2000; Roberts et al., 2006). At the same time, there are individual differences in these patterns of development (Schwaba & Bleidorn, 2018). The field of personality psychology is now shifting its focus to understanding the mechanisms that underlie these patterns of development. One goal of this shift is to understand how much agency individuals can exert over their own development of personality traits; in part, because traits like the big five can predict universally valued outcomes such as health, well-being, and longevity (Ozer & Benet-Martinez, 2006; Roberts et al., 2007; Soto, 2019). The many theories of personality development each offer mechanistic explanations for patterns of personality change and stability. Some of these theories (e.g., Dweck, 2006; Mischel & Shoda, 1995; Peetz & Wilson, 2008) and empirical work (e.g., Robins et al., 2005) suggest that an individual's own views (i.e., lay theories) about personality development may influence that individual's actual personality development. Despite this, there has been little research describing and categorizing lay theories of personality development. The purpose of the present work is to examine general mechanisms of personality change and stability through analysis of lay theories and the different contexts in which specific mechanisms may be applicable or relevant.

What are Lay Theories and Why are They Important?

Given how complex the world and its inhabitants are, it is incredible how seamlessly people appear to interpret environmental inputs and navigate the world. This is largely done by a network of lay theories about how the world and people work. Lay theories (also referred to as

'implicit theories', 'naive theories', and 'folk theories') are beliefs non-experts have about what is true in the world and serve as frameworks that organize and explain complex information (Furnham, 1988; Levy et al., 2006). These theories likely exert some influence on how an individual perceives and engages with their surroundings as well as how they typically think, feel, and behave – their personality (Mischel & Shoda, 1995). Indeed, lay theories predict, albeit sometimes with modest effect sizes, social engagement (Kuwabara et al., 2018; Kuwabara et al., 2020), self-regulation (Molden & Dweck, 2006 for review), health behaviors (McFerran & Mukhopadhyay, 2013; Mukhopadhyay & Yeung, 2010; Wang et al., 2010), stress (Rydstedt et al., 2004), pro-environmental intentions (Soliman & Wilson, 2017), and empathy (Tullett & Plaks, 2016). Thus, lay theories are important for a more complete understanding of people, personality, and life outcomes.

Importantly for the field of personality psychology, lay theories of personality development have the potential to contribute to actual personality change (Allemand & Fluckinger, 2017; Dweck, 2008; Graziano et al., 1998; c.f., Hudson et al., 2021). In a longitudinal study of college students ($N = 295$), participants' theories on the malleability of their traits predicted both perceived and actual personality change across the 4-year span of the study (Robins et al., 2005). If a person's lay theories about personality development do, in fact, influence their personality development, this would help explain the relative success of personality interventions. For example, individuals that hold essentialist lay theories (i.e., personality is fixed and immutable) may act, think, and feel in a way that reinforces personality stability even in the face of various major life events or personality interventions because they are motivated to adhere to their essentialist beliefs (Plaks et al., 2009). If true, we might expect some personality interventions (e.g., Stieger et al., 2021) to elicit even greater personality change

so long as participants understand and believe that personality is malleable through cognitive or behavioral mechanisms. Lay theories of personality development appear to be relevant for personality science, and it will be important to contextualize their relevance around specific conceptualizations of personality and personality change. The next section will describe the most prominent conceptualization of personality and the various "types" of personality change.

Conceptualizing Personality and Personality Change

Personality can be conceptualized as having three "levels" (McAdams, 1995). The first level encompasses broad, decontextualized constructs called traits. One of the most well-established trait frameworks (and the one that will be used in the present studies) is that of the big five personality traits of extraversion, agreeableness, conscientiousness, emotional stability[1], and open-mindedness (John, 2021). The second level is labeled "personal concerns" and contains constructs such as defense mechanisms, coping strategies, skills, beliefs, values, characteristic adaptations, attitudes, and motives that are contextualized in time, place, or role. The third level is labeled "narrative identity" and reflects the "…inner story of the self that integrates the reconstructed past, perceived present, and anticipated future to provide a life with unity, purpose, and meaning" (McAdams, 1995, p. 365). Although lay theories may have implications for this third layer, the present work will focus mainly on the first level and partially on the second level as these levels are likely what most lay people think of when conceptualizing personality and thus, have lay theories of development for.

There are at least four ways to conceptualize personality change (Roberts et al., 2008). The first is rank-order change, which refers to change in the relative ordering of individuals in a population over time and is often measured by test-retest correlations. The second is ipsative

[1] In this paper, negative emotionality (i.e., Soto & John's original label) is keyed in the opposite direction (i.e., emotional stability)

change (also called profile or configural change), which refers to change in the relative ordering of traits within a person (Furr, 2008). The third is individual differences in change, which refers to between-person variation in change trajectories over time (Schwaba & Bleidorn, 2018). The fourth is mean level change, which refers to the degree to which a population decreases or increases in a personality trait over time. The present work will focus on linking lay theories of personality change and stability mechanisms to mean level personality trait change and individual differences in change. These change indices will be the focus of the present work because they more directly convey increases or decreases in personality traits at the population (mean-level change) and individual (individual differences in change) levels compared to rank-order and ipsative change, respectively. The next section will summarize actual theories of personality development and their proposed mechanisms of change and stability to provide context for what lay theories on this topic may be.

Theories of Personality Development

Because there are numerous theories and mechanisms that have implications for personality development even outside of the field of personality psychology (e.g., Theory of Planned Behavior [Ajzen, 1991]). This section will review theories of personality *trait* development with a focus on the change and stability mechanisms those theories explicitly or implicitly propose.[2] A few theories propose *principles* of personality development, which are descriptions of typical developmental patterns; the principles that implicate different mechanisms will be summarized as well. I first start with broad theories including the Neo-socioanalytic Model (Roberts & Wood, 2006), the Five-Factor Theory (McCrae & Costa, 2008), the Cybernetic Big Five Theory (DeYoung, 2015), the Triggering situations, Expectancies,

[2] The present studies do not test these theories. Their mention here is to provide context for what mechanisms lay persons may theorize may be relevant to personality stability or change.

States/State Expressions, and ReActions Framework (Wrzus & Roberts, 2017), and Whole Trait Theory (Fleeson & Jayawickreme, 2015); then I will summarize more narrow theories (and their mechanisms) such as the Paradoxical Theory of Personality Coherence (Caspi & Moffitt, 1993), the Theory of Self-regulated Personality Change (Denissen et al., 2013), the Dynamic Equilibrium Model (also referred to as Set Point Theory; Headey & Wearing 1989; Ormel et al., 2012), and the Theory of Genotype → Environment (Scarr 1992; Scarr & McCartney 1983).

Neo-socioanalytic Model. In this model, Roberts and Wood (2006) emphasize social and individual factors that influence personality development. They specify at least 7 principles of change and stability: (1) Plasticity: personality can be influenced by the environment at any age; (2) Cumulative Continuity: personality traits increase in rank-order stability throughout life; (3) Maturity: as people age, they become more agreeable, conscientious, emotionally stable, and socially dominant; (4) Corresponsive: life experiences reinforce the characteristics that lead people to those experiences to begin with; (5) Identity Development: personalities become more stable as individuals develop, commit to, and maintain their identity; (6) Role Continuity: consistent roles (as opposed to consistent environments) cause greater personality continuity; and (7) Social Investment: investment in age-graded social roles leads to greater personality maturity.

These seven principles implicate at least six mechanisms of personality change and stability. First, the environment, and especially social roles can lead to personality change. Indeed, these roles often come with a sense of contingencies that reward certain kinds of behaviors. Second, personality gradually becomes more stable via genetic processes. Third, when people become more committed to a specific identity, that identity reinforces specific ways of thinking, feeling, and behaving that leads to greater personality stability. For example, someone who identifies as a “good citizen” will behave accordingly by voting in every election,

which reinforces their identity and subsequent behavior of voting. Fourth, staying in the same social roles, such as being a good parent, can also lead to greater personality stability. Fifth, personality "matures" as people enter age-graded social roles such as parenthood and entering the workforce which pressure people to behave in more "mature" ways. Sixth, personality traits are accentuated as people select into situations that reinforce the traits that led them to those situations to begin with. For example, people high in social dominance seek jobs with more power, these jobs in turn were associated with later increased social dominance (Roberts et al., 2003).

Five-Factor Theory. In this theory, McCrae and Costa (2008) make clear distinctions between endogenous traits (akin to Level I of McAdam's conceptualization of personality) that are exclusively influenced by physiological intervention, maturational processes, or events that affect their biological basis and characteristic adaptations (akin to Level II of McAdam's conceptualization of personality) that are influenced by more than just biological mechanisms. With respect to characteristic adaptations, Five Factor Theory specifies at least 7 principles of change and stability: (1) Adaptation: people react to their environments in ways that are consistent with their traits and earlier adaptations; (2) Plasticity: characteristic adaptations change in response to interventions, changes in the environment, social roles and expectations, and biological maturation; (3) Self-concept: People maintain a cognitive-affective view of themselves that is consistent with their traits and provides coherence; (4) Interaction: the environment interacts with traits to shape characteristic adaptations; (5) Apperception: people attend to and construe environments in ways that are consistent with their traits; (6) Reciprocity: people selectively influence environments to which they respond; and (7) Universal dynamics: characteristic adaptations are regulated by cognitive, affective, and volitional mechanisms.

These principles implicate at least 4 mechanisms that each appear to be able to lead to personality change or stability. First, people interact with (and select into) environments in ways that can shape personality. For example, extraverted people may go to more parties which reinforces extraverted behavior, but if parties (or other social activities) are infrequent in the local environment, that person may develop more introverted hobbies (e.g., reading). Second, culture, biology (e.g., genetics), and different social roles can shape personality (e.g., the roles of "student" and "parent" have different demands that can facilitate change or reinforce existing behavior such as being [more] open to new ideas or responsible, respectively). Third, traits and characteristic adaptations can interact with each other to shape personality (e.g., a very open-minded person may make goals to try new foods which leads that person to maintain or increase high levels of open-mindedness); and (4) personality can be regulated by volitional means (e.g., a person motivated to learn a new skill is typically able to do so).

Cybernetic Big Five Theory. In this theory, DeYoung (2015) describes personality as a cybernetic system (i.e., a goal directed, self-regulating system) based in human evolutionary design to optimize functioning. As such, its proposed mechanisms of personality change and stability focus on cybernetic and evolutionary principles. Cybernetic mechanisms involve genetically and environmentally influenced, relatively stable regulatory processes that control personality development by adjusting thoughts, feelings, and behaviors in response to internal and external cues. This process typically occurs in a 5-stage cycle: (1) goal activation, (2) action selection, (3) action, (4) outcome interpretation, and (5) goal comparison. The theory alludes to dynamic interactions among different levels of personality (i.e., higher and lower order traits, characteristic adaptations), situational affordances, and life outcomes that can lead to changes in gene expression or changes in the environment that then affect the cybernetic mechanisms

controlling personality development. A partial example is illustrated when an individual experiences a traumatizing event that causes an epigenetic response (i.e., DNA modification; Al Jowf et al., 2021) of cybernetic mechanisms (e.g., outcome interpretation) subsequently altering personality development (e.g., stress response; Kaminsky et al., 2008).

Triggering situations, Expectancies, States/State Expressions, and ReActions (TESSERA) Framework. This holistic framework integrates ideas from several disparate theories of personality development to detail processes of daily behavior and experiences that lead to personality stability and change (Wrzus & Roberts, 2017). The framework details various processes linking TESSERA components of the model to personality development as well as moderators of those TESSERA components (e.g., valence, externality, automaticity, age, and resource intensity) that may lead to different patterns of development. The TESSERA framework's proposed mechanisms of personality development include those from other theories and literatures and are mostly grouped into associative and reflective processes. Associative processes include the following: (1) Implicit learning: repeated co-occurring cognitive activation of stimuli (e.g., subconsciously picking up on subtle nonverbal cues such as micro expressions that then guide one's social behavior or response); (2) Habit formation: implicit learning of repeated behavior (i.e., situations and contexts such as feeling sad repeatedly trigger specific behaviors such as consuming a tub of ice cream); (3) Feedback: getting information about one's personality from others (i.e., the discrepancy between one's self-perceptions and reflected appraisals may shift one's behavior towards greater congruency); and (4) Reinforcement: regulating behavior after experiencing reactions when showing the behavior (e.g., receiving a large fine for breaking the law punishes, and thus deters, rule breaking behavior).

Reflective processes include the following: (1) Identity development: creating and maintaining a coherent and mostly stable self-view (similar to the Neo-socioanalytic model); (2) Life reflection: gaining insight by evaluating past experiences (frequently linked with becoming more wise); (3) Positive reframing: focusing on positives of an experience; (4) Self-reflection: gaining insights by evaluating one's thoughts, feelings, and behaviors (e.g., shifting one's behavior after noticing a discrepancy between how one perceives themselves vs how they realize they may come across upon reflecting on recent social interactions); (5) Accommodation and assimilation: making sense of experiences and integrating them into the self (i.e., using and/or adjusting existing schemata about a situation and one's thoughts, feelings, and behaviors in said situation); and (6) Generalization: reflective processes synthesize into self.

Other mechanisms identified by TESSERA **not** categorized into associative or reflective processes but that resemble mechanisms from aforementioned theories include: (1) Genetic influences: facilitate continuity via influence on biological processes; (2) Environment: can constrain experiences or trigger situations that facilitate personality change; (3) Social roles: provides proximate environment; (4) Person-environment transactions: people select into, react to, and evoke different reactions from the environment; (5) Self-regulation: processes that change personality to accomplish goals; and (6) Model learning: observing others' personalities (e.g., watching parents, teachers, friends, etc. and adopting behaviors based on explicit or implicit reward structures of their behaviors being expressed).

Whole Trait Theory. Fleeson and Jayawickreme's (2015) theory attempts to synthesize two typically disparate approaches to personality science: describing individuals with broad trait terms versus social cognitive variables (see Mischel & Shoda's [1995] Cognitive Affective Systems Theory of Personality). They argue that the combination of these approaches addresses

weaknesses of each: trait theories often fail to explain the origin of traits and how they work; and social cognitive theories often fail to identify the individual differences their theories are used to explain. Given the authors define personality as density distributions of states that are determined by social-cognitive mechanisms, personality development entails changing the shape or mean of the distribution of those states. Their proposed mechanisms of personality development, while not explicitly stated, appear to include the following: feedback loops (e.g., reinforcement and punishment), situational and environmental influences, volitional and belief processes, repeated enactment (e.g., habit formation, cycles, inertia), learned behaviors, motivational processes (e.g., feared or desired end states), and genetic forces (Jayawickreme et al., 2019).

Paradoxical Theory of Personality Coherence. This theory posits that personality stability and adaptability coexist through paradoxical processes involving the dynamic interplay between persons and characteristics of their environments (Caspi & Moffitt, 1993). This theory emphasizes two mechanisms of personality change and stability. First, personality stability is reinforced during transitions into unpredictable, new situations where personality shapes how people think, feel, and behave but there is no clear information or explicit press for specific manifestations of personality. For instance, a hurricane or other natural disaster that displaces people from their homes puts those individuals in an unfamiliar situation that lacks clear norms for behaving or a strong press to act in a specific manner that has defined contingencies (e.g., rewards and punishments). Consequently, these people will bring their pre-existing patterns of behavior to this new situation, accentuating those attributes and promoting personality continuity. The second mechanism suggests that personality changes during transitions into new situations where personality can manifest and when previous responses are actively discouraged while information to behave adaptively is provided. For instance, being drafted into the military

is a new situation with clear norms for behaving and well-regulated contingencies. People in this situation develop an identity around being in the military and often demonstrate personality change (Jackson et al., 2012).

