Self-regulation underlies temperament and personality: An integrative developmental framework

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Abstract

In this review we present an integrative perspective on temperament and personality development. Personality and temperament are conceptualized as regulatory systems that start as physiological reactivity to environmental features early in life but are increasingly supplemented by regulation efforts oriented towards reference values, such as personal goals and social norms. These reference values change during development as society expects increasingly mature behaviors but it takes regulatory resources and incremental practice before individuals are able to conform to these higher standards. Consistent with this view, a meta-analysis of mean-level development of personality traits in adolescence revealed a decrease in conscientiousness and openness during early adolescence. It seems that negative discrepancies between reference values and actual behavior are responsible for decreases in perceived maturity, but further research is needed to back up this claim by more direct evidence.

Self-Regulation Underlies Temperament and Personality

Temperament has been defined as "constitutionally based individual differences in reactivity and self-regulation, with 'constitutional' referring to the relatively enduring biological makeup of the individual, influenced over time by heredity, maturation, and experience" (Rothbart, 1986, p. 356; for an overview of other conceptions, see Zentner & Shiner, 2012). Personality traits are defined as "relatively enduring patterns of thoughts, feelings, and behaviors that distinguish individuals from one another" (Roberts & Mroczek, 2008, p. 31). Unlike conceptualizations of temperament, classic conceptualizations of personality typically do not include notions of reactivity and self-regulation (for an exception, see Block, 2002). However, Denissen and colleagues (Denissen, Penke, & Wood, 2013; Wood, Spain, & Denissen, 2013) proposed a regulatory model of adult personality traits in which behaviors are interpreted as functional reactions to environmental features (see Fleeson, 2012, for a model with similar assumptions); that is, behaviors are meant to achieve certain desired future states.

The core of our conception of personality traits is that behaviors that are typically associated with traits (e.g., talking to strangers for extraversion) are performed because they are strategic means to desired end states (see also McCabe & Fleeson, 2012). Others have highlighted the importance of self-regulation for understanding personality development. Rothbart (1981) articulated the role of primary and secondary regulation, and described how temperament development can be understood as the maturation of regulatory systems (Posner & Rothbart, 2000).

In the domain of lifespan personality development, our theory compares with social investment theory (SIT) by Roberts and colleagues (Roberts, Wood, & Lodi-Smith, 2005). Like our theory, SIT acknowledges the lifespan malleability of personality and points to social roles as driving forces in the maturation of personality. Within SIT, the maturation of personality traits is seen as occurring when individuals encounter new expectations for communal, responsible behavior in adulthood and alter their behavior to correspond with these changing expectations. Consistent

with this, a recent study by Bleidorn (2012) demonstrated that the increase in conscientiousness in high school students (i.e., late adolescents) is mediated by scholarly goal achievement that becomes salient once students approach high school graduation (for cross-cultural evidence, see Bleidorn et al., in press). Our own perspective expands SIT by more explicitly detailing the regulatory processes that explain how individuals change their behavior to meet these expectations and how these changes become habitual and automatic enough to be regarded as part of their personality.

The remainder of this paper includes three sections. In the first, we describe five regulatory mechanisms that are used to achieve desired states and that provide the basis for individual differences in personality. In the second, we show how these regulatory mechanisms can be a driving force of personality development. In the third, we describe how this account can be applied to understanding personality development in adolescence, by presenting the results of a new meta-analysis and outlining other questions suggested by this perspective that can be tested in future research. [Denissen, Penke, & Wood (2013) provide a complete account of the theory.]

A Taxonomy of Regulatory Mechanisms

Regulatory mechanisms are defined as reactions that are strategically performed to decrease discrepancies between a person's current state and some referent standard (Carver & Scheier, 2001; Denissen et al., 2013). We discuss five such mechanisms (for their origin in the literature on emotion regulation, see Gross & Thompson, 2007). First, individuals can select or deselect situations based on their eliciting features (e.g., leaving a stressful situation). Selection is best understood as a movement towards or away from the triggering set of environmental features. For example, people may select certain environments that fit their personality (Scarr, 1996), or they may learn or decide to avoid situations that are not conducive to their goals.

Second, individuals might modify the situational features that are associated with undesired outcomes. In contrast to situation selection, however, the person modifies environmental features (e.g., trying to attenuate or accentuate certain environmental features, or trying to alter certain

features of a social role) without moving to a qualitatively different situation. For example, a conscientious individual could structure his office (e.g., by organizing files according to work projects) in order to facilitate goal achievement.

