

Personality Processes: Mechanisms by Which Personality Traits “Get Outside the Skin”

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Abstract

It is time to better understand why personality traits predict consequential outcomes, which calls for a closer look at personality processes. Personality processes are mechanisms that unfold over time to produce the effects of personality traits. They include reactive and instrumental processes that moderate or mediate the association between traits and outcomes. These mechanisms are illustrated here by a selection of studies of traits representing the three broad domains of personality and temperament: negative emotionality, positive emotionality, and constraint. Personality processes are studied over the short term, as in event-sampling studies, and over the long term, as in lifespan research. Implications of findings from the study of processes are considered for resolving issues in models of personality structure, improving and extending methods of personality assessment, and identifying targets for personality interventions.

Contents

| | |
|---|-----|
| INTRODUCTION | 316 |
| Temperament and Personality | 317 |
| Social-Cognitive Perspectives on Personality Processes | 318 |
| Trait Processes: Moderating and Mediating Mechanisms | 319 |
| Overview | 320 |
| NEGATIVE EMOTIONALITY | 321 |
| Neuroticism | 321 |
| Neuroticism and Moderation Processes | 322 |
| Neuroticism and Mediation Processes | 323 |
| Anger | 324 |
| Anger and Moderation Processes | 324 |
| Summary and Implications for Personality Theory and Measurement | 324 |
| POSITIVE EMOTIONALITY | 325 |
| Extraversion | 325 |
| Extraversion: Mediation and Moderation Processes | 325 |
| Summary and Implications for Personality Theory and Assessment | 327 |
| CONSTRAINT | 327 |
| Conscientiousness | 328 |
| Conscientiousness and Moderation Processes | 328 |
| Conscientiousness and Mediation Processes | 329 |
| Summary and Implications for Personality Theory and Measurement | 330 |
| CONCLUSIONS AND FUTURE DIRECTIONS | 331 |

INTRODUCTION

The study of personality processes examines how personality is manifested in people's thoughts, feelings, and behaviors to result in consequential outcomes. Whereas psychologists more commonly investigate how external,

environmental influences affect internal processes within the individual, that is, how these factors get "under the skin," in this review I reverse the direction of the metaphor. What are the processes that produce the effects of personality traits? In other words, how do traits get outside the skin?

Reviews of studies documenting associations between traits and important life outcomes amply confirm the predictive power of personality (Ozer & Benet-Martínez 2006, Roberts et al. 2007). Personality traits predict consequential outcomes for individuals (e.g., happiness, longevity), couples (e.g., relationship quality), groups, and society (e.g., volunteerism, criminality). These reviews provide an extensive catalogue of *what* personality predicts but do not examine *how* personality gives rise to these associations. With such a strong foundation of empirical evidence in place, research can now focus on the processes underlying these observed associations between personality traits and outcomes. A greater understanding of personality processes may inform personality theory and measurement and foster beneficial personality development and change.

My focus in this article is on personality trait processes. Trait theories assume that people differ reliably from one another in their stable patterns of cross-situational behavior, and personality traits describe these individual differences in terms of characteristic thoughts, feelings, and behaviors (Funder 2001). Most of those who study trait structure agree that individual differences in personality are captured by the dimensions of the five-factor model or Big Five taxonomy, comprising the broad trait dimensions of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience/intellect, and their more specific facets (Digman 1990; Goldberg 1990; John et al. 2008; McCrae & Costa 2003, 2008; Saucier & Goldberg 2001). An alternative six-factor structure, which includes a dimension of honesty-humility (Ashton & Lee 2007, Lee & Ashton 2008), has proved useful in cross-language studies (Saucier 2009).

However, the study of the structure of personality traits is primarily descriptive. It is the “what” of personality, rather than the “how” or the “why” (Revelle 1995). Even McCrae and Costa’s well-elaborated five-factor theory of personality (McCrae & Costa 1996, 2008), which places traits in the context of biology, biography, external influences, self concept, and characteristic adaptations, leaves the dynamic processes linking these various elements largely unspecified. Understanding personality processes goes beyond describing individual differences by explaining the expression of individual differences. The study of personality processes asks why personality traits have their consequential effects on important life outcomes. Why do extraverted people tend to be happier than introverted people? Why do less conscientious and more neurotic people tend to live shorter lives than more conscientious or more emotional stable people?

As we try to answer these kinds of questions, it is helpful to keep in mind a simple definition of a “process.” An unsystematic survey of online dictionary definitions reveals that most boil down to this: “A process is a series of actions that take place over time to produce a result.” For example, the process of natural selection results in the evolution of species, the burning of fossil fuels contributes to global warming, and evaporation produces potable water from the ocean. Similarly, personality processes may be defined as actions or reactions over time that produce the outcomes associated with personality constructs. Two theoretical approaches to personality have proved useful for the study of personality processes: temperament models and social-cognitive models.

Temperament and Personality

To begin to answer “why” questions, it is necessary to view personality traits in a broader theoretical context that goes beyond descriptive or taxonomic issues. Categories for personality description do not help us to understand why a neurotic person erupts in anger to a mild provocation, or when an

Table 1 Correspondence between the five broad personality traits and the five broad temperament constructs

| Personality traits | Temperament constructs |
|--------------------|------------------------|
| Extraversion | Positive affect |
| Agreeableness | Affiliativeness |
| Conscientiousness | Effortful control |
| Neuroticism | Negative affect |
| Intellect/openness | Orienting sensitivity |

impulsive adolescent will, surprisingly, use a condom. In searching for such explanations, the relation between temperament and personality becomes important. Biologically based individual differences in temperament include the broad dimensions of negative emotionality, positive emotionality, constraint (effortful control), and their more specific components (Rothbart 2011). Temperament is studied primarily in infants and young children but, over the course of development, temperament forms the basis for many aspects of personality, and the distinction between temperament and personality becomes less meaningful. By adulthood, temperaments map quite well onto the Big Five traits. As summarized in **Table 1**, negative emotionality is most highly correlated with neuroticism; positive emotionality with extraversion; constraint with conscientiousness; affiliativeness with agreeableness; and orienting sensitivity with openness to experience (Evans & Rothbart 2007).

The biological bases of temperament address processes going on under the skin but also provide insight into personality processes outside the skin. Theories of temperament include psychobiological and developmental mechanisms to explain why people behave as they do. For example, in temperament theory, biologically based approach and avoidance systems have been proposed that produce individual differences in sensitivity to reward and punishment (Gray 1987). These biological systems give rise to differences in approach and avoidance behaviors that temperament researchers call “positive emotionality” and “negative emotionality” and personality trait

Instrumental personality processes: the tendency to create opportunities that promote certain thoughts, feelings, behaviors, and outcomes

CAPS: cognitive and affective processing system

KAPA: knowledge-and-appraisal personality architecture

“If... then” profiles: characteristic patterns of within-person variability in behaviors across situations

researchers label with trait terms such as “extraversion” and “neuroticism.” Caspi and colleagues viewed the development of personality as a gradual merger of temperament and the five-factor model and, in so doing, addressed both trait structure and processes (Caspi et al. 2005). They identified several mechanisms that maintain stability or create change in personality traits over the life course, one of which in particular, niche building or situation selection, has proved useful for thinking about personality processes more generally. That is, people create, seek out, or otherwise gravitate to environments that are compatible with their traits. This tendency is comparable to instrumental processes described by McCrae & Costa (1991). In contrast to temperamental processes, which refer to trait-consistent reactions people have to their environments, instrumental personality processes refer to the active alteration of environments to attain trait-consistent outcomes.