Theory of Self-regulated Personality Change. This theory suggests that behaviors associated with traits are strategic means to achieve desired end states (Denissen et al., 2013). The theory is centered around and expands upon the social investment principle of the Neo-socioanalytic Model (Roberts & Wood, 2006). The Theory of Self-regulated Personality Change notes at least 5 regulatory mechanisms responsible for personality development: (1) Selection: people move towards or away from environments that (don't) align with the personality traits or goals; (2) Modification: people change features in their environment that have undesirable outcomes; (3) Attention: people focus their attention away from undesirable features in their environment; (4) Reappraisal: people change their cognitive representations of situational features to influence their emotional and behavioral responses; and (5) Suppression: people can inhibit their primary emotional or behavioral responses to situational features.

Dynamic Equilibrium Model. This model suggests that people have a highly stable, genetically determined set-point for each trait which acts as a reference point for which individuals return after experiencing various normative life events (Headey & Wearing 1989; Ormel et al., 2012). The model notes at least 2 mechanisms of personality development beyond genetics. First, the theory suggests that while most life experiences may *temporarily* shift personality around the set-point, some non-normative life experiences have the potential to *permanently* shift the set-point, thus leading to long term personality change. Second, and similar to other theories, the theory proposes that people select into specific social roles and environments because of their personality.

Theory of Genotype → Environment. This theory proposes that an individual's genotype directly or indirectly influences their personality development via interactions with their environment (Scarr 1992; Scarr & McCartney 1983). The theory focuses on 3 mechanisms involving gene-environment interactions: (1) Passive gene-environment correlations: parents provide both genes and an environment that align with their own characteristics; (2) Evocative gene-environment correlations: people's genetic traits elicit specific responses from others in their environment; (3) Active gene-environment correlations: individuals select and modify their environments based on their genotype. These mechanisms, especially the latter two, are proposed in several other theories (i.e., Five Factor Theory, TESSERA, Theory of Self-regulated Personality Change, and Dynamic Equilibrium Model).

In sum, these five broad and four narrow theories of personality development describe in varying degrees of specificity a diverse list of mechanisms that may cause personality change or stability. While some of these theories appear to emphasize unique content, most of the mechanisms described above share overlapping features that can be synthesized into 5 broad categories. First, the *environment*, its characteristics, and one's role in it, can offer new opportunities for change, or limit potential experiences leading to personality stability. Second, *biology*, including genetics, gene expression, neurotransmitters, and neurological structures, are often linked with trait stability and adaptive personality change throughout adulthood. Third, *interactions*, including among traits or levels of personality, between genes and the environment, between person and the environment, etc. can shape personality in dynamic ways. Fourth, *regulation* covers mechanisms around feedback loops, reinforcements and punishments, motivational processes, volitional change, attentional processes, reflective processes, and cybernetic mechanisms that are directed at homeostasis (i.e., stability) or optimizing functioning

(i.e., change). Lastly, *repetition* includes mechanisms such as habit formation, accentuation, cycles, inertia, and learned behaviors. These broad categories can provide a basis for what we might expect lay theories of personality change and stability mechanisms to be. The next section summarizes literature surrounding what lay theories of personality development mechanisms are and identifies four research questions about lay theories of personality development mechanisms that will contribute to personality science.

Lay Theories of Personality Change and Stability Mechanisms

Little research has examined what people's lay theories of personality change and stability mechanisms are. Much of this literature has focused more narrowly on specific potential lay theories of personality change such as entity versus incremental lay theories (Dweck, 2006), the potential for life events to change personality (Rakhshani et al., 2022; Schwaba et al., 2023), genetic and environmental contributions to personality stability and change (Haslam et al., 2007), and changes in social roles and volitional change practices (Baranski et al., 2017; Cochran et al., 2021). These studies identified a select few potential lay theories *a priori* for the participants. Presumably, participant endorsement of these lay theories (i.e., essentialism, environment, genes, volition) suggest that lay theories of personality change and stability mechanisms may at least partially resemble mechanisms proposed by theories of personality trait development.

A complementary approach to these *a priori* methods is using open-ended narrative questions in which participants are asked what they believe will cause change or stability in their personality (traits). This approach adds to previous work in at least two ways. First, it can provide new insights into additional lay theories and especially theories around specific attributes. Participants may reveal other mechanisms that do (not) mirror those from major

theories of personality development. Second, an open-ended narrative approach provides an opportunity to evaluate how often explanations compatible with *a priori* approaches appear in free responses. It may be the case that participants would not endorse mechanisms such as "volitional change" if it were not already identified for them.

Beyond answering what lay theories of personality change and stability mechanisms people have, there are at least four additional questions related to lay theories that can help progress the field of personality psychology. First, do people hold different lay theories for the development of different traits? Virtually all the major theories of personality trait development summarized above do not make any distinctions among the big five traits with respect to the various mechanisms they propose. That is, they implicitly assume that each change or stability mechanism is equally applicable to say, extraversion, as they are to say, conscientiousness. However, different traits may change (or remain stable) through different mechanisms, and asking people about their lay theories might be a preliminary way to assess this issue. Considering a biological perspective, preliminary evidence already suggests that traits may be associated with different personality development mechanisms. For example, extraversion has been consistently linked with the dopaminergic system whereas conscientiousness does not appear to be consistently linked with a neurotransmitter system let alone the dopaminergic system (Chavanon et al., 2013; Depue & Fu, 2013; Mueller et al., 2014; Wacker et al., 2013). This suggests that phenomena that influence the dopaminergic system may impact the development of extraversion but not conscientiousness.

In a similar vein, each of the big five (at least measures of them) have differential weighting of affective, behavioral, and cognitive content (Wilt & Revelle, 2015; Zillig et al., 2002), and these components might be differentially linked to different mechanisms (e.g.,

Roberts et al., 2017). For example, emotional stability is characterized mostly by affective content (Wilt & Revelle, 2015; Zillig et al., 2002) and thus might be more reactive to certain mechanisms that target affective components (e.g., serotonergic system). In contrast, something like anti-depressants that target affective components might cause less or no change in a trait like conscientiousness which is characterized more so by behavioral content (Roberts et al., 2017). Identifying differences in mechanisms for each trait can improve the efficiency and targeting of specific interventions for specific traits.

A second question about lay theories that can inform personality science is: do people have different lay theories of personality development when considering anticipated development versus retrospective development? There are many ways of soliciting information from participants about their lay theories of personality development. In a qualitative context, it is important to consider how individuals think something *will* unfold (i.e., anticipated change) versus how something *did* unfold (i.e., retrospective change). Evidence suggests that there might be differences in how people perceive future versus past change. The End of History Illusion is one such phenomena that suggests that people believe they have changed considerably in the past but will change relatively little in the future (Quoidbach et al., 2013; but see Harris & Busseri, 2019). These differences in how individuals anticipate events versus retrospectively describe events can provide important cues to the contextual relevance of a given personality development mechanism.

For example, one could imagine a new college student at the start of their first semester eager for a fresh start, a new opportunity to recreate themselves; they might anticipate that being in a new environment (the university), they will increase in openness. After the semester is over and upon further reflection, they might in fact have increased in openness but realized that the

change was caused by their own goal pursuits of increasing in openness (i.e., volitional change). Armed with these new insights, that individual may then try to realize other personality trait change goals and start to act, think, and feel in ways that lead them to actualize those goals. This example illustrates that one change mechanism may be relevant in so far as encouraging an attitude that change is possible when anticipating personality development whereas another mechanism may be responsible for observed personality development.

A third question about lay theories that can inform personality science is: do people hold different lay theories of personality development when considering personality at different levels of abstraction? Personality has been defined and conceptualized in many ways and this is true among researchers and lay persons alike (e.g., McAdams, 1995; Mischel & Shoda, 1995; Semin & Chassein, 1985). Just as it is very likely that different mechanisms are associated with different traits, it is likely that different mechanisms are associated with different components of what some people typically consider as personality that aren't the big five (e.g., values, attitudes, beliefs, self-esteem, other traits). By differentiating what mechanisms might be linked with different conceptualizations of personality, we can learn the contextual relevance or applicability of different mechanisms. Beyond being useful for intervention efforts, this information could help explain paradoxical findings in the literature where different conceptualizations of personality have been used.

For example, the Post-traumatic Growth researchers have long thought that people often experience positive personality change following adversity (Linley & Joseph, 2004). However, longitudinal evidence suggests that Post-traumatic Growth may rarely manifest at the trait level (e.g., Foregeard et al., 2022; Rakhshani & Furr, 2020). Examining whether individuals hold different lay theories of personality development when considering the big five or personality

more broadly defined can help determine whether the underlying implied mechanism of Post-traumatic Growth (e.g., environment facilitates change) is applicable to the big five or perhaps other conceptualizations of personality (e.g., characteristic adaptations, narrative identity).

A fourth question about lay theories that can inform personality science is: are people's lay theories of personality change and stability mechanisms associated with mean level change in personality traits? Understanding predictors of personality change is a major goal of personality science (Bleidorn et al., 2020). This is in part because the big five personality traits predict so many universally valued outcomes and knowing how to change personality could potentially lead to interventions that could improve these outcomes. Learning whether lay theories of personality development predict mean level change in the big five can aid in this endeavor by informing researchers if these are variables that should receive more empirical attention.

Moreover, the extent to which a person's lay theory of personality development is accurate may lead them astray for volitional personality change efforts. For example, we can imagine two individuals, Tim and Bob, who both want to become more emotionally stable. Tim's theory is that if he becomes a father (i.e., new role), he will become more emotionally stable; in contrast, Bob's theory is that taking an anti-depressant and going to therapy (i.e., biology, reflective behaviors) will lead him to be more emotionally stable. If Tim's theory is inaccurate, which evidence would suggest (e.g., Asselmann & Specht, 2021; Denissen et al., 2019; Jokela et al., 2009; Specht et al., 2011; van Scheppingen et al., 2016), his (very odd) volitional change effort will have been unsuccessful and very consequential, potentially leading to the opposite of the desired effect (i.e., a decrease in emotional stability). If Bob's theory is accurate, which some evidence would suggest (e.g., Roberts et al., 2017), he will have attained

his goal and his time, money, and effort would not be in vain. By examining how lay theories predict personality change, we gain a better sense of which are accurate.

The Present Studies

This dissertation uses two longitudinal studies to examine general mechanisms of personality change and stability through analysis of lay theories and the different contexts in which specific mechanisms may be applicable or relevant (i.e., it does not test theories of personality development). The first exploratory study uses existing data: a naturalistic, two-wave, mixed methods design with a large sample of four cohorts of college students, a time in the life span that shows relatively large amounts of personality change (Roberts & DelVecchio, 2000; Roberts et al., 2006; Schwaba & Bleidorn, 2018). At Time 1, participants completed a personality measure, indicated how they thought their personality traits would change across the semester, and what they thought would cause change (or stability) via free responses and checklists of mechanisms. This study was designed to provide preliminary answers to the following research questions:

(RQ1) What mechanisms do students believe cause personality change or stability?;

(RQ2) Are students consistent in their proposed mechanisms across traits?;

(RQ3) Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?;

(RQ4) Do students report mechanisms at different rates when considering personality traits specifically versus personality defined broadly?; and

(RQ5) Is mean level personality trait change associated with specific mechanisms of change or stability?

The second study had a similar design to the first (i.e., student sample), but had three waves of data collection to permit use of latent growth curve modeling (and thus, more accurate examination of linear change) and did not include free response (i.e., qualitative) components. Thus, the second study partially replicated the exploratory study for RQ2 (Are students consistent in their proposed mechanisms across traits?), RQ3 (Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?), and RQ5 (Is mean level personality trait change associated with specific mechanisms of change or stability?).

EXPLORATORY STUDY METHODS

Procedures

This study was approved by the Michigan State University Institutional Review Board (exempt status). Participants consisted of four cohorts of undergraduate students in a psychology department subject pool who completed a Qualtrics survey near the beginning of a semester and another Qualtrics survey approximately eight weeks later near the end of the semester for SONA credit. This study took place at the height of the Covid-19 pandemic. Data were collected during the following academic semesters: Fall 2020, Spring 2021, Fall 2021, and Spring 2022 for the first, second, third, and fourth cohorts, respectively. The survey was changed slightly across cohorts with differences noted in the data codebook that can be accessed using the following OSF link: https://osf.io/e5f7q/. The changes relevant for the present study are noted below in the measures section. A flow chart of the changes and branching logic for this exploratory study are depicted in Figure 1.

Participants that failed (or that had missing data for) one or more of the quality control checks at a given wave were excluded from any analyses involving that wave (i.e., their data for that wave were changed to NAs). Both waves contained three quality control checks: (1) an attention check item; (2) an honesty check item (i.e., did you answer all items honestly?); and (3) a seriousness check item (i.e., did you take the survey seriously or just click through?). These exclusion criteria produced valid *n*s for Time 1 of 263, 289, 476, and 526 (N_{T1} = 1554) as well as valid *n*s for Time 2 of 204, 216, 407, and 438 (N_{T2} = 1321) for cohorts one, two, three, and four, respectively. The difference between the Times 1 and 2 sample sizes reflects a retention rate of 85.01% across the study. Using the following parameters, the study had 85.82% power to detect small effects (i.e., r = .10): two-tails, alpha set to .01, and a sample size of 1321.

Table 1 shows the demographic breakdown of each cohort. The combined sample had an average age of 19.38 (SD = 2.32). The combined sample identified mostly as female (81.31%), followed by male (16.95%), and other (1.75%). A small portion of the combined sample identified as Hispanic (6.62%). Most of the combined sample identified their race as exclusively white (70.07%).

This study was exploratory and was not pre-registered. Data and code are available on OSF using this link: https://osf.io/e5f7q/.

Measures

Table 2 notes all the measures completed by each cohort and at each time point.

Personality Traits were measured using the 60-item Big Five Inventory – 2 (BFI-2; Soto & John, 2017). This measure uses the average of 12 items to compute scales scores for each of the big five personality traits: extraversion, agreeableness, conscientiousness, emotional stability, and open-mindedness. Items were rated using a 5-point scale (*strongly disagree* to *strongly agree*). Each cohort completed this measure at Time 1 (beginning of the semester) and Time 2 (end of the semester). Table 3 displays the means, standard deviations, Cronbach's Alphas, and stability coefficients for the big five and their facets at each time point.

Anticipated Trait Change/Stability was measured using a questionnaire adapted from previous work on personality change forecasting (e.g., Robins et al., 2005). Participants were given the following instructions: "Now, think forward to how specific aspects of your personality will change. Please report to what extent you feel your personality will change for each trait listed below between now and the end of this semester." Participants used a rating scale (*will decrease, will decrease slightly, will stay the same, will increase slightly, will increase*) to indicate how they anticipate changing or staying the same for each of the big five factors across

the semester. Each cohort completed this measure at Time 1. Supplementary Table 2 displays the means and standard deviations for each of these items with anticipated change reflected in the left half of the table.