Third, people can direct attention away from undesired features of the situation to increase its hedonic value (e.g., looking away from an aversive stimulus) or to facilitate more long-term goals. As an example of the latter, in a famous experiment by Mischel and his colleagues (Mischel, Ebbesen, & Raskoff Zeiss, 1972), children were more successful at suppressing the urge to eat a marshmallow when they directed their attention away from it.

Fourth, people can change their appraisals or representations of the situational feature in question. For example, if they are facing a difficult project deadline, they can redefine stress as a challenge. In the above-described experiment by Mischel, this strategy suppressed the urge to eat a tempting marshmallow: Children who managed to modify their cognitive representation of the marshmallow's appetitive features were more successful at this. Similarly, a highly conscientious individual who is following a diet could try to attenuate the appetitive appeal of the marshmallow by cognitively re-constructing it as a food item that is undesirable because of its caloric value (Metcalfe & Mischel, 1999).

Finally, individuals can try to suppress their primary reaction to the situational feature. For example, they might experience an emotion due to their attention to a discrepancy that is relevant for a certain desired end state, but refrain from behaviorally expressing the emotion. For example, an extraverted individual might feel bored while studying for an exam but might try to suppress the urge to talk to a neighboring student while studying at the library. Research has found that the mechanism of suppression is less conductive in terms of well-being, compared to other strategies like reappraisal (John & Gross, 2004).

We argue that many of the consistent patterns of affect, behavior, and cognition that define personality can be conceptualized as functionally motivated to achieve certain reference values

(e.g., goals, social norms). Personality might thus be seen as a heterogeneous mix of mechanisms that constitute, in an additive or interactive fashion, alternative routes to similar developmental and social outcomes (equifinality). For example, agreeable persons may be characterized by a reference value (i.e., goal, desired end-state) of "promoting and conserving harmonious interactions with others". As such, they might avoid situations and persons that are associated with high levels of conflict, attenuate conflicts by appeasing behaviors when it nevertheless arises, selectively ignore provocations by others, systematically appraise behaviors by other people as benign, suppress overt expressions of anger when they arise, or any combination of the above.

To summarize, we propose that the five self-regulation mechanisms constitute a basis for individual differences in personality. Evidence that supports this claim is that personality is robustly associated with a systematic range of constructs related to self-regulation. Studies show substantial relationships between traits and constructs such as goals (e.g., Roberts, O'Donnell, & Robins, 2004), and situational expectancies (Ames, 2008; Wood, Harms, & Vazire, 2010). For example, one particularly informative study by McCabe and Fleeson (2012) used a diary design to relate daily fluctuations in extraversion-related goals (e.g., "trying to have fun") and extraverted behavior and found that the former could predict 74% of the variance in the latter.

Self-Regulation as Driving Force of Personality Development

A core tenet of our theoretical framework is that regulatory mechanisms can be improved by practice, which optimizes and automates regulatory behaviors (Mauss, Bunge, & Gross, 2007). In addition, people can draw upon previous experiences in regulatory situations. For example, many older adults apply lessons learned in past experiences when confronted with problems (Aldwin, Sutton, Chiara, & Spiro, 1996). Such improved self-regulation by practice can explain why mean levels of personality traits increase in a socially desirable direction over the lifespan (this is referred to as the "maturity principle"; Roberts & Wood, 2006).

To the extent that one's personality is rooted in stable individual differences in the frequency

and efficiency of self-regulation mechanisms, age-related changes in personality development should be driven (mediated) by shifts in the individual's use of these mechanisms. In fact, preliminary evidence shows that the association between age and affect is partially mediated by the self-perceived efficiency of self-regulation mechanisms (Kessler & Staudinger, 2009). Similarly, age-related decreases in negative emotions such as anger and anxiety are partially mediated by changes in the reappraisal strategy of accepting of negative emotions non-judgmentally (Shallcross, Ford, Floerke, & Mauss, 2012).

Ultimately, the most conclusive piece of evidence to support that personality maturation depends on self-regulation improvements would come from intervention studies. Based on the present perspective, such interventions would target self-regulation mechanisms. For example, they might be focused on the non-judgmental acceptance of negative emotions (Baer, 2003), shifting attention away from threatening cues (Hakamata et al., 2010), or the positive reappraisal of threats (Hallion & Ruscio, 2011). Recently, a so-called bottom-up approach intervention to increase conscientiousness was developed based on expectancy-value theory (Magidson, Roberts, Collado-Rodriguez, & Lejuez, in press). Specifically, this intervention requires people to identify important life goals (e.g., "being a dedicated employee") and then planning specific activities to fulfil these goals (e.g., "showing up at work on time"; "limiting leisurely Internet use at work", etc.) According to our perspective, the repeated practice of these activities will over time lead to their automatization and subsequent personality change.