As we shall see, integrating biological and taxonomic approaches to traits generates hypotheses about trait processes and, in so doing, extends the utility of trait theories. Social-cognitive approaches to personality provide another perspective that has been influential in the study of processes. In contrast to trait approaches, social-cognitive models propose a more unified view of the structures and processes characterizing individuals.

Social-Cognitive Perspectives on Personality Processes

Kelly’s personal construct theory is an early example of a unified approach to personality structure and processes, and it remains relevant today with its echoes in contemporary social-cognitive models of personality (Walker & Winter 2007). In Kelly’s theory, personal constructs were postulated to be unique cognitive schemas that individuals develop to categorize their social world and shape their behavior (Kelly 1955/1991). The cognitive and affective processing system (CAPS; Mischel 2004; Mischel & Shoda 1998, 2008) and the

knowledge-and-appraisal personality architecture (KAPA; Cervone 2004, 2005) are more recent social-cognitive models with roots in construct theory.

According to CAPS, personality consists of five kinds of cognitive and affective subsystems that process information from the social world and generate behavior. These “mediating units” are (a) encodings (categories for construing the world); (b) expectancies and beliefs about the world (e.g., self-efficacy); (c) affects, goals, and values; (d) competencies; and (e) self-regulatory plans. Individuals are uniquely characterized by the content of these systems, by the particular way they are interconnected, and by their accessibility. The centerpiece of CAPS is the proposition that, as a result of the unique workings of the inter-related system of mediating units, individuals’ behavior can be described in terms of stable “if... then” profiles or behavioral signatures. These are characteristic patterns of within-person variability in behaviors across situations (e.g., Shoda et al. 1994, Wright & Mischel 1987). The social-cognitive perspective is intended to improve upon the trait approach for behavioral prediction because it provides a way to take situational factors, as uniquely processed by the individual, into account.

Patterns of behavior in existing observational datasets have been described with if... then behavioral signatures, but CAPS has not been widely applied to predict behavior. If... then profiles are complex ways of describing individuals that cannot be reduced to a smaller number of explanatory principles, which limits their utility. Moreover, the CAPS model does not integrate the now widely accepted five-factor trait structure with its processing dynamics. Similar limitations apply to KAPA. Although KAPA has been applied successfully to predict behavior (Cervone 2004, Cervone et al. 2008), the detailed assessments required to do so reduce the appeal of this approach, particularly in applied settings. More recently, as discussed later in this review, others have drawn on CAPS in their studies of personality trait processes, uniting elements

of trait and social-cognitive approaches to the benefit of both.

At this point, we might wonder what exactly is to be gained by studying trait processes. The renaissance in trait psychology, triggered ironically by Mischel's (1968) critique of trait constructs, has emphasized personality structure and measurement to the neglect of personality processes (John & Srivastava 1999). The study of personality traits has made significant advances in the prediction of behavior without studying personality processes. However, to actually use our newfound knowledge about the role of traits in shaping people's lives for good or for ill, the next leap forward for personality psychology is to increase our understanding of trait processes.

Trait Processes: Moderating and Mediating Mechanisms

Two mechanisms that are commonly invoked in the study of processes are moderation and mediation (Rusting 1998). Moderation and mediation are distinct theoretical concepts that help us hypothesize about how traits affect outcomes (Hampson 2008, Rothbart & Bates 2006), and they are associated with different statistical methods (Baron & Kenny 1986, MacKinnon et al. 2007). **Figures 1–4** depict, respectively, a direct association between a trait and an outcome, a trait as a moderator, a moderated trait effect, and a mediated trait effect. **Figure 1** shows an association between a trait and an outcome without specifying any intervening processes, for example, the association between extraversion and happiness, conscientiousness and longevity, or neuroticism and interpersonal difficulties. **Figure 2** illustrates a moderating process in which a trait affects the association between a nontrait predictor and an outcome. For example, the association between socializing and feeling happy may depend on a person's level of extraversion: as a result of socializing, those who are more extraverted may feel happier than those who are less extraverted. Another kind of moderating process, shown in **Figure 3**, is one in which the association



Figure 1

Direct association between a personality trait and an outcome.

between a trait predictor and an outcome is moderated by another individual difference. To illustrate, the association between neuroticism and interpersonal difficulties may be moderated by problem-solving skills: For those with better problem-solving skills, neuroticism may have less of an effect on interpersonal difficulties. **Figure 4** shows mediation, in which a trait influences an outcome through an intervening variable. For example, conscientiousness may result in longevity because people who are more conscientious are more likely to engage in health-enhancing behaviors.

Broadly speaking, mediation corresponds to instrumental or self-regulative trait processes, whereas moderation is typically a reactive process (McCrae & Costa 1991, Rothbart & Derryberry 1981). Reactive personality processes influence outcomes indirectly by having moderating effects (see **Figure 2**). That is, an association between a predictor and an outcome (e.g., aversive events are associated with depression) may be even stronger for those with higher levels of a relevant trait (e.g., neuroticism). Instrumental or self-regulatory processes imply a mediating mechanism (see **Figure 4**) through which proactive trait-related actions bring about changes in outcomes (e.g., more conscientious people adhere to treatment regimens and have better health outcomes). There are exceptions to the general principle that mediation

Moderation: the association between a predictor and an outcome differs depending upon the level of a third (moderator) variable

Mediation: the influence of a predictor on an outcome occurs through an intervening (mediating) variable

Reactive personality processes: the tendency to experience certain thoughts, feelings, behaviors, and outcomes

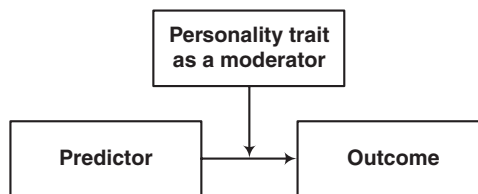


Figure 2

Moderation of the association between a predictor and an outcome by a personality trait.

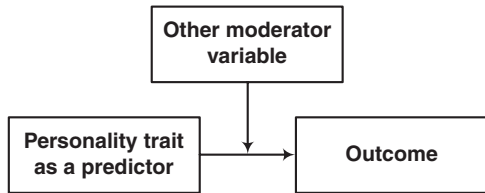


Figure 3

Moderation of the association between a personality trait and an outcome by another variable.

processes are instrumental and moderation processes are reactive. As we shall see later, instrumental processes involving constraint can also involve moderating mechanisms, for example, when constraint is applied to reduce the impact of a predictor on an outcome (e.g., resisting peer pressure to experiment with drugs).

Above, I defined personality processes as a series of actions or reactions over time. Mediation clearly fits this view because, in the ideal test of mediation, the assessment of the predictor, hypothesized mediator, and outcome is performed in sequence across time (MacKinnon et al. 2007). It is less obvious that moderation processes unfold over time, but they also take place in sequence. Take the case of trait reactivity, which is commonly studied in terms of moderation. For example, it is hypothesized that more neurotic people react more strongly (e.g., with greater anxiety) to threatening situations. The implicit timeline is that higher neuroticism is a pre-existing condition that people bring to the threatening situation, which results in greater anxiety. Therefore, the ideal design to test this hypothesis would be to assess neuroticism prior to exposing participants to threat and to assess anxiety shortly after: That is, the moderation process involves a sequence over time. In reality, both mediation and moderation are often tested cross-sectionally, limiting inferences about causality.

Longitudinal studies permit more confident inferences about the likely causal sequence of events involved in both kinds of personality process.