Anticipated Trait Change/Stability Mechanisms: Free Response. Based on what participants indicated on the Anticipated Trait Change/Stability measure, they were asked to indicate why they thought they would increase, stay the same, or decrease in a given trait across the semester. For example, if a participant marked that they "will increase slightly" in extraversion in the Anticipated Trait Change/Stability measure, they received the following instruction for the present measure: "You indicated that you think you will become more extraverted (i.e. sociability, assertiveness, and energetic) across the semester. Please briefly describe what you think will cause this change." This was done for each of the big five. Cohorts 1 and 2 completed this measure at Time 1.

Anticipated Global Personality Change/Stability Mechanisms: Free Response. Since personality is not exclusively composed of the big five and because people may not necessarily think of their whole personality only in terms of these five specific traits, the instructions for Cohorts 3 and 4 were changed to ask about personality broadly defined. Specifically, participants were given the following instructions: "Thinking about what is going to happen over the course of the semester, please describe what your personality will be like at the end of the semester, describe how it will have stayed the same or changed from now, and describe in as much detail as possible what will have caused you to stay the same or change." Cohorts 3 and 4 completed this measure at Time 1.

Anticipated Trait Change/Stability Mechanisms: Checklist. To complement the qualitative data coming from coding the free response items, we adapted personality

change/stability mechanisms from the coding scheme into a 9-item checklist form for Cohorts 3 and 4. Participants were given the following instructions: “Which of these do you think will cause your level of extraversion (i.e., your tendency to be sociable, assertive, and energetic) to change or remain the same across this semester? (please select all that apply)”. Items were descriptors of mechanisms designed to be intuitive for a broad audience. An example item is: “Something about my environment will make it easier to change this trait”. This measure was given for each of the big five and Cohorts 3 and 4 completed it at Time 1. Endorsement rates for each mechanism separate for each big five trait and time point are provided in Supplementary Table 3 with the anticipated items reflected in the left half of the table.

Retrospective Trait Change/Stability was measured using a questionnaire identical to the *Anticipated Change by Trait* measure but with instructions and response options adapted to reflect past tense. Participants were given the following instructions: “Now think back to how specific aspects of your personality have changed since the beginning of this semester when you took the first survey. Please report to what extent you feel your personality has changed for each trait listed below since the start of the semester.” Participants used a rating scale (*decreased, decreased slightly, stayed the same, increased slightly, increased*) to indicate how they thought they changed or stayed the same for each of the big five factors since the beginning of the semester. Each cohort completed this measure at Time 2. Supplementary Table 2 displays the means and standard deviations for each of these items with retrospective change reflected in the right half of the table.

Retrospective Trait Change/Stability Mechanisms: Free Response. Based on what participants indicated on the Retrospective Trait Change/Stability measure, they were asked to indicate why they thought they increased, stayed the same, or decreased in a given trait since the

beginning of the semester. For example, if a participant marked that they "decreased" in extraversion in the Retrospective Trait Change/Stability measure, they received the following instruction for the present measure: "You indicated that you think you have become less extraverted (i.e. sociability, assertiveness, and energetic) since the start of the semester. Please briefly describe what you think caused this change." This was done for each of the big five. Cohorts 1 and 2 completed this measure at Time 2.

Retrospective Global Personality Change/Stability Mechanisms: Free Response. A nearly identical instruction set as the Anticipated Global Personality Change/Stability Mechanisms: Free Response measure was used but with language adapted to reflect past tense. Participants were given the following instructions: "Thinking about what happened over the course of the semester, please describe what your personality is like now, describe how it stayed the same or changed from the beginning of the semester, and describe in as much detail as possible what caused you to stay the same or change." Cohorts 3 and 4 completed this measure at Time 2.

Retrospective Trait Change/Stability Mechanisms: Checklist. This measure was identical to the Anticipatory Trait Change/Stability Mechanisms Checklist but with instructions and items adapted to use past tense. Participants were given the following instructions: "Which of these do you think caused your level of extraversion (i.e., your tendency to be sociable, assertive, and energetic) to change or remain the same across this semester? (please select all that apply)". An example item is: "Something about my environment made it easier to change this trait". This measure was given for each of the big five and Cohorts 3 and 4 completed it at Time 2. Endorsement rates for each mechanism separate for each big five trait and time point are

provided in Supplementary Table 3 with the retrospective items reflected in the right half of the table.

Qualitative Coding.

Coding Scheme. A coding scheme was developed to classify personality change and stability mechanisms in participant responses to the free response measures. Two personality psychology experts, a graduate student, and a small team of research assistants created an initial list of codes based on their cumulative knowledge of the existing personality development literature. After reviewing the first 30 free responses (Anticipated Trait Change/Stability Mechanisms: Free Response), additional codes were created, coding instructions were modified for clarity, and definitions of the initial list of codes were revised to more neatly fit participant responses. A similar process has continued since the start of the coding process: after each coding task, research assistants marked confusing or challenging participant responses that were reviewed and discussed in lab meetings with two personality psychology experts and a graduate student; this occasionally led to revisions to code definitions or coding instructions. The final instructions documents for coding the responses are available on OSF and the codes are described in detail in Table 4.

When the free response items were changed for Cohorts 3 and 4 to ask about "Global Personality" rather than each of the big five, the research team revisited the coding protocol; we reviewed the first 20 free responses and concluded that three additional codes were appropriate. First, we added the code "no explanation" to describe responses in which participants noted personality change but did not explain a mechanism. Second, we added the code "self-acceptance" to describe responses in which participants did not want to change their personality because they were content with it. Third, we added the code "not personality" to describe

responses in which participants wrote about concepts that did not fit into a broad definition of personality (e.g., acute stress).

Coder Training. The research assistants involved in the development of the coding scheme received no further training than the noted lab meeting discussions of complicated or confusing participant responses. Other research assistants were trained by the first author. The coders would review the coding instructions, code 20 responses, and meet with me to discuss any questions that arose during coding as well as discuss rationale for selected codes. This process was repeated until the research assistant demonstrated a strong understanding of the coding procedures. All research assistant coders were encouraged to mark codes they would like to review during lab meetings.

Lay Theories of Personality Development Codes

Since we wouldn't expect lay theories to mirror the specificity and sophistication of major theories of personality development, this section summarizes potential lay theories about mechanisms of personality stability and change and theories of personality development that either explicitly or implicitly support each lay mechanism. The list of mechanisms was developed from the exploratory study. Since some of these mechanisms are supported by multiple theories of personality development (e.g., biological influences), only one or two exemplary theories will be noted for a given mechanism with a more comprehensive list of all supporting major personality development theories for that mechanism listed in Table 4. Lastly, some theories of personality development describe more mechanisms of change or stability than others, so some theories will be disproportionally represented as supporting material.

Environment facilitates change.[3] This mechanism is defined as "something about the participant's environment makes it **easier** for the participant to change their personality." An example participant response where this code would apply is, "I think the fact that I can't really leave for class means that I will spend more time in my room. Because I'm spending more time there, I'll want to be more organized so I don't lose track of anything. Also, I will spend more time finishing assignments and studying for classes because I won't be able to hang out with friends as much". Most theories of personality development acknowledge the potential of the environment to exert influence on personality. Indeed, even the Five Factor Theory of personality has the *plasticity* postulate which states, "Characteristic adaptations change over time in response to biological maturation, social roles and/or expectations, and changes in the environment or deliberate interventions" (McCrae & Costa, 2008, p. 165). Notwithstanding, the Neo-socioanalytic model of personality is perhaps the most cited theory for describing the potential of the environment to change personality with its *plasticity principle*: "Personality traits are open systems that can be influenced by the environment at any age" (Roberts & Wood, 2006, p. 19).

Environment hinders change.[4] The opposite of the previous mechanism, this mechanism is defined as "something about the participant's environment makes it **harder** for the participant to change their personality." An example participant response where this code would apply is, "Since I will be staying at home this semester, I do not see myself becoming more or less extroverted". Most theories of personality trait development acknowledge that the environment (broadly defined) can be a source of personality stability. The Paradoxical Theory of Personality

[3] Coders were trained using the code "situation promotes change". The code has been changed for this document to improve clarity.
[4] Coders were trained using the code "situation hinders change". The code has been changed for this document to improve clarity.

Coherence is a good example this; it argues that when individuals are in new situations where there is pressure to act but no information on how to act adaptively, individuals will default to their typical, effortless way of acting that has been adaptive in previous situations, thus reinforcing personality stability (Caspi & Moffitt, 1993). The Triggering situations, Expectancies, States/State Expressions, and ReActions Framework also supports "environment hinders change" as a personality development mechanism in that a stable environment can constrain the number of triggering situations that could lead to personality change (Wrzus & Roberts, 2017, p. 260).

Essentialism. This mechanism is defined as "…personality is stable and unchanging." An example participant response where this code would apply is, "I have had the same level of agreeableness my whole life". While virtually every theory of personality development acknowledges the relative stability of personality, none go so far as to say personality is completely stable and immutable. Even the Five Factor Theory notes that personality traits change, albeit almost exclusively due to biological phenomena. While earlier work by McCrae and Costa (1994) note that personality is "set like plaster" by age 30, they have since taken a less extreme stance considering new evidence (see Costa et al., 2019). Despite the theoretical support and empirical evidence suggesting that personality changes, it is relatively common for lay persons to believe that personality is stable and unchanging (Dweck, 2006).

New role. This mechanism is defined as "the participant starts a position where an identity is attached (e.g., becoming an employee, student, parent), which evokes and reinforces specific behaviors (e.g., being on time)." An example participant response where this code would apply is, "The fact that I am starting college is a motivation for me to stay more organized than before, lessening my procrastination. I am hoping I become more conscientious because of this".

The Neo-socioanalytic Model's focus on social roles provides the greatest theoretical support for this mechanism. It's Social Investment Principle states that "Investing in social institutions, such as age-graded social roles, outside of the self is one of the driving mechanisms of personality development in general and greater maturity in particular" (Roberts & Wood, 2006, p. 19).

Volitional. This mechanism is defined as "Proactive, self-directed personality trait change or stability. The individual chooses to do an action with the intent of personality change or stability." An example participant response where this code would apply is, "I am always improving in this category, and am always working on being more compassionate, as sometimes it is hard for me to understand what people are going through". The theory that provides the best theoretical support for this mechanism is the Theory of Self-regulated Personality Change (Denissen et al., 2013). In this framework, personality is a set of functional behaviors directed towards reference values that can be established by personal goals, social norms, or physiologically based hedonic preferences. In this vein, individuals that have goals or needs to change their reference values, can change their personality. Beyond this theory, the Triggering situations, Expectancies, States/State Expressions, and ReActions Framework does mention that individuals can volitionally change their personality through reflective processes: "Reflective processes presumably change and maintain personality by consciously thinking about one's past experiences, behavior, thoughts, and feelings. Such processes might take place, for example, as part of volitional development…" (Wrzus & Roberts, 2017, p. 261).

Maturity. This mechanism is defined as "Personality naturally or automatically changes with age." An example participant response where this code would apply is, "I'm growing older and getting my organizational skills fine-tuned". The Five Factor Theory (McCrae & Costa, 2008) is most consistent with this mechanism as it suggests that changes in traits across the

lifespan occur from biological maturation and developmental and reproductive events that have a biological underpinning. Since these change processes have biological underpinnings (i.e., programmed from our DNA), they are "automatic" in a sense that they are out of the individual's control but rather play about due to aging processes (e.g., more self-control with developing frontal lobes into young adulthood).

Repeated enactment. In contrast to volitional, this mechanism is defined as "engaging in a specific activity that passively reinforces personality stability or change. The individual chooses to do an action without the intent of personality stability or change." An example participant response where this code would apply is, "I am taking a Software design class, and already have had to be creative with projects, and know I will become more creative and open-minded through this class". Wrzus & Roberts' (2017) model best exemplifies this mechanism: "Repeated sequences of Triggering situations, Expectancies, States/State expressions, and Reactions lead to personality change and continuity over time through [conscious or sub-conscious] associative and reflective processes" (p. 255). These tesserae can occur passively as part of an associative process such as implicit learning, for example, and without an individual's intent to affect their personality.

Biology. This mechanism is defined as "Manipulation of biological systems such as hormones or neurotransmitters that can produce personality change. This may include things like medication or winter (lack of sunlight)." An example participant response where this code would apply is, "Two weeks ago, I was prescribed an antidepressant and it has already decreased some of my negative emotions". Virtually all theories of personality development acknowledge the role biology plays on personality. One such theory is the Cybernetic Five Model (DeYoung, 2015), which suggests that personality is an evolved, genetically influenced cybernetic system

where changes in psychological function (e.g., personality change) must involve change in biological function (e.g., neural pathways). Other theories such as the Dynamic Equilibrium Model (Headey & Wearing 1989; Ormel et al., 2012) focus on biology as key contributors of personality stability.

Accentuation / interactionism. This mechanism is defined as "An individual's current standing on a trait leads them to behave / feel / think in a certain way which reinforces the stability or change of that trait." An example participant response where this code would apply is, "Living with my family again means having to make compromises, trusting them to do the right thing, and understanding that the situation right now is hard for everybody. I think I'll remain agreeable because it's the most compassionate thing to do to realize that we're all going to have to get through this in the same house". The theory that best supports this mechanism is the Theory of Genotype → Environment (Scarr 1992; Scarr & McCartney 1983). Two postulates of this theory are relevant here: evocative mechanisms in which an individual's personality evokes specific responses from their surroundings; and active mechanisms in which individuals create or seek environments in accordance with their genotypes. Both reflect a dynamic interplay between the person and the environment leading to personality stability or change.

Self-acceptance. This mechanism is defined as "The participant is content with their current personality and does not want or feel the need to change." An example participant response where this code would apply is, "I think my personality will stay the same at the end of the semester. I am someone who enjoys change but I think my personality is exactly where I want it to be as well as people say the same thing to me". Few theories of personality development appreciate and explicitly note the potential factor(s) the individual's attitude towards their own personality may play in personality development (cf. humanistic perspectives

such as Maslow, 1950; Rogers, 1961). The Triggering situations, Expectancies, States/State Expressions, and ReActions Framework (Wrzus & Roberts, 2017) includes reflective processes as key components of personality development: individuals that have engaged in self-reflection and are content with their patterns of behavior, thoughts, and emotions would be expected to exhibit greater personality stability.

EXPLORATORY STUDY ANALYTIC PLAN

Qualitative Coding

For the first two cohorts (n_1 = 289; n_2 = 322), there were 10 free response items (2 for each big five trait: 1 for anticipated and 1 for retrospective) each with 11 possible applicable codes (i.e., each free response could have more than one code). For the last two cohorts (n_3 = 507; n_4 = 575), there were 2 free response items (1 for anticipated and 1 for retrospective) with 14 possible applicable codes. In total, there were an estimated 8,274 free response items that were coded by either 5 or 6 raters over the course of two years. Given this coding approach, there are several options for both calculating intercoder reliability and determining a final code for each free response.