Explaining mean-level personality development in adolescence

To illustrate the usefulness of our theoretical model, we applied it to explain mean level development of personality traits during adolescence. The shape of adolescents' mean level personality development has been suggested to be curvilinear, with decreasing maturity in early puberty and increases thereafter (i.e, U-shape; Soto, John, Gosling, & Potter, 2011). However, the only meta-analysis so far on mean-level personality development (Roberts, Walton, & Viechtbauer,

2006) did not differentiate between early and late adolescence, so the exact shape of mean-level development required a closer look.

Applied to a transition like puberty, our model predicts a U-shaped developmental pattern of levels in personality traits. This prediction starts from the assumption that most important social or demographic transitions (like puberty) are associated with a shift in reference values (e.g., parents increasingly expect responsible behaviors from their adolescent children). These reference values might not immediately result in corresponding behavioral changes because individuals need time to become aware of and internalize the new values and develop a novel behavioral repertoire to accommodate to them. During this initial phase, there might even be a decrease in perceived maturity because individuals are now held to a higher standard to which they cannot (yet) live up due to underdeveloped regulatory ability (this is also consistent with a decrease in self-esteem during this period; Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002). After this initial phase is completed and a novel regulatory repertoire is in place, incremental practice is expected to result in strengthening regulatory ability until it reaches levels that are consistent with the corresponding reference value. As soon as observers (including the self) pick up on these improvements, ratings of personality maturity should increase.

We therefore conducted a meta-analysis of studies that reported age differences in personality traits in adolescence. Details of the analysis are included in supplementary material available online. We found 14 articles (with 20 samples) that reported age differences in mean-levels of the Big Five personality factors across adolescence, (liberally) defined as the age group between 10 and 20 years. Effect sizes were calculated as the difference between two age groups (for cross-sectional studies) or time points (for longitudinal studies), standardized by the standard deviation of the first measurement. Results are displayed in Figures 1 and 2. It needs to be emphasized that these figures do *not* depict absolute levels personality traits (which are depicted in Figure 3) but rather the direction of development (i.e., slope). Thus, numbers below zero indicate a

decrease in mean-levels, whereas numbers above zero indicate increases in mean-levels.

Applied to conscientiousness, we thus found evidence for a quadratic mean-level shape of conscientiousness. After all, the effect size plot (of slopes) indicates a decrease in early adolescence, followed by an increase in late adolescence (see Figure 1). Similarly, openness decreased in early adolescence and increased (though somewhat less steeply) during later adolescence (see Figure 2). The other three personality factors did not change.

To facilitate interpretation, we saved the estimated values for both conscientiousness and openness to experience. We then started from age 10 as a reference value and added the predicted slope value to this reference value. We used the result of this computation and added the slope for age 12.77, age 15.54, and age 18.31 (i.e., multitudes of 2.77, the average time lag between studies). For example, the predicted slope for openness for age 10 was -.33, so we plotted this as the predicted absolute value for age 12.77. The results are depicted in Figure 3 and clearly show the expected U-shaped development in mean level.

These plots are partly consistent with the results by Soto et al. (2011), who found that in early puberty there are decreases in conscientiousness and openness, followed by an increase. Soto also found decreases in extraversion, emotional stability, and agreeableness, which were not significant in our meta-analysis when effect sizes were aggregated within samples. However, when age differences were analyzed using multilevel modeling (see supplementary material), we could also replicate the decrease in extraversion and emotional stability. Only the U-shaped pattern of agreeableness reported by Soto could not be replicated, which might be due to differences in sample, instrument, and rating source.

Our proposed framework explains the curvilinear shape of mean-level personality change during adolescence, with decreases in early adolescence followed by increases during later adolescence. It poses that increasingly responsible and socially desirable reference values are the key. In early life, adolescents do not yet have the regulatory resources to live up to these demands,

so they are judged as less mature. For example, early adolescents might be limited in their regulatory ability, for example because the neuronal foundations of self-control are still developing (Steinberg, 2007). Only later, when they have learned from experiences and accumulated resources, do they (most of them) gradually come to live up to social reference values, resulting in stabilization of and (eventually) increases in maturity.