Moderation is tested by the interaction between the trait and the predictor variable on the outcome. Mediation is tested by evaluating the paths between the trait predictor, hypothesized mediator, and the outcome. Both processes can be tested using traditional regression techniques and more complex structural equation models (Kline 2010) and latent growth models (Duncan et al. 2006). The two processes are not mutually exclusive, nor are they the only possible trait mechanisms (Gross et al. 1998). For example, there are also more complex processes, such as moderated mediation and mediated moderation, but fortunately for the comprehensibility of this article, these have not yet been widely applied to personality processes (Muller et al. 2005).

Overview

In what follows, I examine a selection of studies investigating personality processes organized by domains common to models of both personality and temperament: negative emotionality (neuroticism and anger), positive emotionality (extraversion), and constraint (conscientiousness and effortful control). The starting point for this selection was a review of articles appearing in major personality journals from 2008 through 2010 identifying studies that investigated trait processes as I have chosen to define them. Some of these articles led down a winding trail to other journals and even other subdisciplines of psychology. The result is a selective and illustrative review, not a systematic one. For each personality/temperament domain, one or more traits are described, some of their more striking direct effects

Structural equation modeling: a statistical technique that evaluates the fit of a hypothesized model that specifies associations among several variables

Latent growth modeling: a statistical technique to estimate change over time in a variable as well as individual variability in this change



Figure 4

Mediated (indirect) effect of a personality trait on an outcome.

on consequential outcomes are noted, and examples of studies of personality processes are presented. The implications for trait theory and measurement are discussed, and the review concludes by suggesting directions for future research on personality trait processes.

NEGATIVE EMOTIONALITY

A selection of studies of neuroticism and anger illustrates trait processes for negative emotionality. Neuroticism and anger are closely aligned with the temperament of negative emotionality (Clark & Watson 2008, John et al. 2008, Rothbart 2011) and with the neurological behavioral inhibition system (BIS; Gray 1987, Gray & McNaughton 2000). The central feature of negative emotionality is a greater sensitivity to negative events leading to orientation of behavior and attention to negative stimuli (Canli 2006, Eysenck & Eysenck 1985, Gray & McNaughton 2000). From this perspective, negative emotionality includes both internalized emotions such as fear and externalized emotions such as anger and frustration. Hence Elliot & Thrash's (2010) labeling of negative emotionality as "avoidance" temperament is somewhat misleading. Negative emotionality does not preclude traits that may be more conventionally thought of as "approach," or proactive, such as aggression. Indeed, Costa & McCrae (1992) include angry hostility as one of the six facets of neuroticism.

However, in the Big Five taxonomic approach to personality (Goldberg 1993, John & Srivastava 1999), and also in the interpersonal circumplex (Wiggins 1991), the broad dimension of agreeableness contrasts traits describing positive versus negative interpersonal thoughts, feelings, and behaviors, including hostility (e.g., warm, kind, helpful, cooperative versus cold, cruel, hostile, thoughtless). Although compelling from a descriptive point of view, this solution is not consistent with current biological theory. Here is an instance where the language for describing individual differences apparently does not map neatly onto the underlying biological systems that give rise to

them. For example, the neurotransmitter serotonin is associated with quarrelsome behavior (Moskowitz 2010) and is believed to be involved in the BIS, which would relate quarrelsomeness more closely to neuroticism than disagreeableness in models of trait structure (Smillie 2008).

Neuroticism

The trait of neuroticism is the chronic tendency for some individuals to experience more negative thoughts and feelings than others, to be emotionally unstable, and to be insecure. In contrast to those who are emotionally stable, more neurotic individuals are prone to being worried, anxious, moody, irritable, and depressed (Costa & McCrae 1992, John & Srivastava 1999). Neuroticism predicts a wide range of negative outcomes, including psychopathology (Clark & Watson 2008). People who are more neurotic have lower self-esteem and subjective well-being (Ozer & Benet-Martínez 2006). Higher levels of neuroticism are associated with undesirable interpersonal consequences such as less satisfying relationships and divorce (Roberts et al. 2007) and more aggressive behavior (Wilkowski & Robinson 2008). Neuroticism predicts negative health outcomes, such as reporting more somatic symptoms (Costa & McCrae 1987, Watson & Pennebaker 1989).

The overlap between the indicators of neuroticism and measures of self-reported health suggests that neuroticism may predict subjective distress but not more objective measures of disease. However, there is an impressive body of evidence showing prospective associations between negative emotionality and physical disease, particularly cardiovascular disease (Friedman & Booth-Kewley 1987, Suls & Bunde 2005) as well as physical distress (Charles et al. 2008). Mortality is incontrovertibly an objective outcome, and a number of studies have associated higher levels of neuroticism with reduced longevity (Roberts et al. 2007, Shipley et al. 2007, Terracciano et al. 2008, Wilson et al. 2003). Mroczek & Spiro (2007) related neuroticism assessed over a 12-year period in

BIS: behavioral inhibition system

old age to mortality, looking at both the level of neuroticism and the rate of increase. Men with a combination of high and more rapidly increasing neuroticism had the highest mortality risk. This is a landmark study because it established the importance of trait level and trait change over time as predictors of a consequential outcome. Of course, the association between level of neuroticism and mortality could be due to some unknown third variable, but the predictive power of the rate of change of neuroticism suggests a trait process is at work and strengthens the argument that neuroticism may be causally related to mortality. Nevertheless, neuroticism is not uniformly and consistently found to be related to mortality or poor health outcomes (Friedman et al. 2010). The heightened attention and sensitivity to negative stimuli that characterizes negative emotionality may also have protective effects for health (Kern & Friedman 2011).

Neuroticism and Moderation Processes

Neuroticism as a moderator of predictor-outcome relations. The conceptualization of neuroticism as heightened sensitivity to negative stimuli implies that, compared to more emotionally stable people, those who are more neurotic will have stronger emotional responses to the same adverse experiences. Many studies support this temperamental or reactivity hypothesis (e.g., Canli 2006, Gross et al. 1998, Suls & Martin 2005). Recent research confirms the greater emotional reactivity of more neurotic individuals across a variety of everyday settings. Tong (2010) related the experiencing of anger, sadness, fear, and guilt in response to events recorded over the course of two days. Participants also rated their appraisals of these events on dimensions such as fairness. Higher neuroticism was associated with stronger appraisal-emotion associations, confirming that, for example, a more neurotic person reacts to unfair events with more anger than does a less neurotic person. In a similar vein, Denissen & Penke (2008) found that the

relation between poor relationship quality and low self-esteem was stronger for people high on neuroticism. Wasylikiw and colleagues investigated whether neuroticism moderated the effect on depression of ideal self-discrepancy, an aversive state in which one is failing to live up to one's aspirations (Wasylikiw et al. 2010). In a questionnaire study, and in an experimental study where the saliency of the ideal self-discrepancy was manipulated, the amount of discrepancy between actual and ideal selves was a stronger predictor of depression for those with higher levels of neuroticism.

In contrast, Taga and colleagues observed a beneficial modifying effect of neuroticism in the Terman Lifecycle study (Taga et al. 2009). Surprisingly, bereavement in this sample was associated with decreased risk of mortality. Moreover, for bereaved men, higher neuroticism at age 30 was associated with even lower mortality risk, demonstrating that neuroticism can be associated with more positive health outcomes. This finding may be unique to this particular cohort. However, as a longitudinal study of personality processes unfolding over time, it suggests that the moderating effect of neuroticism (and perhaps other traits) may differ over the short term versus the long term. Neuroticism may increase the immediate experience of negative emotions, but this stronger emotional response may also lead to longer-term adaptive behaviors such as increased vigilance with regard to health or more concerted efforts to find a new partner. The contrast between moderation effects of neuroticism observed in short-term experience sampling studies such as Tong's (2010) versus long-term lifespan studies such as Taga and colleagues' (Taga et al. 2009) highlights the value of using both methodologies in studying personality processes (Mroczek et al. 2003).