Intercoder reliability is assessed by having two or more coders categorize free response content and using those categorizations to compute a numerical index of the extent of agreement between or among the coders (Lombard et al., 2002). Given the nature of the design, lower intercoder reliability is not surprising. Specifically, when more codes are available, lower intercoder reliability is more likely because it can be challenging for raters to keep many codes in their working memory (Hruschka et al., 2004; Roberts et al., 2019). Moreover, participants often provided very brief responses requiring coders to use greater interpretation with an already conceptually sophisticated coding scheme, which typically produces lower intercoder reliability (O'Connor & Joffe, 2020).

Multiple measures of intercoder reliability exist with the most common being to report the percentage of data units on which coders agree (Feng, 2014). However, this approach is inappropriate because percentages are inflated by agreement occurring by chance (Hallgren, 2012). There are several reliability indices that correct for chance agreement, and they typically

produce comparable estimates under normal conditions. Krippendorff's alpha was used as this index is appropriate for nominal data (i.e., presence or absence of a code) with multiple raters while adjusting for chance-agreement and being able to handle missing data. Notably, however, this and almost all reliability indices assume that codes are mutually exclusive (i.e., only one code could be applicable to a given participant's response), and the present study used non-mutually exclusive codes (i.e., multiple codes could apply to a given participant's response). At least one group of researchers has attempted to account for non-mutually exclusive codes in reliability calculations (Figueroa et al., 2023). However, this approach may deflate reliability coefficients when coding schemes have a relatively large number of categories because agreement by absence becomes more common, which in turn, reduces the kappa (reliability) score.[5]

Krippendorff's alpha produces a reliability coefficient on a -1 to 1 metric. Since lower intercoder reliability is expected, the more flexible reliability estimate interpretations of Landis and Koch (1977) are useful for interpreting results: values less than 0 as indicating no, between 0 and .20 as slight, .21 and .40 as fair, .41 and .60 as moderate, .61 and .80 as substantial, and .81 and 1 as nearly perfect agreement. Results of the reliability analyses are present in Table 5. There are several ways to determine the "final code" for a given participant response based on ratings from up to 6 coders. Since the reliability varied considerably across categories (ranging from .00 to 1.00) and since this study is exploratory, two tentative determinations of final codes per participant were used.

For the first approach, all codes from each rater counted towards the final code(s), but each code was weighted based on the number of raters that selected that code. For example, for

[5] Generalized kappa does not currently have R or other statistical software support open to the public.

participant 1, if raters 1, 2, 3, and 4 used the rating "volitional" and raters 5 and 6 used the rating "repeated enactment", the final code**s** for participant 1 would be 4/6 volitional, 2/6 repeated enactment, and 0/6 for each other possible code. This approach produced a ratio on a 0 to 1 scale that reflects the clarity of which raters could identify a given code as well as the actual presence of a code for a given participant response. Supplementary Tables 4 through 8 have the means and standard deviations for this coding approach for each code separated by time, trait, and whether participants thought they would increase, stay the same, or decrease on that trait.

For the second approach, all codes from each rater counted towards the final code(s) in a 0 (not present) or 1 (present by at least one coder) fashion. Furthermore, there was no weighting procedure (as in the first approach) nor was there a cutoff for how many raters had to endorse a code for the code to count towards the final codes (i.e., as long as at least one of the six raters endorsed a unique code, it counted). For example, for participant 1, if raters 1, 2, 3, 4, and 5 used the rating "volitional" and only rater 6 used the rating "repeated enactment", the final codes for participant 1 would be "1" for both volitional and repeated enactment, and "0" for each other possible code. Supplementary Tables 9 through 13 have the means and standard deviations for this coding approach for each code separated by time, trait, and whether participants thought they would increase, stay the same, or decrease on that trait. Supplementary Tables 14 through 18 have the means and standard deviations for each coding approach for each code separated by just time and trait for cohorts 1 and 2. Supplementary Table 19 has the means and standard deviations for each code separated by time for cohorts 3 and 4.

Each analysis involving qualitative data used both final coding procedures in separate analyses (i.e., one set of multilevel models using the first final coding approach and another set of multilevel models using the second final coding approach). When correlating the two final

coding approaches, the average correlation for cohorts 1 and 2 was .87[6] and ranged from .75 to 1.00; the average correlation for cohorts 3 and 4 was .82 and ranged from .71 to .90. The level for determining a statistically significant result (i.e., alpha) was set to .01 for all analyses. Below, I summarize the analyses that addressed each research question.

RQ1. What mechanisms do students believe cause personality change or stability?

The first, and most basic research question of this exploratory study was addressed via descriptive statistics and frequencies of each qualitative coding category. Codes were described at various levels of aggregation. That is, they were separated by or aggregated across anticipated vs retrospective change, whether participants were reporting on mechanisms for decreasing, staying the same, or increasing, and/or by each big five factor (for cohorts 1 and 2). Only qualitative data were used for this research question.

RQ2. Are students consistent in their proposed mechanisms across traits?

Addressing this research question involved a series of multilevel models for each coding category. Each model had traits and "time" (i.e., anticipated vs retrospective) nested within individuals predicting each of the coding categories. Each model used dummy coding for each of the traits with a random trait (agreeableness) serving as the reference group. Each model differed in which data were used. Since the qualitative data for cohorts 1 and 2 were separated by whether participants thought they would increase, stay the same, or decrease on each trait (in the case of anticipated change), these categories were dummy coded with "stay the same" being the reference group. The first model for qualitative data from cohorts 1 and 2 used the first approach of final codes (i.e., ratios of agreement); and the second (logistical) model used the second approach of final codes (i.e., each endorsed code counts). The quantitative (checklist) data for

[6] There were two perfect correlations and one undefined due to zero variance in one of the codes; when doing the *r*-to-*z* transformation, these values had to be deleted before calculating the average correlation.

cohorts 3 and 4 did not distinguish whether participants thought they would increase, stay the same, or decrease on a given trait, so the (also logistic) multilevel model did not have those dummy codes but otherwise was the same as the above models. For each model, the effect of interest was the main effect of trait on each coding category.

RQ3. Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?

The analyses from RQ2 in addition to a separate set of multilevel models addressed RQ3. From the previous multilevel models, the effects of interest were the main effects of time (i.e., anticipated change vs retrospective change) on each coding category. Since cohorts 3 and 4 were asked about stability and change mechanisms of personality broadly defined (as opposed to each big five), these data required their own multilevel models with time nested within individual predicting each coding category.

RQ4. Do students report mechanisms at different rates when considering personality traits specifically versus personality defined broadly?

This research question was addressed via a series of multilevel models. Each model had personality conceptualization and "time" (i.e., anticipated vs retrospective) nested within individuals predicting each of the coding categories. Personality conceptualization was dummy coded such that global personality was always the references group against each of the big five traits. A first pair of multilevel models, again, one for each final coding approach, used qualitative data from cohorts 1 and 2 as well as qualitative data from cohorts 3 and 4 (analyses will not be run for the three codes unique to the latter two cohorts). A second pair of multilevel models used quantitative data from cohorts 3 and 4 as well as qualitative data from these cohorts.

The effects of interest were the main effects of personality conceptualization on each coding category.

RQ5. Is mean level personality trait change associated with specific mechanisms of change or stability?

Perhaps the most sophisticated statistical modeling technique available to two-wave data is the latent change score model, a class of structural equation models. In the present exploratory study, the generic model for addressing research question 5 is depicted in Figure 2. In this illustration, Big Five T1 is an unmeasured latent variable reflecting one of the big five at time 1 with pathways towards its three manifest indicators (i.e., it's corresponding facets); Big Five T2 is the time 2 counterpart of Big Five T1; Δ latent change is the latent change score that captures big five trait change between times 1 and 2; and Mechanism_X is one of the X possible mechanism codes for either retrospective or anticipated personality change or stability for each corresponding trait (these analyses used qualitative data for cohorts 1 and 2 and quantitative data for cohorts 3 and 4). The pathway linking each mechanism to the latent change score is the effect of interest and reflects the extent to which a given mechanism is associated with change in each trait (akin to a Beta coefficient in regression).

This approach is advantageous over other typical approaches (e.g., paired t-test) in that it offers the benefit of measuring reliable change in the construct of interest (i.e., without measurement error) as well as (depending on how the model is specified) variance in that change (i.e., individual differences in change).

With research questions involving latent variable change or development, it is necessary to first confirm whether the focal latent construct is measured in the same way across assessment occasions. To meaningfully interpret estimates of mean-level change in the big five personality

traits, scalar measurement invariance (i.e., invariance of item intercepts) must be established (Vandenberg & Lance, 2000). Measurement invariance was tested through a series of nested confirmatory factor analysis models using facets as the "items" of each factor and starting with the least restrictive model and imposing constraints in each successive model (i.e., constraining the loadings to equality, then intercepts, and then variances). Criteria from Little (2013) was used to determine the level of measurement invariance achieved for each of the big five. Specifically, Little (2013) suggests that a change in the Comparative Fit Index of less than .01 from the preceding model achieves the tested type of measurement invariance.

EXPLORATORY STUDY RESULTS AND DISCUSSION

All analyses and data cleaning were conducted in R Version 2022.02.3+492 (R Core Team, 2013). Since each of the 4 cohorts completed one or more measures for the same construct, and since two types of final coding approaches were used for the qualitative data, a large number of analyses are conducted for the below research questions. While this made for a high type 1 error rate, it also permitted cross-validation using different methods and sub-samples. To permit greater comparability across the analyses, research questions 2, 3, and 4 are conducted within a multilevel modeling framework and are sometimes addressed within the same models to minimize the number of analyses run. To facilitate cross-model comparisons for research question 5, all latent change models are specified identically (see Figure 2).

RQ1. What mechanisms do students believe cause personality change or stability?

This research question used free-response data to examine lay-theories of mechanisms of personality change and stability. These data can offer insights into how (if at all) students approach personality change and can potentially inform existing theories of personality development. When asked about which mechanism(s) would cause change or stability in each of their big five personality traits, the present student sample provided responses that ultimately led the research team to create the coding protocol described in the previous section that included the following codes (see also Table 4 for more details): environment facilitates change (i.e., something about the environment makes it easier to change), environment hinders change (i.e., something about the environment makes it harder to change), essentialism (i.e., traits are stable and unchanging), new role (i.e., having a new position that affects specific behaviors relevant to traits), maturity (i.e., trait naturally changes with age), volitional (i.e., actively trying to change or keep the same level of a trait), repeated enactment (i.e., frequent engagement in certain

activities that passively affect traits), biology (i.e., changes in hormones or neurotransmitters lead to changes in traits), and accentuation / interactionism (i.e., one's current level of a trait lead them to interact with the environment in a way that affects that trait). When asked about which mechanism(s) would cause change or stability in their personality more generally, the student sample provided responses that ultimately led to the same codes as well as three additional codes: self-acceptance, no explanation, and not personality. The differences in participant responses that warranted these additional codes suggests that the operationalization of personality matters as far as which mechanisms students believe are relevant to their personality changing or staying the same.

Certain contextual features may be relevant to which mechanisms students believe cause personality change or stability. Specifically, the direction of personality change (i.e., increase, stay the same, or decrease), the specific trait (i.e., each of the big five), and time (i.e., anticipated versus retrospective change) may affect participant responses. Several informal observations can be made from the descriptive information from Supplementary Tables 4 through 19, which show the breakdown of code means and frequencies across these different contextual features. First, whether the participants thought they would/did increase, stay the same, or decrease on a given trait seems to matter for which mechanisms participants thought were relevant. Intuitively and partially validating the coding approach, when participants thought they would/did not change, the environment hinders change and essentialism mechanisms were more commonly coded compared to the participants that thought they would/did increase or decrease in each trait. In the same vein, when participants thought they would/did increase or decrease, the environment facilitates change mechanism was more commonly coded than if participants thought they would stay or stayed the same in a given trait.

Second, some mechanisms were more commonly coded than others. When considering the qualitative data across the various levels of aggregation (i.e., time, trait, final coding approach), environment facilitates change (most common), environment hinders change, essentialism, and volitional codes appeared more frequently than the rest. The new role, maturity, and biology mechanisms were rare--potentially suggesting that these are not common lay-explanations for personality change and stability for the student participants in the present study.

Third, participants appear to report that certain mechanisms are more or less relevant depending on which big five trait (or if global personality) was being asked about in the free-response questions. For example, the essentialism and accentuation / interactionism codes were consistently more frequently coded for agreeableness than the other big five traits; the environment hinders change code was consistently more frequently coded for extraversion than the other big five traits; the volitional code was consistently more frequently coded for conscientiousness than the other big five traits; the repeated enactment code was consistently more frequently coded for open-mindedness than the other big five traits; and the biology code was consistently more frequently coded for negative-emotionality than the other big five traits.

Lastly, whether participants report certain mechanisms more or less frequently when considering anticipated versus retrospective personality change or stability is less clear from these tables and need more formal statistical analyses (see RQ3). These contextual features will be explored in greater detail in the next research questions and analyses below.

RQ2. Are students consistent in their proposed mechanisms across traits?

This research question more formally examines whether lay-persons endorse certain personality change and stability mechanisms differently depending on which of the big five traits

is being considered. A series of multilevel models using both qualitative and quantitative (i.e., checklist) data was run to address this research question and detailed results are available in Supplementary Tables 20 to 37 for the qualitative data and Supplementary Tables 38 to 46 for the checklist data. The effects of interest specific to RQ2 are traits predicting each mechanism code (Model 2 in each Table) and conclusions are based on whether the addition of traits at this modeling step improved model fit based on a chi-square difference test. Table 6 synthesizes results from these various models.

Analyses involving the qualitative data suggests that students appeared to distinguish proposed mechanisms for traits in 5 of 9 instances when using the average final coding approach (i.e., for environment facilitates change, environment hinders change, volitional, repeated enactment, and accentuation / interactionism) and 7 of 9 instances when using the any final coding approach (i.e., the addition of essentialism and maturity). Considering the analyses involving the checklist data, students appeared to distinguish proposed mechanisms for traits in all instances. These results suggest that despite differences in final coding approaches or use of qualitative versus checklist data, students do appear to distinguish whether certain stability and change mechanisms are more or less relevant to specific big five traits at least in 5 of the 9 codes examined in the present study.

These analyses did not permit direct comparisons among each of the big five personality traits as one trait had to serve as the reference group. Notwithstanding, further exploration of differentiation across traits was attempted via visual inspection of the code means and frequencies across Supplementary Tables 3 and 14 to 19. A few surprising and consistent patterns emerged. Regardless of time, final coding approach, or type of data used (i.e., qualitative vs checklist), essentialism always had the highest mean or frequency and environment facilitates

change the lowest for agreeableness. This suggests that at both times one and two and for both the qualitative and checklist data, students most frequently reported essentialism and least frequently reported environment facilitates change as the mechanism explaining their change or stability in agreeableness compared to the other big five personality traits. Similar patterns emerged such that regardless of time, final coding approach, or type of data, volitional had the highest mean or frequency for conscientiousness; and biology had the highest mean or frequency for negative emotionality. There were no systematic effects with respect to one trait having the highest or lowest means and frequencies across all codes.

RQ3. Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?