An alternative account of these findings is that the ability to self-regulate is not actually limited during adolescence but that reference values (temporarily) shift towards values that are considered socially immature by society in general. With some leeway, a version of this argument is consistent with Moffitt's (1993) theory of antisocial behavior, which states that the maturity gap during adolescence temporarily increases the attractiveness of deviant behavior. Applied to personality development, it might be that in the transition to middle school, socially endorsed reference values might be attuned towards rebellious behavior that run counter to "adult" social institutions such as schoolwork and other intellectual endeavors. Such temporary counter-norms (i.e., reference values that are inconsistent with more adult notion of maturity) might lead to corresponding decreases in conscientiousness and openness to experience.

Of course, this explanation is still consistent with the assumptions of our regulatory framework that explaining changes in traits requires understanding both changes in reference values and also changes in the regulatory resources and behavioral patterns needed to implement them. Our results suggest that reference values related to conscientiousness and openness begin to increase substantially in adolescence, perhaps due to the salience of developmental norms that increasingly specify to behave in a fashion that is more hard-working and exploring novel ideals during adolescence. The observed decreases in openness and conscientiousness might reflect a combination of shifting social and personal expectations toward more mature behavior and a temporary lack of regulatory ability and resources to fulfill these new expectations. By comparison, the lack of corresponding effects for agreeableness might be due to the overriding concern for peer

popularity during this period (e.g., van der Linden, Scholte, Cillessen, te Nijenhuis, & Segers, 2010). Future studies should include more direct assessments of regulatory abilities as well as reference values such as personal goals and perceived norms.

Conclusion

In this paper, we have described a portion of a theory that personality development is driven by shifts in self-regulation systems that make use of mechanisms like the selection and modification of environmental features, the shifting of attention, the reappraisal of environmental challenges, and the suppression of undesired impulses. Our theory integrates conceptualizations of childhood temperament and adult personality, as well as adult emotional aging. It points to promising ways to modify temperament via the incremental practice of self-regulation mechanisms. As we demonstrate, this model is generative: we were able to predict how patterns of personality change should look for Big Five-related traits in early adolescence (ages 10-20). For every period of the lifespan, we expect that an assessment of reference values and (average) regulatory capacity determine the shape of mean-level development of different personality traits. Specifically, this model lays out predictions about why personality traits change in this manner during these ages (and at other ages): personality changes should be initiated by changes in reference values that individuals slowly start living up to.

Somewhat counter-intuitively, when a reference value for the trait begins to increase substantially, this may frequently be expected to result at first in a *decrease* in the self-perceived trait level if the behavioral level does not meet this new standard. Over time however, increases in a reference value should ultimately result for increases in both self-perceived and behavioral levels of the trait as people actively work to adjust their behavior and develop the regulatory skills to match and accommodate this standard. When reference values shift towards less socially desirable levels, or when individuals' regulatory resources are eroded (e.g., in very old age, or during periods of extensive stress), the corresponding trait should regress towards less socially desirable levels as

well. Although these are exciting possibilities, more evidence is needed to demonstrate the extent to which individual differences as well as lifespan changes in self-regulation capacity underlie personality trait development.

Figure 1.

Plot of effect sizes (standardized mean differences between age groups) for conscientiousness. Negative values indicate decreases following the age on the x-axis, positive values indicate increases.

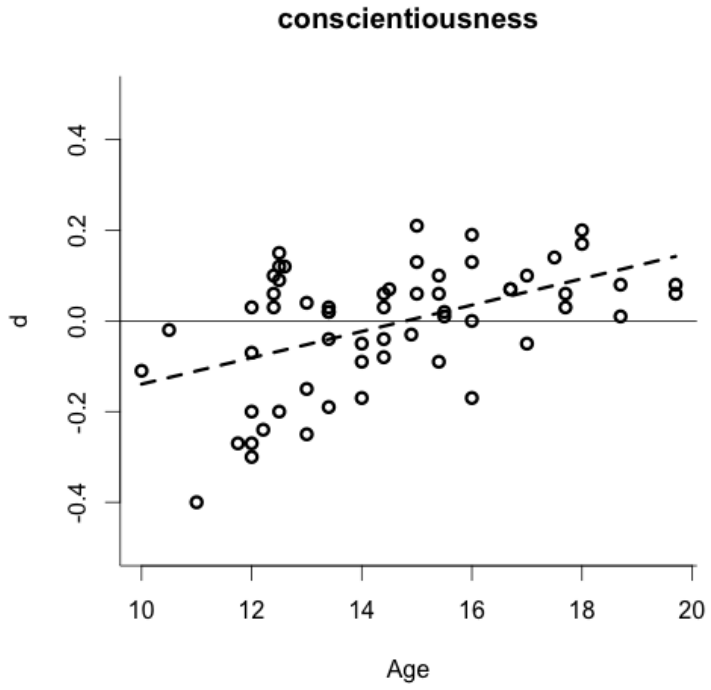


Figure 2.