Neuroticism-outcome effects moderated by other variables. We can all probably recall a regrettable incident when we gave way to a strong emotional reaction. To avoid minor embarrassments and much more serious consequences of emotional reactivity, it would

be helpful to find ways to reduce the association between neuroticism and emotional reactivity. Feltman and colleagues investigated whether mindfulness could moderate the effects of neuroticism on anger and depressive symptoms: A mindful state directs attention and awareness to the present (Feltman et al. 2009). They demonstrated that the association between neuroticism and anger, and neuroticism and depression, was stronger for those at lower levels of mindfulness. In a longitudinal study of couples in the community, Hellmuth & McNulty (2008) found that neuroticism was associated with subsequent intimate partner violence. However, neuroticism resulted in less violence for individuals who had less stress and who had more effective problem-solving skills.

These two studies demonstrate the importance of the context provided by the individual's other traits and abilities for predicting the impact of neuroticism on emotional outcomes. In so doing, these studies provide promise for interventions to reduce undesirable trait effects, not necessarily by attempting to change the trait itself, but instead by changing other aspects of the context, including the intrapersonal context, in which the trait operates. However, interventions to reduce the undesirable effects of negative emotionality may not be entirely beneficial for people high in neuroticism. For example, increasing their positive emotions could detract from the benefits to cognitive functioning they experience from the effects of trait-consistent negative mood (Tamir & Robinson 2004). Moreover, neuroticism's effects may be difficult or impossible to modify by increasing the experience of positive events. In a diary study, Longua and colleagues observed that the experience of daytime positive events buffered the effects of negative daytime events on negative affect and nighttime stress, but only for those low on neuroticism (Longua et al. 2009). Such findings are consistent with the view that neuroticism is associated with heightened sensitivity to negative events, and consequently increases in positive events may have no impact on subsequent negative emotions for those high on neuroticism.

In an experimental study, Moeller and colleagues examined both self-reported trait neuroticism and an implicit measure of aggressive responding as predictors of aggressive tendencies (Moeller et al. 2010). The implicit measure assessed the extent to which individuals differed in the strength of their associations between stress primes and aggressive thoughts. Moeller and colleagues likened the implicit association to if...then behavioral signatures in CAPS (i.e., "if" primed with a stress word, "then" this person is more likely to make an aggressive word association). They examined whether this implicit measure interacted with neuroticism to predict aggressive behavioral tendencies. They found a tendency for physical aggression to be highest for those with the combination of high neuroticism and high implicit stress-aggression associations (i.e., moderation by neuroticism).

Neuroticism and Mediation Processes

Investigations of potential mediators of neuroticism appear to be less common, perhaps because personality processes associated with neuroticism are generally considered to be temperamental (i.e., reactive) rather than instrumental (McCrae & Costa 1991). An instrumental process that could apply to neuroticism is mediation via health behaviors. Neurotic individuals, prone to experience intense negative emotions, may use health-damaging behaviors such as substance use to reduce their negative affect. Mroczek and colleagues examined whether the association between neuroticism and mortality observed in the Normative Aging Study could be explained by such a health-behavior model (Mroczek et al. 2009). They found that cigarette smoking partially mediated the effects of neuroticism on mortality, whereas drinking alcohol did not. These findings provide only modest support for the health-behavior model.

In another form of mediated instrumental process, niche building or situational selection (Caspi et al. 2005), people may experience more negative life events as a consequence of their higher neuroticism, which in turn may

result in more adverse outcomes. In a diary study of married couples, Bolger & Schilling (1991) investigated both situation selection and reactivity processes. They found that those higher in neuroticism did experience more stressful events (situation selection). However, this greater exposure to stressful events was only half as powerful at explaining distress as neurotics' greater reactivity to these events, indicating that reactivity was the more important process. Research continues to amass showing that neurotics are generally more reactive to stress than are nonneurotics (Suls & Martin 2005). However, the assessment of stress, independent of neurotics' greater reactivity to their stress, is challenging. Studies using more objective measures of stress, such as the Life Events and Difficulties Schedule, in which self-reported life events are objectively coded for their level of stress by independent raters, would be helpful in this context (Monroe 2008).

Anger

Trait anger is the tendency to experience anger on a chronic, ongoing basis, whereas state anger is a transitory negative emotion. Anger and hostility are associated with cardiovascular disease and early mortality (Suls & Bunde 2005), as well as harmful behavioral outcomes such as domestic violence, child abuse, violence in the workplace, and substance use (Wilkowski & Robinson 2008). Processes involved in trait anger and hostility are important for developing interventions to reduce the negative outcomes associated with these aspects of negative emotionality and may help resolve the conundrum of where these traits should be placed in structural models of personality.

Anger and Moderation Processes

What personality processes result in someone high in trait anger actually expressing that anger? Aggressive behavior is not well explained by either situational or dispositional factors alone, making it an ideal candidate for a combined social-cognitive and dispositional approach. In their integrated cognitive model

(ICM), Wilkowski & Robinson (2010) draw on three cognitive processes: interpretation, rumination, and effortful control. Consistent with a reactive view, they proposed that those with high trait anger are automatically more likely to interpret situational input as hostile. However, ruminating on this hostile interpretation will amplify the anger response to the situation, whereas exerting effortful control will suppress the anger response. They propose a moderating process in which those low in trait anger are more likely than those high in trait anger to use effortful control to down-regulate their angry responses when hostile thoughts are activated. Support for their model comes from both self-report and implicit evidence for these different cognitive processes. For example, individuals low on trait anger showed less effect of hostile priming than those high on trait anger, but only if the experimental design permitted them to use temperamental effortful control (Wilkowski & Robinson 2007). Consistent with CAPS (Mischel & Shoda 1998), in the ICM trait anger is conceptualized as an integration of several processes. A person predisposed to angry acts is more likely to respond with anger in a situation that is interpreted as hostile and ruminated upon and in which he or she fails to exert effortful control.

Summary and Implications for Personality Theory and Measurement

The illustrative studies of moderation processes for neuroticism and anger show that people with higher levels of these traits are more emotionally reactive, which usually has adverse consequences for them. Other factors can moderate this reactivity, which is promising for intervention purposes. Traits of negative emotionality also influence outcomes by mediation processes, such as through health behaviors and niche selection. These studies also illustrate the role that other personality traits play in trait processes. Consequences of higher emotional reactivity, associated with traits such as neuroticism and anger, can be reduced or amplified by the modifying effects of effortful control.

Does this research help resolve the location of anger and hostility in structural models of personality? Viewed as different forms of negative affect, they work well subsumed together under the broad temperamental dimension of negative emotionality, and the identification of various moderating effects also suggests that anger and hostility are temperament based. Yet, trait disagreeableness involves interpersonally directed negative affect (externalizing behavior), and hence hostility is found as a facet of agreeableness-disagreeableness in the Big Five taxonomy. Although the broad trait dimension of agreeableness has not typically been viewed as a temperament-based trait, it is interesting that, in line with the findings from process studies, more recent conceptualizations of temperament include affiliativeness, which aligns with agreeableness (Zentner & Shiner 2011). The ultimate resolution of these kinds of inconsistencies should come about when we better understand the underlying biological bases of temperaments and traits.

Where traits of negative emotionality are placed in a structural framework affects how they are measured (e.g., as facets of neuroticism or disagreeableness). Another factor to consider when measuring these traits is their social undesirability. As a result, they are prone to inaccuracies in descriptions of the self and others. The implicit measure used by Moeller and colleagues to assess the strength of aggressive associations offers an approach that may reduce the impact of social-desirability bias (Moeller et al. 2010). The combination of both explicit (questionnaire) and implicit measures provides a more complete assessment of negative emotionality as well as a new approach to the study of reactive processes.