This research question more formally examines whether lay-persons endorse certain mechanisms differently when considering future- versus past-oriented personality change or stability. The same multilevel models from RQ2 as well as additional sets of multilevel models were used to address RQ3. Detailed results for each of these models are presented in Supplementary Tables 20 to 75 with effects of interest being the "time" variable in each of these models. Given how the items were asked, Time 1 (noted as "T1" in the Tables) reflects anticipated change and Time 2 (noted as "T2" in the Tables) reflects retrospective change. Positive values for these fixed effect coefficients indicate higher average codes for retrospective change (Time 2) whereas negative values indicate higher average codes for anticipated change (Time 1). There were 8 sets of multilevel models that included time as a predictor of each of the 9 mechanisms; each set of models used different subsamples to answer different research questions (e.g., the first set of models used qualitative data from cohorts 1 and 2; the eighth set of models used qualitative and checklist data from cohorts 3 and 4).

Table 7 synthesizes all the results from each of the 72 coefficients from these models. A majority of these coefficients (48 or 66.67%) were statistically significant suggesting that in most cases, participants consider the relevance of mechanisms differently when considering future versus past personality change or stability. Across sets of models, significant coefficients were generally in the same direction for each code except new role and biology (only one significant coefficient in the latter case). Volitional (fifth row on Table 7) had significant negative coefficients for all 8 models suggesting these codes were more commonly endorsed or selected at Time 1 than at Time 2. In other words, students were more likely to say that their own proactive efforts towards change (i.e., volitional) were likely to promote their future change than they were to report this retrospectively as a cause of change they experienced. Similar patterns emerged for accentuation / interactionism (significant negative coefficients for all eight models), environment facilitates change (significant negative coefficients for seven models), and repeated enactment (significant negative coefficients for six models).

Environment hinders change had significant positive coefficients in 6 of the models suggesting this code was more commonly endorsed or selected at Time 2 than at Time 1. This pattern of results is consistent with the pattern of results for the items asking participants if they thought their personality traits and facets would or did increase, stay the same, or decrease (Supplementary Table 2). That is, with few exceptions, participants anticipated greater personality trait and facet change than they reported for retrospective items, so it follows that participants reported more change mechanisms at Time 1 (e.g., volitional) and more stability mechanisms at Time 2 (e.g., environment hinders change and to a lesser extent, essentialism). In sum, participants do appear to report mechanisms at different rates when considering anticipated versus retrospective change.

RQ4. Do students report mechanisms at different rates when considering personality traits specifically versus personality defined broadly?

This research question more formally examines whether lay-persons endorse certain personality change and stability mechanisms differently when considering personality broadly defined compared to the common operationalization of personality using the big five traits. A series of multilevel models were run to address this research question, and detailed results are summarized in Supplementary Tables 49 to 75. The effects of interest specific to RQ4 are personality conceptualization predicting each mechanism code (each Model 3 in each Table) which are reflected in the fixed coefficients for each "G" (global personality) vs "X" (each of the big five). Positive values for these fixed effect coefficients indicate higher average codes for the big five trait controlling for the effect of time (anticipated vs retrospective reports) whereas negative values indicate higher average codes for global personality controlling for the effect of time. Three sets of multilevel models were run for each mechanism to compare rates when considering each of the big five versus global personality. Table 8 provides a synthesis of results from each set of models.

The first set of models used the average final coding approach for each of the cohorts to compare rates of mechanisms for global personality versus each of the big five (Supplementary Tables 49 to 57). Of the 45 coefficients, 34 were significant, suggesting that participants typically reported mechanisms being more or less relevant depending on the conceptualization of personality. Notwithstanding, these results were generally not consistent within code (i.e., same direction and significance of effects for each of the five traits) nor within trait (i.e., same direction and significance of effects for each of the nine mechanisms). For example, the first row and first column for each trait in Table 8 shows that the coefficient for environment facilitates

change was sometimes significant and negative and sometimes not significant; furthermore, the coefficients in the first column for extraversion are sometimes not significant, sometimes significant and positive, and sometimes significant and negative. The two exceptions to this pattern were that (1) environment hinders change was consistently more frequently endorsed for each of the big five compared to global personality; and (2) maturity was consistently more frequently endorsed for global personality compared to each of the big five.

The second set of models used the any final coding approach for each of the cohorts to compare rates of mechanisms for global personality versus each of the big five (Supplementary Tables 58 to 66). Similar to the first set of models, 34 of the 45 coefficients were significant suggesting that participants typically reported mechanisms being more or less relevant depending on the conceptualization of personality. Also like the first set of models, results were generally not consistent within code nor within trait with two exceptions: (1) environment facilitates change was consistently more frequently endorsed for global personality compared to each of the big five; and (2) environment hinders change was consistently more frequently endorsed for each of the big five compared to global personality.

The third set of models used the any final coding approach for the third and fourth cohort qualitative data as well as the checklist data for those cohorts to compare rates of mechanisms for global personality versus each of the big five (Supplementary Tables 67 to 75). In most cases (36 of 45), coefficients were significant, suggesting that participants typically reported mechanisms being more or less relevant depending on the conceptualization of personality. Like the previous two sets of models, results were generally not consistent within code nor within trait with a few exceptions: (1) environment facilitates change and essentialism were consistently more

frequently endorsed for global personality compared to each of the big five; and (2) maturity was consistently more frequently endorsed for each of the big five compared to global personality.

When considering all three sets of models together (Table 8), at least four observations become more evident. First, across mechanisms, it appears that endorsement frequencies for accentuation / interactionism and volitional are not so differentiated between the two conceptualizations of personality (10 and 7 non-significant coefficients, respectively); in contrast, endorsement frequencies for essentialism, environment hinders change, repeated enactment, environment facilitates change, and biology appear to be differentiated between the two conceptualizations of personality (0, 1, 2, 2, and 3 non-significant coefficients, respectively). Second, a large portion of the significant coefficients were negative (77 of 104) suggesting that in most instances, mechanisms were more frequently endorsed for global personality than for traits. Third, the directions and significance of effects for a given mechanism were rarely in the same direction across the sets of models and traits. The closest exception was that coefficients for environment facilitates change were negative and significant in 13 of the 15 models. Lastly, there is some consistency within mechanisms and traits across models. For instance, all three models comparing rates of environment facilitates change for global personality versus agreeableness had significant negative coefficients. This suggests that these three models that used data collected using slightly different methods triangulated on the same pattern of results in 16 of 45 instances. In sum, students tend to report mechanisms at different rates when considering personality traits specifically versus personality defined broadly, but there are few, if any, clear patterns in which they do this.

RQ5. Is mean level personality trait change associated with specific mechanisms of change or stability?

This research question aimed to see if any of the mechanisms that were coded from the qualitative data or endorsed mechanisms from the checklist data predicted how students' big five personality traits changed across the two waves of the study. A series of latent change score models were run to address this research question as these models are perhaps the most sophisticated approach for analyzing the present data. This approach can model personality change free of measurement error. When working with latent variables in a repeated measure context, it is first necessary to make sure the same latent constructs are measured at each time point. To this end, measurement invariance for each big five trait was computed separately using facet indicators (see Supplementary Table 76). Using recommendations (i.e., change in CFI < .01 from preceding model) for establishing measurement invariance from Little (2013), each big five trait met criteria for strict measurement invariance permitting the use of latent change score models.

The next step in addressing this research question was to establish baseline latent change score models. A common issue with these models is over-saturation so the strict invariance model was used as a basis to free parameters for estimation. The latent change score and its variance were added to the model based on code from Kievit and colleagues (2018). After having convergence issues, error variances were set free to vary. Results from these base models are shown in Table 9. Notably, the model for negative emotionality still did not converge successfully and all the change score estimates for each of the big five traits were not significant suggesting mean level change across the timeframe of the study was not significantly different from zero for each of the traits. Notwithstanding, the change score variance was significant for each of the traits except agreeableness suggesting that there are individual differences in mean level change that could still be predicted from the personality change and stability mechanisms.

The final step to address this research question was to add a covariate term to the base model to estimate the association between each mechanism and the latent change score. Each of the big five had 54 associated mechanism variables that were used as covariates: nine mechanisms, two time points, and three ways to measure a mechanism (average final coding approach, any final coding approach, and the checklists). The results of each of these analyses are displayed in Supplementary Tables 77 to 81. Across these 268 analyses (two of the mechanism variables for agreeableness had zero variance so analyses could not be run on those), there were 11 significant correlations—all of which were smaller than |.05| and only occurred at Time 2 in an otherwise inconsistent manner across models. Since the number of significant results barely surpassed the number of significant results predicted to occur due to Type I error, they will not be discussed further. In sum, it appears that the personality change and stability mechanisms as measured in the present study are not associated with mean level change in personality.

FOLLOW-UP STUDY METHODS

Procedures

This study attempted to mirror the methods of the pilot study with two notable changes. First, a third wave of data collection took place to permit more sophisticated analysis of personality change via latent growth curve modeling. Participants completed the Time 1 survey in the first two weeks of the semester, the second survey four weeks later, and the third survey four weeks after the second survey. Because the pilot study revealed which lay theories people may hold about personality change and stability mechanisms, the second change is that the proposed study only used quantitative methods (i.e., the checklist) for participants to indicate what would be responsible for personality change or stability as opposed to the more exploratory mixed-methods design of the first study. The checklist did not include the three additional codes that arose during data collection for cohorts 3 and 4 as those were an artifact of the question stem changing from asking about each of the big five traits to personality broadly defined and the proposed study is evaluating the big five. Due to a programming error, the checklist was not included in the final wave of data collection.

Participants were undergraduate students at MSU that completed an online Qualtrics survey during the Spring 2024 academic semester for course credit. The survey was open to all students in the subject pool that had not already participated in the initial exploratory study. Participants that failed (or that had missing data for) one or more of the quality control checks at a given wave were excluded from any analyses involving that wave (i.e., their data for that wave were changed to NAs). Each of the three waves contained two quality control checks: (1) an honesty check item (i.e., did you answer all items honestly?); and (2) a seriousness check item (i.e., did you take the survey seriously or just click through?). The first and third waves also

contained an attention check item. These exclusion criteria produced valid *n*s of 512, 431, and 345 for Times 1, 2, and 3, respectively. The difference between the Times 1 and 3 sample sizes reflects a retention rate of 67.38% across the study. Using the following parameters, the study had 32.02% power to detect small effects (i.e., $r = .10$): two-tails, alpha set to .01, and a sample size of 345.

Table 10 shows the demographic breakdown of the follow-up sample. The sample had an average age of 19.34 (SD = 2.07). The combined sample identified mostly as female (79.72%), followed by male (19.49%), and other (1.18%) with a separate question showing 1.38% identified as transgender. A small portion of the combined sample identified as Hispanic (7.52%). Most of the combined sample identified their race as exclusively white (71.99%).

The goal of this study was to replicate and expand on the exploratory study by adding another wave of data collection to use more sophisticated latent variable modeling. To this end, analyses were to mirror the exploratory study wherever possible and a basic pre-registration for this was completed before analyses. This pre-registration as well as data and code are available on OSF using this link: https://osf.io/e5f7q/.

Measures

Personality Traits were measured using the 60-item Big Five Inventory – 2 (BFI-2; Soto & John, 2017). Participants completed this measure at each of the three waves. Table 11 displays the means, standard deviations, and Cronbach's Alphas for the big five and their facets at each time point. Table 12 displays the stability coefficients across each combination of waves (i.e., Time 1 to Time 2, Time 2 to Time 3, and Time 1 to Time 3) for the big five and their facets.

Anticipated Trait Change/Stability were measured using the same questionnaire from the exploratory study that adapted from previous work on personality change forecasting (e.g., Robins et al., 2005). Participants completed this measure at Time 1.

Anticipated Trait Change/Stability Mechanisms: Checklist. The same 9-item checklist of personality change/stability mechanisms that were based on the coding protocol from the exploratory study was used. Participants completed this measure for each of the big five at Time 1. Endorsement rates for each mechanism separate for each big five trait and time point are provided in Supplementary Table 84 with the anticipated items reflected in the left half of the table.

Retrospective Trait Change/Stability was measured using the same questionnaire from the exploratory study (i.e., identical to *Anticipated Trait Change/Stability* but with instructions adapted to use past tense). Participants completed this measure at Time 3.

Retrospective Trait Change/Stability Mechanisms: Checklist. The same 9-item checklist of personality change/stability mechanisms that were based on the coding protocol from the exploratory study was supposed to be used at Time 3 (i.e., identical to the *Anticipated Trait Change/Stability Mechanisms: Checklist* but with instructions and items adapted to use past tense). However, due to a programming error, this measure was not included in the study.

FOLLOW-UP STUDY ANALYSIS PLAN

Analyses attempted to mirror what was done in the exploratory study wherever possible as noted in the analysis pre-registration. The level for determining a statistically significant result (i.e., alpha) was set to .01 for all analyses. Below, I summarize the analyses that addressed each research question.

RQ1. Are students consistent in their proposed mechanisms across traits?

Addressing this research question involved a multilevel logistic model for each coding category. To be consistent with the exploratory study, each model was to have traits and "time" (i.e., anticipated vs retrospective) nested within individuals predicting each of the coding categories. However, due to a programming error, there was no mechanism data collected at Time 3 and thus, no effect of time could be added to these models. Each model used dummy coding for each of the traits with a random trait serving as the reference group. For each model, the effect of interest was the main effect of trait on each coding category.

RQ2. Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?

Due to a programming error, this research question could not be addressed using the data that was collected in the follow-up study.

RQ3. Is mean level personality trait change associated with specific mechanisms of change or stability?

Measurement invariance was determined using the same criteria and procedures as the exploratory study. For consistency and comparison purposes, measurement invariance was tested for waves one and three (eight weeks apart as was done in the exploratory study).

Latent growth curve modeling, a type of structural equation modeling, was used to address this research question. With three waves of data, a more accurate pattern of change can be gauged from the data compared to two wave models. Figure 3 depicts the latent growth curve model with linear change specified for the slope (i.e., -0.5, 0, 0.5). The parameter of interest is the path from Mechanism X (i.e., each coding category for a given trait) to the slope, which reflects change in the given trait across the study.

FOLLOW-UP STUDY RESULTS AND DISCUSSION

All analyses and data cleaning were conducted in R Version 2022.02.3+492 (R Core Team, 2013).

RQ1. Are students consistent in their proposed mechanisms across traits?

This research question is identical to RQ2 from the exploratory study which found that across the different methods (i.e., qualitative vs checklist data) and subsamples (i.e., different cohorts in each of the analyses), the multilevel models revealed that students *do* distinguish at least 5 of the 9 mechanisms of personality stability and change when considering big five traits separately. When considering the checklist data exclusively, students were distinguishing all mechanisms across the big five. Using the same analytic procedures where possible to the exploratory study, the multilevel logistic models for the present study using checklist data (Supplementary Tables 87 to 95) suggest that students were distinguishing each of the mechanisms (i.e., for all nine) across the big five—replicating results from the exploratory study. In other words, participants do not hold that a given mechanism applies to each of the big five equally.