Plot of effect sizes (standardized mean differences between age groups) for openness to experience. Negative values indicate decreases following the age on the x-axis, positive values indicate increases.

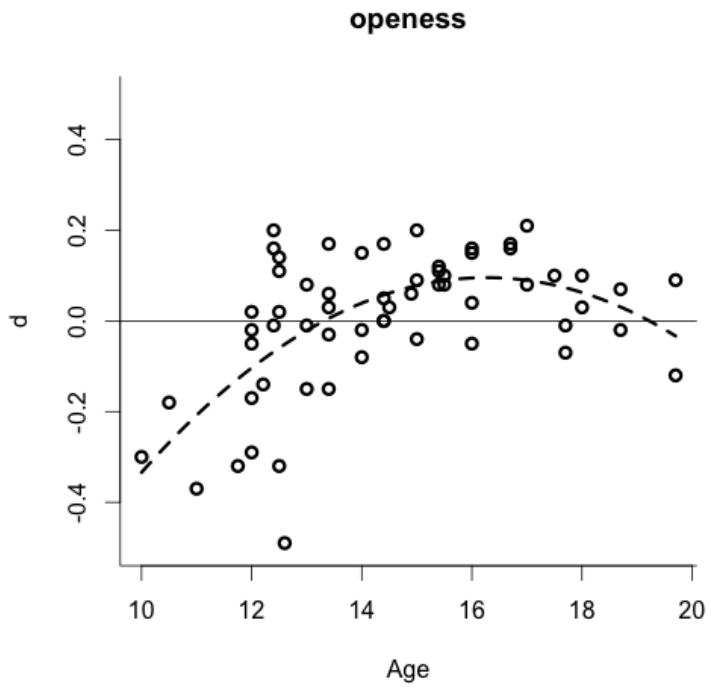
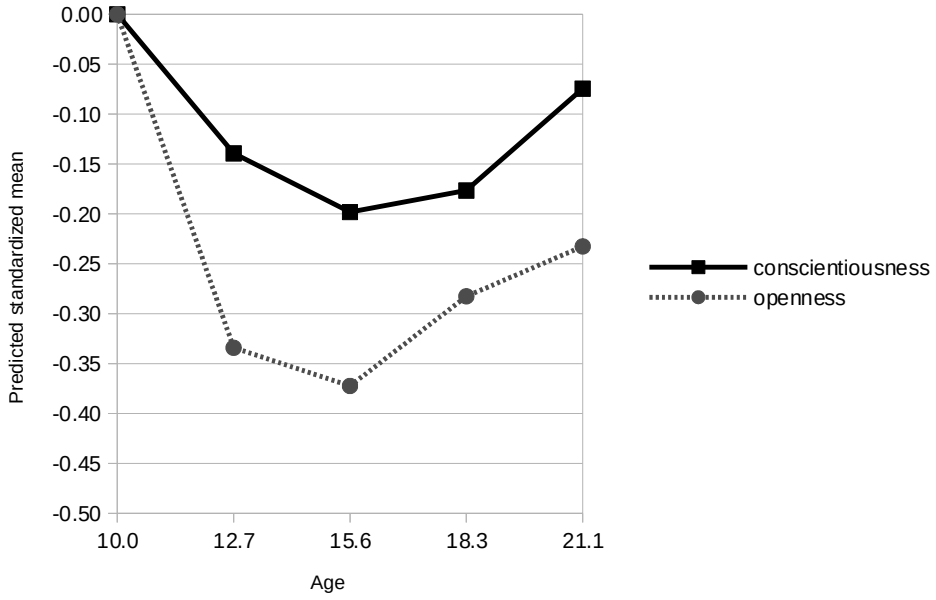


Figure 3.

Estimated values for conscientiousness and openness to experience. Age 10 was used as reference value (set at zero). Every 2.77 year increase along the x-axis (average time lag), the predicted value corresponding to the regression equation plotted in Figures 1 and 2 (dotted lines) were added in an cumulative fashion.



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