POSITIVE EMOTIONALITY

In contemporary theories of the neurobiological bases of personality, sensitivity to reward is central to positive emotionality (e.g., Canli 2006, Cloninger 1987, Corr 2006, Depue 2006, Gray 1987, Gray & McNaughton 2000, Smillie et al. 2006, Zuckerman 1994).

For example, the neurological behavioral approach system (BAS; Gray & McNaughton 2000), in which dopamine is believed to play a major role, is triggered by rewards, and BAS activity is assumed to underlie positive affect and approach motivation (Smillie 2008). Elliot & Thrash (2010) argue that approach temperament, which orients behavior and attention toward positive stimuli, is the common underlying core of the temperament of positive emotionality and of the trait of extraversion.

Extraversion

Extraversion is closely aligned with the temperament of positive emotionality or positive affect (Clark & Watson 2008, John et al. 2008, Rothbart 2011) and emerges as a broad dimension in all descriptions of personality structure. Extraversion-introversion contrasts people who are described as sociable, energetic, and assertive with ones who are reserved, withdrawn, and submissive (Eysenck & Eysenck 1985, John & Srivastava 1999).

People who are more extraverted experience greater happiness, subjective and existential well-being, than those inclined to introversion. Consistent with an underlying approach temperament, extraverts are more likely to use coping strategies that involve engaging with a challenge, such as problem-solving, than strategies of disengagement or avoidance (Carver & Connor-Smith 2010). They are more likely to be popular, have higher status, get satisfaction from their work, and be accepted by their peers (Ozer & Benet-Martínez 2006). However, extraversion has only rarely been found to be directly related to some of the other widely studied consequential outcomes such as longevity, marital stability, and occupational success (Roberts et al. 2007).

Extraversion: Mediation and Moderation Processes

Extraversion processes illustrated here are drawn from studies of happiness. Although extraversion is manifested in other forms of

BAS: behavioral approach system

direct effects, many of these contribute to greater happiness (e.g., being successful, being popular). On average, people who are more extraverted are happier than those who are less extraverted, regardless of their circumstances. This is testimony to the power of personality. Happiness is enormously valued, yet it evades many people, so a better understanding of the personality processes by which extraverts experience happiness would be widely appreciated. In pursuing this quest, personality researchers have examined both mediation and moderation mechanisms.

From an instrumental perspective, extraverts are happier because they are more likely to actively create situations for themselves that make them happy. In particular, extraverts describe themselves as enjoying socializing with other people. Hence, compared to introverts, extraverts should spend more time with other people, and consequently they should be happier. This is a mediation hypothesis because extraversion's effect on happiness is postulated to be the result of greater social participation. From a temperamental, reactive, perspective, when extraverts and introverts are exposed to the same situation such as a social event, extraverts should experience greater happiness. According to the reward-sensitivity account, extraverts' greater happiness is explained by their capacity to attend and orient to positive, rewarding aspects of their environments. This biological account of extraversion implies a moderating mechanism whereby extraverts should consistently derive greater happiness than introverts from the same situations.

As an account of extraverts' higher levels of happiness, mediation through social participation has received only modest empirical support. Doing things with other people does make us happy, but whether extraverts spend more time socializing than introverts and, in doing so, increase their happiness has not been well established. Experience sampling methodologies yield the kind of fine-grained data necessary to identify small but important differences in sources of daily happiness necessary to study these personality processes.

For example, Srivastava and colleagues studied individuals' social interactions and their associated emotions over the course of a day (Srivastava et al. 2008). Higher extraversion was associated with experiencing more positive affect, but extraversion was also associated with only somewhat more social participation, which only partially mediated the relation between extraversion and positive affect.

Lucas and colleagues studied extraverts' greater happiness assessed at random intervals throughout the day as well as by daily diaries (Lucas et al. 2008). Across these two methods, extraverts were happier than introverts, and they did spend more time socializing. However, after controlling for their greater social activity, extraverts were still happier than introverts, so again the mediation hypothesis was not fully supported. Interestingly, those who were more extraverted did not get much more of a boost in happiness from social situations than those who were less extraverted. That is, extraverts were consistently happier than introverts, but this was not because they obtained substantially greater pleasure from socializing. This finding is contrary to what would be expected if extraversion was a strong moderator of the relation between socializing and happiness. Overall, in this study the majority of participants' happiness was a direct effect of their extraversion, regardless of social activity, suggesting that there may be other as yet untested processes involved. The process of "acting extraverted" could be such a mechanism.

In our daily lives, we behave in more or less extraverted ways, and Fleeson and colleagues hypothesized that individuals would feel happier when they were being more extraverted (Fleeson et al. 2002). The within-person association between behaving in an extraverted way and feeling happy may also be stronger among more extraverted people. This is a moderation process: Extraversion should moderate the association between behaving in an extraverted way and feeling happy. Using three different methodologies (experience sampling several times a day, a diary study conducted over a week, and a laboratory study), participants

reported being happier when their behavior was more extraverted. This association was not consistently stronger for more extraverted people, contrary to a moderating process.

Summary and Implications for Personality Theory and Assessment

The association between happiness and extraversion can be explained to a modest degree by mediating mechanisms involving social participation and by moderating effects of extraversion on the link between social activity and happiness. However, much work remains to be done to understand the trait process involved in experiencing happiness and the moment-by-moment variability in happiness levels that we all experience in our daily lives. Social activity is just one of many influences on subjective well-being, so there may be other mediators to explore in addition to socializing (e.g., physical activity) to better understand extraversion processes and happiness.

If being briefly more extraverted makes a person happier for that moment, perhaps repeated experience of extraverted states could result in more lasting happiness by, in effect, making a person more extraverted. This is a promising idea for clinical intervention and has the wider implication that personality traits are amenable to change. This idea is, in fact, present in current personality theorizing (Roberts et al. 2008). For example, the proposition that repeated experiences of states could change traits is part of sociogenomic personality psychology advocated by Roberts & Jackson (2008) to explain personality development and change. They draw on sociogenomic biology to demonstrate that even genetic effects, once thought immutable, are in fact subject to alteration and triggering by environmental factors (Krueger & Johnson 2008). In their model, states play a key mediating role: Repeated experience of states eventually will result in changes in traits.

Findings on extraversion processes also have implications for trait measurement. Questionnaire scales to measure extraversion typically include many items assessing social

participation. However, although extraverts may not consistently derive more pleasure than introverts from social events, their capacity to extract greater happiness from life seems incontrovertible. To align questionnaire measures more closely with theory and findings on extraversion processes, there should be less emphasis on social activity and more items that tap into other potentially rewarding situations.

CONSTRAINT

In addition to positive and negative emotionality, constraint is a third well-established area of temperament and personality (Carver 2005, Rothbart 2011). Unalloyed approach and avoidance tendencies cannot have been adaptive during human evolution and certainly cause problems in today's world. The underlying biological basis of constraint is believed to be located in attentional networks in the brain, although these have yet to be fully charted (Nigg 2000, Rothbart 2007, Rothbart & Rueda 2005). Accordingly, the deployment of effortful control depends on there being sufficient mental capacity, such as working memory, available to regulate the other systems (Rothbart 2007). Such capacity is viewed by some investigators as a relatively fixed attribute of the person, whereas others hypothesize that it fluctuates. For example, the strength model of ego depletion postulates that effortful control fluctuates because it diminishes with use but can be replenished (Baumeister et al. 2007, Hagger et al. 2010). Others have suggested that in addition to intentional, goal-based inhibition there is reactive, automatic inhibition (Eisenberg et al. 2004, Nigg 2000, Rothbart & Ahadi 1994).