As with the exploratory study, the present analyses did not permit direct comparisons among each of the big five personality traits as one trait had to serve as the reference group. Further exploration of differentiation across traits was attempted via visual inspection of the code frequencies on Supplementary Table 84 and findings will be compared against the corresponding data from the exploratory study (left half of Supplementary Table 3). With a few exceptions, the general pattern of results was similar across the two studies (i.e., the proportions endorsing a given mechanism within trait; the rates for a given mechanism across traits). In both studies, environment facilitates change was the most frequently endorsed mechanism and biology the

least. Also in both studies, environment facilitates change, repeated enactment, and accentuation / interactionism were *most frequently* endorsed for extraversion; environment hinders change and biology for negative emotionality; essentialism for agreeableness; and volitional for conscientiousness. Environment facilitates change and repeated enactment were *least frequently* endorsed for agreeableness; environment hinders change and accentuation / interactionism for open-mindedness; and volitional and maturity for negative emotionality.

The major difference across the two studies was that the sample proportions were higher in 40 of the 45 mechanism-trait combinations in the follow-up study compared to the exploratory study. While most of these sample proportions were still close in range across the two studies, some notable differences occurred for new role and extraversion (21.06% in exploratory study vs 31.38% in follow-up study); volitional and extraversion (28.64% vs 40.35%); volitional and conscientiousness (43.91% vs 57.31%); and repeated enactment and extraversion (36.43% vs 47.47%). This difference is base rates across the two studies may have occurred because participants in the first study were asked to complete the free-response items asking about mechanisms before completing the checklist whereas participants in the second study were not asked these free-response items.

RQ2. Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?

Due to a programming error, this research question could not be addressed using the data that was collected in the follow-up study.

RQ3. Is mean level personality trait change associated with specific mechanisms of change or stability?

The same research question as the exploratory study, the aim was to see if any of the endorsed mechanisms from the checklist data predicted how students' big five personality traits changed across the waves of the study. Different from the exploratory study, the present research question was addressed using a series of latent growth curve models. This approach can model personality change free of measurement error and provide a more accurate picture of change (compared to the latent change score models) with the use of three waves of data collection. When working with latent variables in a repeated measure context, it is first necessary to make sure the same latent constructs are measured at each time point. To this end, measurement invariance for each big five trait was computed separately using facet indicators (see Supplementary Table 96). Using recommendations (i.e., change in CFI < .01 from preceding model) for establishing measurement invariance from Little (2013), each big five trait met criteria for strict measurement invariance permitting the use of latent growth curve models.

The next step before running the full latent growth curve models with mechanism covariates is to first run the baseline models to establish if the models will converge, whether there is significant mean level change, and whether there are significant individual differences in mean level change. Results of these baseline models are displayed in Table 13. Using the most unrestrictive model for each analysis, none of the slopes were statistically significant from zero (i.e., no mean level change); none of the slope variances were statistically significant from zero (i.e., no individual differences in change); and the model for conscientiousness did not successfully converge. As per the pre-registration, this pattern of results meant that no subsequent analyses involving adding mechanisms as covariates would proceed. Given that some of the change score variances were significant in the exploratory study which had a larger sample, it is plausible that there was not enough statistical power to detect slope variance in the

follow-up study. In sum, there was not sufficient change nor individual differences in change in the big five personality traits across the duration of the follow-up study to be able to test this research question.

GENERAL DISCUSSION

The present studies used multi-method, longitudinal data to provide an initial investigation into lay theories of personality development and their association with personality trait change. This dissertation addressed the following five research questions which are important for improving theories about personality development and understanding predictors of personality change: (1) What mechanisms do students believe cause personality change or stability?; (2) Are students consistent in their proposed mechanisms across traits?; (3) Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?; (4) Do students report mechanisms at different rates when considering personality traits specifically versus personality defined broadly?; and (5) Is mean level personality trait change associated with specific mechanisms of change or stability?. Below I summarize findings and discuss implications of the findings for each research question separately.

RQ1. What mechanisms do students believe cause personality change or stability?

When asked what would or did cause personality change or stability across their semester, students in the exploratory study provided responses that ultimately led to 11 content codes (see also Table 4 for more details) and a "does not apply" code: environment facilitates change (i.e., something about the environment makes it easier to change), environment hinders change (i.e., something about the environment makes it harder to change), essentialism (i.e., traits are stable and unchanging), new role (i.e., having a new position that affects specific behaviors relevant to traits), maturity (i.e., trait naturally changes with age), volitional (i.e., actively trying to change or keep the same level of a trait), repeated enactment (i.e., frequent engagement in certain activities that passively affect traits), biology (i.e., changes in hormones or

neurotransmitters lead to changes in traits), accentuation / interactionism (i.e., one's current level of a trait lead them to interact with the environment in a way that affects that trait), self-acceptance (i.e., contentment with current personality), and no explanation (i.e., expressed desire or hope for personality change without explaining how this would happen). All content codes have some form of a parallel with one or more postulates of current theories of personality development suggesting that at least at the sample level, students' intuitions about these processes seem to coincide with theorists' even if indirectly. For example, the volitional change code, which reflects proactive, self-directed personality trait change, is consistent with the Five Factor Theory principle of universal dynamics which states that characteristic adaptations are regulated by cognitive, affective, and volitional mechanisms (McCrae & Costa, 2008).

The identification of consistent themes in lay perceptions of mechanisms of personality development has implications for personality intervention work. Namely, there is some evidence suggesting that beliefs about personality change and perhaps by extension beliefs about *how* personality changes, may affect one's ability to actualize personality change (see Jackson & Wright, 2024 for discussion). The current findings shed light on what theories lay people may have about personality change and thus, what may need to be addressed before a personality intervention begins. That is, the first step in a personality intervention may need to be to educate participants that personality change is possible; in this vein, they might explain change and stability processes so that participants can more consciously work towards change and counter/avoid stability processes where possible. In the present studies, essentialism (i.e., belief that personality is stable and unchanging) was endorsed by 13.26% to 45.92% of the sample depending on context. If personality intervention participants hold essentialist beliefs, they will likely behave in ways that reinforce their stability rather than enact any of the intervention

practices, as these participants might see such activities as a waste of time. Other mechanisms that were coded should also be relevant to personality interventions in a similar vein. For instance, participants who hold volitional beliefs (i.e., one's active efforts towards change can facilitate change) might be more motivated to fully participate in personality change interventions and consequently, actualize change.

Despite the broad coverage of personality change and stability mechanisms, the list of codes used in this study is not exhaustive. It is unlikely that nuances within codes or rarer codes were captured by this study's methods for at least five reasons. First, a team of personality researchers and experts developed the coding scheme, and these individuals are versed in existing theories of personality development potentially resulting in confirmation bias. Second, participants were given limited space to respond to the prompts and thus, may not have had the opportunity to fully communicate all the potentially relevant mechanisms or distinctions across similar processes that ultimately led to a single coded mechanism. Third, it is possible that--even among students presumably interested in psychology (i.e., the current sample) --participants might not have sufficient insight and awareness of mechanisms causing their own personality change or stability as these processes are often subtle and gradual. Fourth, there are several ways to conceptualize personality and only two were used here: the trait factors and facets as labeled from the BFI-2 and a more global description of personality. People may have different intuitions about change or stability mechanisms in other personality conceptualizations like narrative identity, for example. Fifth, a somewhat homogenous convenience sample was used for these studies; a more diverse sample with respect to age, culture, life experiences, and other factors may have different theories about mechanisms of personality change and stability.

RQ2. Are students consistent in their proposed mechanisms across traits?

A vast majority of personality development theories for the big five do not differentiate whether certain proposed mechanisms of change or stability are distinctly related to one or more of the traits versus to the others. This likely follows from an emphasis in science to create parsimonious theories and relatively generalized explanations for phenomena. Alternatively, this lack of differentiation may reflect the nascency of the field and limited understanding of these processes thus far. Although the present work did not directly test mechanisms of personality development, there was suggestive evidence that individuals tended to offer different mechanisms as explanations for change or stability across traits. This means that parsimony may not be appropriate for something as broad as *personality* and as complex and multi-deterministic as *human psychological development*. Furthermore, it suggests that theories of personality development can be improved, and personality development research made more efficient, by making more specific predictions about specific traits.

Students distinguished among the big five with respect to which mechanisms of change and stability were relevant. The most consistent findings across the two studies and relevant analyses were that essentialism always had the highest mean or frequency and environment facilitates change the lowest for agreeableness; volitional had the highest mean or frequency for conscientiousness; and biology had the highest mean or frequency for negative emotionality. Results for agreeableness suggest students believe this trait to be relatively stable and least affected by the environment compared to the other big five traits. These beliefs may explain why previous work on personality change interventions that used similar samples (Hudson et al., 2020) found agreeableness to change the least compared to the other traits. However, the same logic does not seem to extend to the present conscientiousness finding. That is, if beliefs about volitional change for conscientiousness mattered for actual change in conscientiousness, we

might expect volitional change interventions to be particularly effective for this trait compared to the others; however, a mega-analysis of volitional change interventions using student samples (Hudson et al., 2020) did not reveal such a pattern. Notwithstanding, it remains unclear how much of the variance in personality changes are attributable to beliefs about specific mechanisms of change versus something else. More research is needed to better understand what having these differentiated beliefs about mechanisms of trait change and stability means for how individuals approach personality change.

RQ3. Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?

If beliefs about certain mechanisms of personality change or stability matter for personality development, then understanding how, if at all, these beliefs differ when considering future versus past development can help inform theory. For example, the End of History Illusion is a theory that suggests that these sorts of perceptions about future and past personality development can predict behavior (Quoidbach et al., 2013). Specifically, the theory suggests that people anticipate little to no change and retrospectively report (a lot of) change has already happened to them. Data from the present study are somewhat inconsistent with this claim: the student sample anticipated greater future personality change and endorsed more change mechanisms as responsible for that future change while retrospectively reporting less change and more stability mechanisms. Indeed, results from the present study are more consistent with previous work that has challenged the End of History Illusion (e.g., Busseri, 2013; Busseri, 2024; Harris & Busseri, 2019). One methodological difference between the present study and that of Quoidbach et al. (2013) may explain this apparent contradiction: the present study asked about change across a single semester whereas the Quoidbach et al. (2013) study asks about change

across a ten-year period; this suggests that the end of history illusion may not generalize to perceived changes across shorter timeframes or for predominantly younger sample. Because these perceptions of anticipated and retrospective change appear to have implications for decision making (e.g., spending money; Quoidbach et al., 2013), the present findings elucidate important contextual limitations that should be considered when trying to predict those behaviors.

RQ4. Do students report mechanisms at different rates when considering personality traits specifically versus personality defined broadly?

Given the variety of ways to conceptualize personality, an important gap in our understanding is whether there are (or if lay-persons think there are) different mechanisms of change and stability for these different conceptualizations. When comparing perhaps the most common conceptualization of personality in the big five personality traits to a more global definition of personality, notable differences in types and endorsement rates of certain change and stability mechanisms were evident. First, when considering how global personality (vs the big five) would or did change or remain stable across a semester, students in the present study more frequently responded in ways that were reflective of self-acceptance. It might be easier to feel self-acceptance when considering a broad definition of personality that better reflects the whole person and identity; in contrast, it might be easier to want to change or feel dissatisfaction with current levels of specific traits. Indeed, a large proportion of some student samples express desires to change their big five traits (Baranski et al., 2021).

Second, when asked about global personality, students sometimes did not provide actual explanations for change or stability but rather expressed “hope” for change. At this broad level of abstraction, it may be hard for participants to articulate specific mechanisms. Third, when

considering global personality, participants provided responses that were not consistent with typical conceptualizations of personality according to our team of personality researchers (e.g., participants appeared to be describing states rather than traits). Without more focused or narrow definitions of personality, participants may derive incorrect conclusions about what the researchers are asking about. For endorsement rates of specific mechanisms, a general pattern emerged suggesting that students tend to differentiate the relevance of certain mechanisms between the two conceptualizations of personality; however, no systematic effects emerged.

These findings have at least three implications for the field of personality psychology. First, they highlight the importance of the level of specificity in instructions when using survey questions that target specific constructs. When participants were presented with a broad definition of personality, they appeared to bring their own ideas of what constitutes personality into answering the prompt and ultimately responded in ways that were not consistent with what the researchers were looking for (i.e., focusing on states versus traits). Second and perhaps relatedly, having to include the "no explanation" code in the protocol when switching to the broad definition of personality suggests participants may have limited insight or struggle to articulate explanations for change or stability when considering constructs at broad levels of abstraction. Third, the general pattern of participants distinguishing responsible mechanisms of personality change or stability across the two conceptualizations of personality may partially explain some inconsistencies in the literature. For example, the Post-Traumatic Growth literature (see Jayawickreme et al., 2021 for discussion) has not found consistent links with growth in personality when using the big five as the conceptualization of personality. The present study suggests environment facilitates change, a primary mechanism implied by Post-Traumatic Growth, was more commonly linked with global personality compared to individual big five

traits. This could mean that Post-Traumatic Growth may be occurring in a more global conceptualization of personality but perhaps not at the level of the big five.

RQ5. Is mean level personality trait change associated with specific mechanisms of change or stability?

Identifying predictors of personality change is a major goal of personality science. In both present studies, there was not enough personality trait change occurring across the 8-week duration of the studies and little to no variance in trait change which precluded the ability to try and identify lay-theories of mechanisms of personality change as predictors of personality change. Indeed, for each of the big five traits in both studies, stability coefficients were high and mean-level change effect sizes low. Past research suggests young adulthood (the general life stage of the current sample) is a sensitive period for personality change. The general lack of personality trait change in the present samples suggests that 8 weeks may not be long enough for sufficient personality trait change to occur and that future work examining change should consider longer gaps between assessments. Relatedly, it is possible that whatever (if any) changes occurred in personality across the 8 weeks, a trait measure (e.g., BFI-2 which was used in the present study) was not sensitive enough to pick them up. While there is no definitive lapse of time that would make personality trait versus personality state measures more appropriate, the present work suggests that a personality state measure may be more effective when examining change across 8 weeks. Due to these limitations, the present studies could not conclude whether lay theories of mechanisms of personality change and stability matter for personality development.

Limitations and Future Directions

Despite several strengths of the present work (i.e., longitudinal, multi-method design, relatively large sample, replication with preregistered analyses), at least five limitations must be noted (some alluded to and discussed above). First, intercoder reliability was quite low for the mechanism codes. Discussed previously, this was likely due to various factors including the complexity of the coding task, the number of codes, and the limited space for participants to provide free responses. Despite this, results using the mechanism codes were generally consistent with the checklist data. Future research could benefit from the following: a more standardized and longer coder training procedure; a simpler categorization of codes; as well as pressing for more detailed responses or allowing more space for participants so that there is more "signal" for coders to rate. Second, lay theories of mechanisms of personality change and stability are not particularly observable by others so this work had to rely on self-reports and participant insight which have known limitations and may have affected the specificity and number of mechanism codes produced. Future research could target specific populations that presumably would have high insight on this topic without necessarily being biased by extensive knowledge on personality development (e.g., clinical psychologists). Third, the sample was relatively homogenous which may have hindered a more comprehensive understanding of lay theories of personality change and stability mechanisms. Fourth, while some measures were adapted from those used in previous research, those measures (and other used in this study) were not formally validated which can be problematic for drawing accurate conclusions as well as for replication (Lilienfeld & Strother, 2020). Lastly, the duration of the study was not sufficiently long enough to capture meaningful change in personality traits.