Another perspective on constraint is provided by Strack & Deutsch's (2004) reflective impulsive model, in which the impulsive system activates automatic approach or avoidance behavior, whereas the reflective system governs reasoned action and can regulate the impulsive system. Together, according to the model, these systems result in social behavior. Moreover, the impulsive and reflective systems are not limited to conscientiousness but are

Sociogenomic biology: gene expression is influenced by the environment, and consequently the relation between genes and phenotypes is transactional

implicated in all the broad personality dimensions. Similarly, in Rothbart's model of temperament, effortful control moderates negative and positive emotional reactivity (Rothbart 2011). The burgeoning of these various models demonstrates that impulsivity and constraint are coming under increasing scrutiny, with implications for the study of the personality processes related to conscientiousness and perhaps other traits.

Conscientiousness

Studies of trait conscientiousness illustrate processes for constraint. In temperament models, constraint is presumed to be the precursor to later trait conscientiousness (Carver 2005, Clark & Watson 2008, Elliot & Thrash 2010, Rothbart 2011). The trait of conscientiousness describes individual differences in adhering to socially prescribed rules and norms for impulse control, in being task- and goal-directed, and in being able to delay gratification (John & Srivastava 1999). At the extremes, the conscientiousness dimension distinguishes people who are orderly, industrious, and planful from those who are undisciplined, lazy, and unreliable. These qualities reflect impulse control and restraint versus a lack thereof.

The two most striking associations between conscientiousness and consequential outcomes are with health and job performance (Ozer & Benet-Martínez 2006). Friedman and colleagues (Friedman et al. 1995) first demonstrated that lower levels of childhood conscientiousness are associated with earlier mortality, and this finding has subsequently been replicated in other longitudinal studies (Kern & Friedman 2008). Barrick & Mount's (1991) meta-analysis established that higher levels of conscientiousness are associated with better job performance, a finding that holds up across different measures of conscientiousness and widely differing occupations. Many studies demonstrate that lack of conscientiousness is associated with health-damaging behaviors (Bogg & Roberts 2004), and lack of self-control and constraint is associated with

a range of significant behavioral problems including conduct disorder and substance abuse (Wills & Dishion 2004).

Conscientiousness and Moderation Processes

The direct association between conscientiousness and health behaviors is well established, and both moderating and mediating processes involved in this relation have been examined. Risky sex is of particular significance as a health behavior. HIV/AIDS infection is primarily transmitted via sexual contact, so understanding the factors that determine whether or not people engage in safe sex is necessary for the development of appropriate interventions. Low conscientiousness has been consistently associated with unsafe sex. Nevertheless, the association is comparatively modest, indicating that many other factors are involved and that interactions among these factors should be examined.

Cooper (2010) investigated the effects of personality traits and situational factors on risky sex in a longitudinal study of adolescents and emerging adults. Multilevel models of a large corpus of reported occurrences of sexual intercourse were collected over time, which enabled the evaluation of between- and within-person variability. Although there was evidence of modest levels of stable between- and within-person effects of personality traits on risky sex (e.g., sex without a condom) and modest stable situational effects (e.g., first-time partner versus long-term relationship), the interactions between traits and situations generated the major findings from this study (i.e., moderated effects). The preponderance of the between-person effects showed that personality traits were most likely to predict risky sex with first-time or casual sex partners. Within-person effects showed that adolescents with traits that put them at most risk (e.g., low conscientiousness) showed the greatest variability across situations and the riskiest behavior. Moreover, interaction patterns were not consistent across the different measures of risky sex (e.g., alcohol involved, condom use), adding another level

of complexity to the findings. Importantly, in some situations, impulsive (low conscientious) individuals displayed no risky behaviors at all. This study demonstrates the significance of examining moderation and within-person variability for a more complete understanding of when dispositions are translated into highly consequential behaviors.

Studies such as Cooper's (2010), in which multilevel event sampling methods have been applied to the study of conscientiousness processes, are still relatively rare. These findings, however, indicate that this approach uncovers effects that may remain hidden in studies limited to between-person data. For example, in a diary study of a community sample, the relations between daily hassles and health behaviors such as snacking, alcohol consumption, and smoking were moderated by certain facets of conscientiousness (O'Connor et al. 2009). Those with lower self-efficacy ate fewer vegetables on days when they experienced hassles, and those with higher levels of order were more likely to exercise on days when they experienced hassles. Surprisingly, those with higher levels of self-discipline smoked more and drank more caffeine on days when they experienced hassles, perhaps as a consequence of their high motivation for task completion in the face of these hassles.

Other studies illustrate how personality processes may be investigated in the context of cognitive social-psychological theories such as the Theory of Planned Behavior (Ajzen 1985, 1991) using more conventional prospective, between-person designs. Such studies have shown beneficial moderating effects of higher levels of conscientiousness on the relation between intentions and the performance of health behaviors, including exercise behaviors (Rhodes et al. 2002, 2005) and smoking initiation (Conner et al. 2009). In a similar vein, drawing on the prototype-willingness model, Wills and colleagues demonstrated moderating effects of good self-control on the association between risk factors such as deviant peers and media exposure on substance use (Wills et al. 2010). Although derived from a different

theoretical tradition, the cognitive constructs in these theories (e.g., self-efficacy, subjective normative beliefs, prototypes) overlap with or are comparable to constructs in Mischel & Shoda's (1998) CAPS model for personality. These studies demonstrate that the addition of personality traits increases the explanatory power of processes involving social-cognitive constructs.

Conscientiousness and Mediation Processes

Mediation has also been invoked as a mechanism underlying the effects of conscientiousness, perhaps more commonly than moderation. When studying those aspects of conscientiousness that involve the exertion of effortful control, such as being planful and delaying gratification, instrumental processes, whereby conscientious people influence their environments, are more likely to be identified than reactive processes. Inspired by the now well-established finding that conscientiousness predicts longevity, a major research effort is under way to identify the pathways by which the influences of early conscientiousness on later health outcomes are mediated. Conscientious people are more likely to engage in health-protective behaviors and to avoid health-damaging behaviors (Bogg & Roberts 2004), but what remains to be demonstrated convincingly is that these health-behavior pathways result in longer, healthier lives for more conscientious people.

Health is not easily reduced to a single variable, being composed of objective and medical factors, psychosocial factors, and subjective perceptions. However, vital status is the ultimate objective measure of health. Friedman et al. (1995) found that the association between childhood conscientiousness at age 11 and longevity among members of the Terman Lifecycle study was partially mediated by lifetime patterns of cigarette use and other health behaviors. More recently, analyzing additional follow-up data, Martin and colleagues found that both child and adult conscientiousness predicted longevity, and the effects of adult

conscientiousness were mediated by health behaviors, particularly smoking (Martin et al. 2007). Participants in the Terman Lifecycle study were children with IQs of 135 recruited in 1921–1922. Using a very different longitudinal sample, my colleagues and I investigated subjective health status at midlife (Hampson et al. 2007). Our participants were drawn from entire classrooms of elementary school children aged 6–12 years who were assessed between 1959 and 1967 in Hawaii. In this 40-year follow-up study, the relation between childhood conscientiousness assessed in elementary school and self-rated health at middle age was partially mediated by smoking and other health behaviors. It is interesting that both studies indicate only partial mediation by health behaviors, leaving other mechanisms to be discovered. Furthermore, in both studies, despite the sample differences, some of the effects of conscientiousness were mediated by educational level, a key determinant of socioeconomic status and hence of numerous life outcomes, suggesting another important mediating mechanism for this trait (Chapman et al. 2010, Nabi et al. 2008).

Mediating mechanisms have also been identified for conscientiousness in studies testing cognitive social-psychological models of health behaviors. In a study predicting fruit consumption from a combination of personality traits and concepts from the Theory of Planned Behavior, individuals who were more conscientious reported eating more fruit, and this relation was mediated by two of the theory's concepts: attitude toward and perceived behavioral control over the outcome (de Bruijn et al. 2009). Drawing on the transtheoretical model of behavior change (Prochaska & DiClemente 1984), Bogg (2008) showed that the effects of the industriousness facet of conscientiousness on stage of change for exercise behavior were mediated by processes associated with the stages of change. Those with higher levels of industriousness reported greater use of processes such as re-evaluation and overcoming resistance, and these processes fully mediated the effects of industriousness in predicting stage of change.

Summary and Implications for Personality Theory and Measurement

Processes by which traits of constraint such as conscientiousness and self-control influence outcomes include both moderation and mediation, reflecting both reactive and instrumental mechanisms. Much of the illustrative research is drawn from health psychology. Studies of moderation show that conscientiousness can reduce or amplify associations between some predictors and health outcomes. Unlike the moderation processes discussed for negative and positive emotionality, moderation by effortful control involves the deliberate moderation of a response, such as resisting the urge to snack in response to stress. Automatic inhibition represents a more reactive form of constraint that has not been nearly as extensively studied. Other studies show that conscientiousness exerts an indirect influence on health outcomes through the instrumental processes of mediation by intervening variables such as health behaviors.

Current theorizing in personality psychology is addressing the relation of trait conscientiousness to other constraint constructs and the temperament of effortful control. One view is that a broad latent construct of disinhibition resulting from inadequate executive functioning encompasses all constructs tapping impulsivity versus constraint. For example, behavioral disinhibition modeled as a latent construct indicated by impulsive sensation seeking (i.e., low conscientiousness), antisociality, and externalizing problem behaviors was negatively correlated with IQ and the capacity of working and short-term memory (Bogg & Finn 2010).

Inhibition is an important aspect of executive functioning; however, the inhibition construct (or metaphor) is itself multifaceted (Nigg 2000). There are numerous forms of cognitive inhibition (e.g., interference control, suppression of ideation, suppression of cued responses), and the tasks used to measure them do not necessarily correlate. Edmonds and colleagues related several laboratory measures of impulsivity and self-report questionnaire measures to self-reported health behaviors (Edmonds et al.

2009). The laboratory and questionnaire measures were mostly unrelated, and they contributed independently to the prediction of health behaviors. The different laboratory measures of impulsivity were also not highly intercorrelated, which raises the question of whether it is appropriate to regard these kinds of tasks as indicators of the same underlying construct. Straightforward relations between measures of executive functioning and personality traits are unlikely. Despite this, researchers, particularly in the field of health behavior, see promise in measuring individual differences in cognitive competencies to understand behaviors that require the ability to override an automatic response (Suchy 2009, Williams & Thayer 2009).

Effortful control, viewed as trait conscientiousness, is conceptualized as a stable, cross-situationally consistent disposition. However, from a temperament perspective, deriving in part from cognitive neuroscience, it is a capacity that is demonstrated in response to situational cues (Robinson & Wilkowski 2010). These two views may not, in fact, be that discrepant. Studies of within-person variability such as Cooper's (2010) discussed above demonstrate that even those who are highly impulsive only behave impulsively under specific conditions. The study of personality processes addresses exactly these kinds of issues—that is, the conditions under which dispositions are manifested in behavior. The recent interest in executive functioning and conscientiousness processes has implications for personality measurement. Although people can describe their tendencies to respond impulsively, to the extent that cognitive inhibitory processes occur outside of awareness, the assessment of constraint may be enhanced by the addition of implicit techniques.

CONCLUSIONS AND FUTURE DIRECTIONS

At the beginning of this review, distinguishing personality processes (“how” and “why”) from personality structure (“what”) proved useful. However, personality processes need to be united with personality structure, measurement, and theory. To study trait processes, it is

necessary to have at least a rudimentary theory about how an internal disposition is manifested in behavior. As we have seen, these theories typically draw on moderating or mediating mechanisms. What determines whether trait processes are best conceptualized as mediation or moderation? As the studies reviewed here illustrate, reactive processes are commonly examined with moderation and instrumental processes with mediation. However, this is not a hard-and-fast rule. Nor should it be concluded that reactive processes necessarily occur automatically whereas instrumental processes involve deliberation and conscious choice. Examples of moderation and mediation were identified for negative emotionality, positive emotionality, and constraint, indicating no simple relation between trait domain and type of process. It appears that approach and avoidance tendencies, and their regulation by constraint, operate through multiple mechanisms involving moderation and mediation and probably many other processes. For an investigator planning a trait-process study, the bewildering choice among these mechanisms must be guided by a theoretical position regarding the nature of the trait and the factors hypothesized to influence its expression.

Theoretical frameworks based on temperament or reactivity that generate hypotheses about moderation, such as BIS and BAS, are discussed above. Another promising direction for the study of trait processes is the combination of constructs from social-cognitive theories with personality traits. We have seen examples of combining traits with elements of CAPS (e.g., Moeller et al. 2010, Moskowitz 2010) and with elements from theories such as the theory of planned behavior and the transtheoretical model (e.g., Bogg 2008, Conner et al. 2009). The neo-socioanalytic theory of Roberts & Wood (2006) provides a framework to help guide these kinds of integration of constructs at various levels of breadth drawn from different theoretical models.

Neo-socioanalytic theory identifies four kinds of individual differences (traits, motives/values, abilities, and narratives), each

Neo-socioanalytic theory: an approach to integrating individual differences across different hierarchically structured domains (e.g., traits and motives)

of which is organized hierarchically. The broadest level in each hierarchy is decontextualized (e.g., conscientiousness, general intelligence), whereas the lower levels become increasingly specified. Within a hierarchy, the effects of higher-level constructs on specific behavioral outcomes may be mediated by lower-level constructs. Associations among constructs will be stronger within one type of individual-difference hierarchy (e.g., traits) than between different hierarchies (e.g., traits and motives/values). However, associations that cut across the type of individual difference will be stronger to the extent that they share features (i.e., are psychologically proximal). Applying the principles of neo-socioanalytic theory should be particularly useful when selecting potential mediators of trait effects, either within the trait hierarchy or from another hierarchy (Bogg et al. 2008).

For the most part, the trait processes described here have been studied for effects of personality at the level of the individual, yet traits also have consequential interpersonal outcomes for dyadic relationships and for larger social groups. When personality processes are studied in social contexts, effects of individual differences on responses to factors such as social exclusion (DeWall et al. 2011), sexual motivation (Cooper et al. 2011), and impression management (Leary & Batts Allen 2011) are observed. There is much scope for further research and theoretical development on personality processes that account for trait influences at the interpersonal and group levels.

The study of trait processes has introduced the field of personality to some new methodologies. In particular, more fine-grained studies of behaviors in context have used various methods for recording activities and situations at random intervals throughout the day or by diaries kept on a once-daily basis (Furr 2009). These methodologies are particularly suited to studying situational influences on behavior over relatively short periods of time. They generate multiple events for each participant, which can then be aggregated in different ways to examine the patterning of behavior across dif-

ferent situations (Moskowitz & Zuroff 2004). Technological advances in programmable portable devices (e.g., cell phones, personal digital assistants, audio recorders) make increasing use of these kinds of data likely in the study of personality processes.