Beyond addressing these limitations, perhaps the most important future direction of this line of research is to better understand how, if at all, beliefs about certain mechanisms being responsible for personality change or stability impact behaviors. There is strong evidence that beliefs influence behavior and no clear evidence why this would not apply in the current context. However, the closest related work has focused exclusively on specific mechanisms, namely essentialism and volitional (e.g., Dweck, 2008; Hudson et al., 2021) so it remains unclear whether having different types of beliefs matter for behavior. In this vein and more specifically for personality change interventions, it remains unclear whether the level of sophistication or complexity of these beliefs (i.e., environment facilitates change is "more simple" than accentuation / interactionism as an explanation for personality change) manifest in different approaches to personality change or if just having the belief that personality is changeable at all is what is most important for the effectiveness of a personality intervention.

CONCLUSIONS

Personality psychology is shifting its focus to understanding the mechanisms that underlie patterns of personality development. Theories of personality development and empirical work suggest that an individual's own views (i.e., lay theories) about personality development may influence that individual's actual personality development. The present work was a preliminary investigation into general mechanisms of personality change and stability through analysis of lay theories and the different contexts in which specific mechanisms may be applicable or relevant. The present work examined up to 13 mechanisms (depending on how personality was conceptualized) students believe are responsible for personality change or stability. The results suggest that the relevance of a given mechanism for personality change or stability depends on the specific big five trait being considered as well as whether future or past change is being considered.

TABLES AND FIGURES

Table 1
Descriptive Statistics for the Demographic Variables for Each Cohort for the Exploratory Study

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	All
Valid *N*	263	289	476	526	1554
Mean Age (*SD*)	19.38 (2.24)	19.50 (2.34)	19.33 (2.79)	19.36 (1.82)	19.38 (2.32)
Gender: Male	38 (14.45%)	53 (18.40%)	81 (17.05%)	90 (17.21%)	262 (16.95%)
Gender: Female	218 (82.89%)	233 (80.90%)	385 (80.88%)	421 (81.05%)	1257 (81.31%)
Gender: Other	7 (2.66%)	2 (0.69%)	9 (2.10%)	9 (1.89%)	27 (1.75%)
Hispanic	23 (8.85%)	24 (8.42%)	27 (5.72%)	28 (5.35%)	102 (6.62%)
Race (Exclusively White)	169 (65.76%)	188 (66.43%)	350 (74.15%)	365 (70.46%)	1072 (70.07%)
Race (Not Exclusively White)	88 (34.24%)	95 (33.57%)	122 (25.85%)	153 (29.54%)	458 (29.93%)
Living Situation: With Caregiver	139 (56.05%)	124 (44.44%)	24 (5.18%)	17 (3.35%)	304 (20.29%)
Living Situation: On-campus	14 (5.65%)	35 (12.54%)	286 (61.77%)	326 (64.17%)	661 (44.13%)
Living Situation: Off-campus (local)	95 (38.31%)	120 (43.01%)	153 (33.05%)	165 (32.48%)	533 (35.58%)
Took Personality Psych Course	40 (15.21%)	48 (16.61%)	66 (13.87%)	80 (15.24%)	234 (15.07%)
Currently taking Personality Psych	45 (17.11%)	74 (25.61%)	102 (21.43%)	138 (26.29%)	359 (23.12%)
Has not taken Personality Psych	178 (67.68%)	167 (57.79%)	308 (64.71%)	307 (58.48%)	960 (61.82%)

Note. Gender: Other includes individuals who selected non-binary OR who self-described; Participants that selected “other” for living situation are not included in the proportions for living situation.

Table 2

Exploratory Study Measure Administration for Each Cohort and Time Point

	Cohorts 1&2		Cohorts 3&4	
Measures	Time 1	Time 2	Time 1	Time 2
Personality Traits	✓	✓	✓	✓
Anticipated Trait Change/Stability	✓		✓	
Anticipated Trait Change/Stability Mechanisms: Free Response	✓			
Anticipated Global Personality Change/Stability Mechanisms: Free Response			✓	
Anticipated Trait Change/Stability Mechanisms: Checklist			✓	
Retrospective Trait Change/Stability		✓		✓
Retrospective Trait Change/Stability Mechanisms: Free Response		✓		
Retrospective Global Personality Change/Stability Mechanisms: Free Response				✓
Retrospective Trait Change/Stability Mechanisms: Checklist				✓

Table 3

Means, Standard Deviations, Cronbach's Alpha, Stability Coefficients, and Cohen's d for each of the Big Five Personality Traits and Their Facets at Each Time Point for the Exploratory Study

	Time 1			Time 2				
	Mean	SD	Alpha	Mean	SD	Alpha	Stability	*d*
Extraversion	3.29	0.72	.85	3.28	0.72	.86	.88	-0.03
Sociability	3.09	1.00	.84	3.12	0.97	.84	.86	0.06
Assertiveness	3.19	0.87	.73	3.17	0.88	.76	.82	-0.04
Energy Level	3.58	0.83	.70	3.54	0.81	.69	.77	-0.07
Agreeableness	3.80	0.57	.77	3.80	0.57	.78	.80	0.00
Compassionate	4.04	0.71	.49	4.04	0.72	.54	.65	0.00
Respectfulness	4.09	0.65	.65	4.08	0.65	.66	.73	-0.02
Trust	3.26	0.79	.64	3.30	0.77	.64	.72	0.07
Conscientiousness	3.64	0.66	.84	3.63	0.67	.86	.85	-0.03
Organization	3.85	0.90	.80	3.83	0.89	.80	.82	-0.04
Productiveness	3.45	0.81	.73	3.42	0.83	.76	.78	-0.06
Responsibility	3.62	0.71	.62	3.63	0.71	.65	.75	0.02
Negative Emotionality	3.27	0.82	.89	3.18	0.82	.90	.83	-0.19
Anxiety	3.79	0.86	.78	3.69	0.86	.75	.78	-0.18
Depression	2.95	0.98	.78	2.86	0.98	.80	.78	-0.14
Emotional Volatility	3.06	1.02	.83	3.00	1.00	.84	.78	-0.09
Open-mindedness	3.74	0.62	.80	3.75	0.67	.85	.84	0.03
Intellectual Curiosity	3.98	0.71	.65	3.98	0.74	.72	.74	0.00
Aesthetic Sensitivity	3.56	0.89	.69	3.60	0.94	.78	.81	0.07
Creative Imagination	3.68	0.75	.67	3.68	0.78	.73	.75	0.00

Table 4

Defined Qualitative Codes, Relevant or Supporting Theories, and Example Participant Responses for each Code in the Exploratory Study

Code	Definition	Relevant Theories	Example
Environment facilitates change	Something about the participant's environment makes it easier for the participant to change.	TESSERA, Neo-Socioanalytic Model, FFT, Dynamic equilibrium model, Cybernetic 5, Paradoxical theory of personality coherence, Self-regulated personality change, Genotype → environment, WTT	I think the fact that I can't really leave for class means that I will spend more time in my room. Because I'm spending more time there, I'll want to be more organized so I don't lose track of anything. Also, I will spend more time finishing assignments and studying for classes because I won't be able to hang out with friends as much.
Environment hinders change	Something about the participant's environment makes it more difficult for the participant to change.	TESSERA, Neo-Socioanalytic Model, FFT, Paradoxical theory of personality coherence	Since I will be staying at home this semester, I do not see myself becoming more or less extroverted
Essentialism	The response implies that personality is stable and unchanging.	TESSERA, Neo-Socioanalytic Model, FFT, Dynamic equilibrium model, Cybernetic 5, Self-regulated personality change, WTT	I have had the same level of agreeableness my whole life.
New role	The participant starts a position where an identity is attached (e.g., employee, student, parent), which evokes and reinforces specific behaviors (e.g., being on time).	TESSERA, Neo-Socioanalytic Model, FFT, Dynamic equilibrium model, Cybernetic 5, Paradoxical theory of personality coherence, Self-regulated personality change	The fact that I am starting college is a motivation for me to stay more organized than before, lessening my procrastination. I am hoping I become more conscientious because of this.

Table 4 (cont'd)

Volitional	Proactive, self-directed personality trait change (or stability). The individual chooses to do an action with the intent of personality change or stability.	TESSERA, FFT, Cybernetic 5, Self-regulated personality change, WTT	I am always improving in this category, and am always working on being more compassionate, as sometimes it is hard for me to understand what people are going through.
Maturity	Personality naturally or automatically changes with age.	TESSERA, Neo-Socioanalytic Model, FFT, Dynamic equilibrium model, Self-regulated personality change	I'm growing older and getting my organizational skills fine-tuned.
Repeated enactment	Engaging in a specific activity that passively reinforces personality stability or change. The individual chooses to do an action without the intent of personality stability or change.	TESSERA, Neo-Socioanalytic Model, FFT, Dynamic equilibrium model, Cybernetic 5, Paradoxical theory of personality coherence, Self-regulated personality change, WTT	I am taking a Software design class, and already have had to be creative with projects, and know I will become more creative and open-minded through this class.
Biology	Manipulation of biological systems such as hormones or neurotransmitters that can produce personality change. This may include things like medication or winter (lack of sunlight).	TESSERA, Neo-Socioanalytic Model, FFT, Dynamic equilibrium model, Cybernetic 5, Paradoxical theory of personality coherence, Self-regulated personality change, Genotype → environment, WTT	Two weeks ago, I was prescribed an antidepressant and it has already decreased some of my negative emotions.

Table 4 (cont'd)

Accentuation / interactionism	An individual's current standing on a trait leads them to behave / feel / think in a certain way which reinforces the stability or change of that trait. Participant notes a level of a trait (e.g., "very extraverted), which leads them to behave (e.g., frequent parties, seek out social situations) in a way the maintains or makes more extreme that level of the trait.	TESSERA, Neo-Socioanalytic Model, FFT, Cybernetic 5, Paradoxical theory of personality coherence, Genotype → environment	Living with my family again means having to make compromises, trusting them to do the right thing, and understanding that the situation right now is hard for everybody. I think I'll remain agreeable because it's the most compassionate thing to do to realize that we're all going to have to get through this in the same house.
***Self-acceptance	The participant is content with their current personality and does not want or feel the need to change.	TESSERA, FFT, Self-regulated personality change, Dynamic equilibrium model, Cybernetic 5, Self-regulated personality change	I think my personality will stay the same at the end of the semester. I am someone who enjoys change but I think my personality is exactly where I want it to be as well as people say the same thing to me.
***No explanation[7]	The participant expresses a desire or hope for personality change without providing any explanation as to how this would happen.	Mindset theory, WTT	I believe that my personality will slightly change overall. This semester, I hope to become a better version of myself, which would include becoming more responsible, more caring, and less emotionally unstable.
***Not personality	The participant describes something that isn't personality such as more transitory psychopathology, a temporary mood, or an emotional state.	N/A	I will probably be more stressed because of school and will probably feel overwhelmed at times.

[7] Coders were trained using the code "wishful thinking". The code has been changed for this document to improve clarity.

Table 4 (cont'd)

Hard to rate	The response (1) does not fit with any of the above categories, (2) is too ambiguous, or (3) does not have enough information to rate. This should be the only code for a given response; do not use this code if any of the other codes are applicable.	N/A	hopefully we get a covid vaccine
Missing data	No response or a response indicating the participant skipped through (e.g., "NA") is given.	N/A	N/A

Note. *** Only Cohorts 3 and 4 have these codes; WTT = Whole Trait Theory; FFT = Five Factor Theory

Table 5

Krippendorff's Alpha for Each Individual Code for Each Cohort (and Big Five Trait) and Time Point (Time 1 Before Slash and Time 2 After Slash)

	Environment facilitates change	Environment hinders change	Essentialism	New role	Volitional	Maturity	Repeated enactment	Biology	Accentuation / interactionism	Self-acceptance	No explanation	Not personality	Hard to rate
Co 1&2: E	.74 / .77	.64 / .64	.65 / .52	.23 / .48	.50 / .47	.36 / .60	.19 / .18	.47 / .52	.09 / .05	-	-	-	.21 / .28
Co 1&2: A	.69 / .77	.46 / .47	.70 / .61	.20 / .27	.46 / .35	.49 / .17	.25 / .17	1.00 / -	.06 / .03	-	-	-	.23 / .32
Co 1&2: C	.67 / .76	.41 / .43	.78 / .60	.13 / .31	.52 / .42	.13 / .76	.14 / .08	.42 / .20	.05 / .00	-	-	-	.27 / .27
Co 1&2: N	.67 / .77	.43 / .52	.69 / .58	.21 / .30	.66 / .66	.39 / .37	.06 / .06	.56 / .58	.11 / .00	-	-	-	.24 / .36
Co 1&2: O	.60 / .76	.48 / .52	.75 / .60	.20 / .47	.48 / .37	.29 / .52	.26 / .20	.00 / .39	.08 / .01	-	-	-	.20 / .45
Co 3&4	.39 / .39	.20 / .22	.53 / .56	.16 / .17	.33 / .31	.39 / .40	.14 / .08	.43 / .52	.08 / .07	.35 / .20	.34 / .20	.29 / .34	.15 / .14

Note. Co = Cohort, E = Extraversion, A = Agreeableness, C = Conscientiousness, N = Emotional Stability, O = Open-mindedness

Table 6

Synthesis of Exploratory Study Research Question 2 Results: Are students distinguishing in their proposed mechanisms across traits?

Data Used	Cohorts 1 & 2 Qualitative		Cohorts 3 & 4 Quantitative
Coding Approach	Avg	Any	-
Environment Facilitates Change	Yes	Yes	Yes
Environment Hinders Change	Yes	Yes	Yes
Essentialism	Yes	Yes	Yes
New Role	Yes	Yes	Yes
Volitional	Yes	Yes	Yes
Maturity	No	No	Yes
Repeated Enactment	Yes	Yes	Yes
Biology	Yes	Yes	Yes
Accentuation / Interactionism	Yes	Yes	Yes

Table 7

Synthesis of Exploratory Study Research Question 3 Results: Do students report mechanisms at different rates for anticipated versus retrospective personality change or stability?

Data Used	Cohorts 1 & 2 Qual		Cohorts 3 & 4 Quant	Cohorts 3 & 4 Qual		Cohorts 1, 2, 3, & 4 Qual		Cohorts 3 & 4 Qual and Quant
Coding Approach	Avg	Any	-	Avg	Any	Avg	Any	Any
Environment Facilitates Change	-	-	-	-	ns	-	-	-
Environment Hinders Change	+	+	ns	+	+	+	+	ns
Essentialism	ns	+	+	ns	ns	ns	ns	+
New Role	ns	ns	-	+	+	+	ns	-
Volitional	-	-	-	-	-	-	-	-
Maturity	ns	-	-	ns	ns	ns	ns	-
Repeated Enactment	-	-	-	ns	ns	-	-	-
Biology	ns	ns	-	ns	ns	ns	+	ns
Accentuation / Interactionism	-	-	-	-	-	-	-	-

Note. - = significant effect with negative coefficient (i.e., code was less common at Time 2 compared to Time 1); + = significant effect with positive coefficient (i.e., code was more common at Time 2 compared to Time 1); ns = coefficient was not significant

Table 8

Synthesis of Exploratory Study Research Question 4 Results: Do students report mechanisms at different rates when considering personality traits specifically versus personality defined broadly?

	E			A			C			N			O		
	S49 -57	S58 -66	S67 -75	S49 -57	S58 -66	S67 -75	S49 -57	S58 -66	S67 -75	S49 -57	S58 -66	S67 -75	S49 -57	S58 -66	S67 -75
Environment Facilitates Change	ns	-	-	-	-	-	-	-	-	ns	-	-	-	-	-
Environment Hinders Change	+	+	-	+	+	-	+	+	ns	+	+	+	+	+	-
Essentialism	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-
New Role	-	-	ns	-	-	-	-	-	+	-	-	ns	-	-	ns
Volitional	ns	-	-	ns	-	-	+	ns	ns	ns	-	-	ns	ns	-
Maturity	-	-	+	-	ns	+	-	ns	+	-	-	+	-	ns	+
Repeated Enactment	-	-	ns	-	-	-	-	-	-	-	-	-	+	ns	-
Biology	-	-	ns	-	-	-	-	-	-	ns	ns	+	-	-	-
Accentuation / Interactionism	ns	ns	+	+	+	ns	ns	ns	+	ns	ns	+	ns	ns	ns

Note. - = significant effect with negative coefficient (i.e., code was less common for the trait compared to global personality); + = significant effect with positive coefficient (i.e., code was more common for the trait compared to global personality); ns = coefficient was not significant; S49-57 used the average final coding approach and qualitative data from each of the four cohorts; S58-66 used the any final coding approach and qualitative data from each of the four cohorts; S67-75 used the any final coding approach for the qualitative data from cohorts 3 and 4 as well as used the checklist data from cohorts 3 and 4.

Table 9

Exploratory Study Base Latent Change Score Models for Each of the Big Five Personality Traits Using Facets as Observed Variables. Unscaled Model Fits and Change Score Estimates and Variances are Reported.

	E	A	C	N[!]	O
CFI	.995	.997	.998	.997	.996
TLI	.993	.995	.998	.996	.994
RMSEA	.041	.028	.022	.031	.033
SRMR	.016	.016	.011	.012	.016
Change score estimate	0.022[N.S.]	0.000[N.S.]	-0.034[N.S.]	-0.082[N.S.]	0.021[N.S.]
Change score variance	0.089*	0.144[N.S.]	0.142*	0.201*	0.181*

Note. Each of these base models were identically specified based on a combination of Kievit et al. (2018) and the strict invariance model but with "auto.var" (i.e., error variances free to vary) set to TRUE to help with convergence; ! = variance / covariance matrix not positive definite; N.S. = not significant; * = $p < .01$

Table 10
Descriptive Statistics of Demographic Variables for the Follow-up Study Sample

	n	Proportion of Sample
Gender: Male	99	19.49%
Gender: Female	405	79.72%
Gender: Other	6	1.18%
Trans: No	499	98.42%
Trans: Yes	7	1.38%
Trans: Unsure	1	0.20%
Hispanic: No	467	92.48%
Hispanic: Yes	38	7.52%
Race (Exclusively White)	365	71.99%
Race (Not Exclusively White)	142	28.01%
Living Situation: With Caregiver	18	3.54%
Living Situation: On-campus	317	62.28%
Living Situation: Off-campus (local)	174	34.18%
Took Personality Psych Course	71	13.84%
Currently taking Personality Psych	111	21.64%
Has not taken Personality Psych	331	64.52%
Age	Mean = 19.34	SD = 2.07

Note. Gender: Other includes individuals who selected non-binary OR two-spirit; Participants that selected "other" for living situation are not included in the proportions for living situation.

Table 11

Means, Standard Deviations, and Cronbach's Alpha for each of the Big Five Personality Traits and Their Facets at Each Time Point for the Follow-up Study

	T_1 (n = 512)			T_2 (n = 431)			T_3 (n = 345)		
	Mean	SD	α	Mean	SD	α	Mean	SD	α
Extraversion	3.28	0.68	.84	3.25	0.69	.86	3.27	0.70	.87
Sociability	3.09	0.94	.81	3.06	0.91	.82	3.08	0.90	.82
Assertiveness	3.16	0.85	.73	3.12	0.85	.76	3.13	0.88	.79
Energy Level	3.59	0.75	.62	3.57	0.77	.67	3.59	0.77	.68
Agreeableness	3.80	0.54	.76	3.74	0.56	.78	3.73	0.57	.79
Compassionate	4.08	0.68	.49	4.00	0.70	.54	4.00	0.72	.59
Respectfulness	4.11	0.61	.64	4.04	0.63	.65	4.02	0.62	.62
Trust	3.21	0.76	.61	3.18	0.75	.63	3.18	0.79	.68
Conscientiousness	3.71	0.63	.84	3.65	0.60	.83	3.72	0.63	.85
Organization	3.96	0.85	.79	3.91	0.84	.78	3.96	0.85	.80
Productiveness	3.50	0.76	.70	3.44	0.74	.71	3.52	0.75	.72
Responsibility	3.67	0.70	.63	3.61	0.67	.65	3.69	0.68	.67
Negative Emotionality	3.13	0.75	.87	3.15	0.75	.89	3.11	0.79	.90
Anxiety	3.69	0.82	.73	3.69	0.77	.72	3.64	0.84	.76
Depression	2.82	0.90	.76	2.83	0.90	.79	2.77	0.94	.81
Emotional Volatility	2.87	0.93	.79	2.92	0.93	.83	2.92	0.93	.83
Open-mindedness	3.63	0.64	.82	3.60	0.66	.84	3.63	0.70	.87
Intellectual Curiosity	3.85	0.74	.68	3.77	0.74	.70	3.81	0.78	.75
Aesthetic Sensitivity	3.44	0.88	.68	3.46	0.90	.75	3.50	0.91	.77
Creative Imagination	3.59	0.79	.70	3.58	0.78	.71	3.59	0.82	.78

Table 12

Stability Coefficients and Cohen's d for Each Big Five Trait and Facet in the Follow-up Study

	$r_{T1\&T2}$	$r_{T2\&T3}$	$r_{T1\&T3}$	$d_{T1\&T3}$
Extraversion	.90	.90	.89	-0.03
Sociability	.86	.88	.86	-0.02
Assertiveness	.82	.82	.79	-0.05
Energy Level	.82	.83	.79	0.00
Agreeableness	.75	.85	.78	-0.19
Compassionate	.59	.67	.60	-0.13
Respectfulness	.69	.79	.68	-0.18
Trust	.76	.80	.78	-0.06
Conscientiousness	.84	.87	.84	0.03
Organization	.79	.86	.82	0.00
Productiveness	.78	.77	.73	0.04
Responsibility	.73	.74	.73	0.04
Negative Emotionality	.84	.88	.84	-0.05
Anxiety	.77	.81	.78	-0.09
Depression	.79	.86	.79	-0.08
Emotional Volatility	.76	.80	.75	0.08
Open-mindedness	.86	.88	.84	0.00
Intellectual Curiosity	.77	.78	.77	-0.08
Aesthetic Sensitivity	.78	.84	.77	0.10
Creative Imagination	.80	.81	.77	0.00

Table 13

Base Latent Growth Curve Models for Each of the Big Five Personality Traits in the Follow-up Study. Unscaled Model Fits and Non-Standardized Intercept and Slope Estimates are Reported.

	E	A	C	N	O
CFI	1.000	.999	.983	.998	.999
TLI	1.001	.997	.948	.994	.998
RMSEA	.000	.036	.182	.060	.038
SRMR	.004	.010	.028	.011	.008
I Intercept	3.275*	3.762*	3.659*	3.124*	3.614*
S Intercept	0.003 N.S.	-0.048 N.S.	-0.036 N.S.	-0.040 N.S.	-0.009 N.S.
I ~~ S	.001 N.S.	0.039*	.012 N.S.	.057*	.038 N.S.
I Variance	0.412*	0.245*	0.319*	0.501*	0.383*
S Variance	0.042 N.S.	0.035 N.S.	-0.021!	0.020 N.S.	0.071 N.S.

Note. Each of these base models were identically specified; ! = negative variance; N.S. = not significant; * = $p < .01$; I = Intercept; S = Slope; ~~ = covariance

Figure 1 Flow chart of Survey 1 for the Exploratory Study

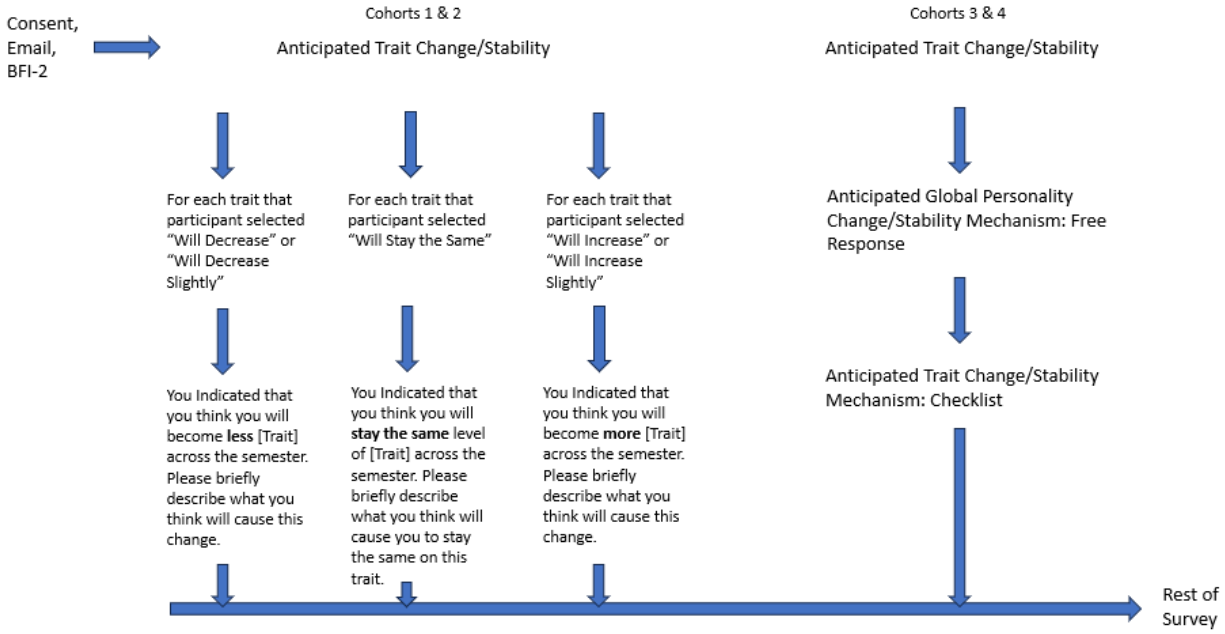


Figure 2 Multiple indicator latent change score model.

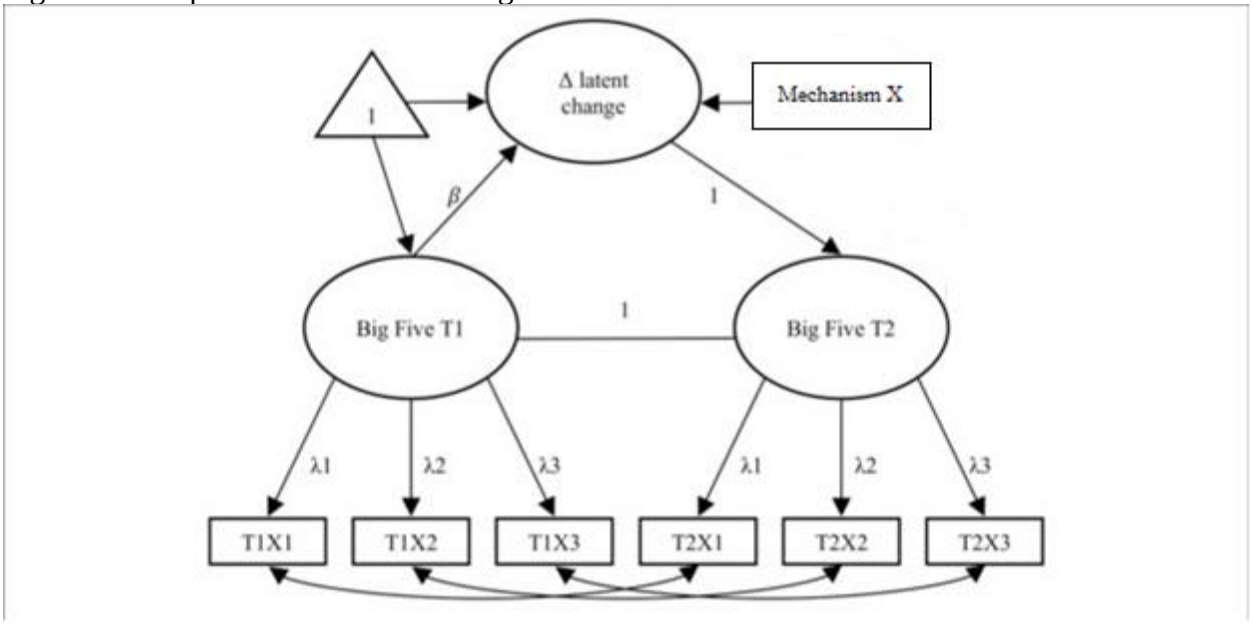
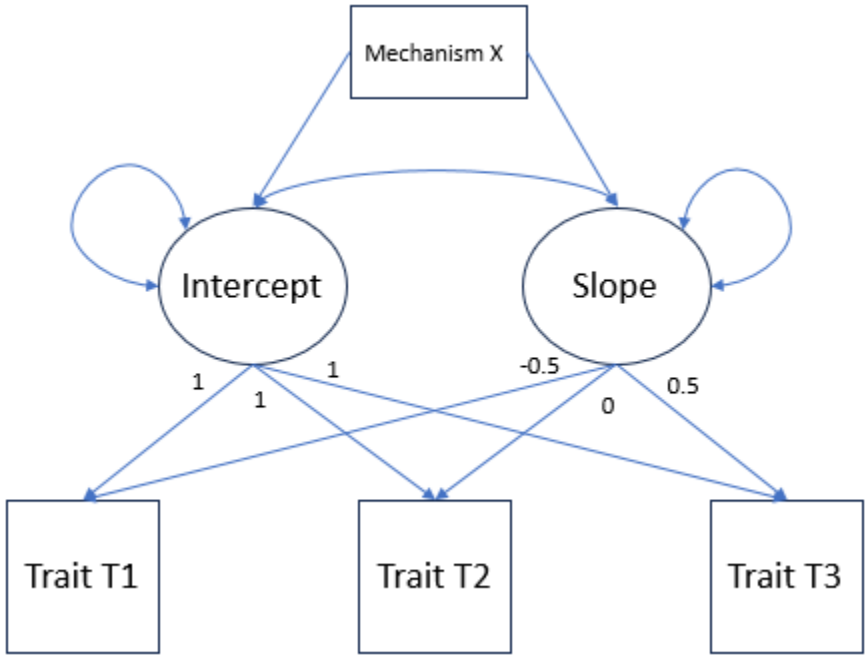


Figure 3 Latent growth curve model.



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