Neuroscience theories of personality are rapidly developing as more powerful technologies for studying brain activity are becoming available to personality psychologists (Canli 2006). Neuroimaging offers a window on personality processes that occur under the skin (in this case, under the skull). As such, these processes are not the focus of this review. However, one important consequence of neuroscience theories of personality is that they have generated new measurement approaches. Guided by neuroscience theories of traits, functional magnetic resonance imaging is being used to map areas of the brain related to personality processes, and rapid advances in this field are likely (Harris et al. 2007).

The study of processes that occur outside of awareness is advanced by using techniques such as implicit associations. For example, Back and colleagues showed that implicit measures of extraversion and neuroticism provided incremental predictive value to questionnaires (explicit measures) in the prediction of behavior related to those traits, whereas implicit measures of conscientiousness did not (Back et al. 2009). They concluded that the underlying approach and avoidance tendencies of extraversion and neuroticism involve automatic processes best captured by implicit measures, whereas conscientiousness involves more conscious control of impulses, best assessed by self-reflective measures such as questionnaires. Whether automatic and reflective processes map so neatly onto the trait domains remains to be seen, but the addition of implicit measures to more traditional questionnaires should be valuable if they can assess aspects of dispositional tendencies that operate outside awareness.

One implication of the study of personality processes is that broader contextual factors, which can be important determinants of when traits are actually manifested in behaviors,

should also be assessed. A system for categorizing situations that is useful for personality psychology has remained elusive (Saucier et al. 2007). Denissen & Penke's (2008) integration of the five-factor trait structure with motivation represents a new approach to this longstanding problem: They used the existing five-factor model as a way to categorize situations. They proposed that traits reflect individual differences in people's motivational reactions to environmental stimuli and developed a version of a five-factor questionnaire in which the items for each trait dimension describe typical cognitive or affective reactions to specified situations. Their measure is an attempt to combine trait measurement with a motivational theory of trait processes.

Another methodological development with implications for the study of trait processes is the increasing use of longitudinal data and techniques for describing trait change over time, such as growth curve modeling (Duncan et al. 2006). With these techniques, we can now evaluate trait development in terms of level and rate of change and relate both these parameters to outcomes such as mortality (Mroczek & Spiro 2007, Mroczek et al. 2009) or substance use (Hampson et al. 2010). Measuring trait change over time may stimulate the discovery of new trait processes involving rate of change. Trait processes unfold over time, during which traits themselves are also changing, adding a layer of complexity to mechanisms studied longitudinally.

Longitudinal studies provide opportunities for studying personality processes over extended periods of time. The study of these processes represents the opposite extreme of the fine-grained analyses of personality processes occurring over the course of a day revealed by event-sampling studies. Studies of personality processes across the lifespan are beginning to identify explanatory pathways to account for associations between traits and outcomes such as mortality (Friedman 2000). A challenge for this work is that few longitudinal studies have been conducted over substantial portions of the lifespan or have repeatedly assessed all the

necessary variables to study personality processes over time. Moreover, findings from any single longitudinal study may be unique to that cohort. One solution to this challenge is to combine data across different studies. Recent developments in integrative data analysis techniques have great potential for the study of lifespan personality processes (Hofer & Piccinin 2009).

Discovering the processes by which traits have their effects will identify opportunities for intervention. As evidence has mounted for the important role played by personality traits in consequential life outcomes, there is increasing interest in the possibility of using this knowledge to bring about beneficial personality change (Moffitt et al. 2011). Interventions may be directed at changing the level or rate of growth of traits, or they may be directed at the processes through which traits are manifested in behavior. For example, the idea that effortful control can be trained and that this can have a lasting impact on the brain offers exciting possibilities for the development of interventions to modify trait conscientiousness (Posner & Rothbart 2007).

The study of trait processes offers an important direction for the future for personality psychology. A focus on personality processes will ground our understanding of personality in its biological roots in temperament and highlight personality change, both developmental change that occurs across the lifespan and deliberate change brought about by interventions. A better understanding of trait processes will inform trait structure and measurement that in turn can be used to further advance the study of trait processes. The study of trait processes necessitates an integrative perspective, requiring researchers to cross traditional boundaries such as social-cognitive versus trait theory, biological versus social explanations, or experimental versus correlational methods. Examples of such research have been reviewed here. Understanding trait processes that explain why personality traits have consequential effects on life outcomes has already become an exciting research agenda for personality psychology.

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Contents

Prefatory

Working Memory: Theories, Models, and Controversies
Alan Baddeley 1

Developmental Psychobiology

Learning to See Words
Brian A. Wandell, Andreas M. Rauschecker, and Jason D. Yeatman 31

Memory

Remembering in Conversations: The Social Sharing
and Reshaping of Memories
William Hirst and Gerald Echterhoff 55

Judgment and Decision Making

Experimental Philosophy
*Joshua Knobe, Wesley Buckwalter, Shaun Nichols, Philip Robbins,
Hagop Sarkissian, and Tamler Sommers* 81

Brain Imaging/Cognitive Neuroscience

Distributed Representations in Memory: Insights from Functional
Brain Imaging
Jesse Rissman and Anthony D. Wagner 101

Neuroscience of Learning

Fear Extinction as a Model for Translational Neuroscience:
Ten Years of Progress
Mohammed R. Milad and Gregory J. Quirk 129

Comparative Psychology

The Evolutionary Origins of Friendship
Robert M. Seyfarth and Dorothy L. Cheney 153

Emotional, Social, and Personality Development

Religion, Morality, Evolution
Paul Bloom 179

Adulthood and Aging

| | |
|--|-----|
| Consequences of Age-Related Cognitive Declines <i>Timothy Salthouse</i> | 201 |
|--|-----|

Development in Societal Context

| | |
|--|-----|
| Child Development in the Context of Disaster, War, and Terrorism: Pathways of Risk and Resilience <i>Ann S. Masten and Angela J. Narayan</i> | 227 |
|--|-----|

Social Development, Social Personality, Social Motivation, Social Emotion

| | |
|---|-----|
| Social Functionality of Human Emotion <i>Paula M. Niedenthal and Markus Brauer</i> | 259 |
|---|-----|

Social Neuroscience

| | |
|---|-----|
| Mechanisms of Social Cognition <i>Chris D. Frith and Uta Frith</i> | 287 |
|---|-----|

Personality Processes

| | |
|--|-----|
| Personality Processes: Mechanisms by Which Personality Traits “Get Outside the Skin” <i>Sarah E. Hampson</i> | 315 |
|--|-----|

Work Attitudes

| | |
|---|-----|
| Job Attitudes <i>Timothy A. Judge and John D. Kammeyer-Mueller</i> | 341 |
|---|-----|

| | |
|---|-----|
| The Individual Experience of Unemployment <i>Connie R. Wanberg</i> | 369 |
|---|-----|

Job/Work Analysis

| | |
|--|-----|
| The Rise and Fall of Job Analysis and the Future of Work Analysis <i>Juan I. Sanchez and Edward L. Levine</i> | 397 |
|--|-----|

Education of Special Populations

| | |
|---|-----|
| Rapid Automatized Naming (RAN) and Reading Fluency: Implications for Understanding and Treatment of Reading Disabilities <i>Elizabeth S. Norton and Maryanne Wolf</i> | 427 |
|---|-----|

Human Abilities

| | |
|---|-----|
| Intelligence <i>Ian J. Deary</i> | 453 |
|---|-----|

Research Methodology

| | |
|--|-----|
| Decoding Patterns of Human Brain Activity <i>Frank Tong and Michael S. Pratte</i> | 483 |
|--|-----|

| | |
|--|-----|
| Human Intracranial Recordings and Cognitive Neuroscience <i>Roy Mukamel and Itzhak Fried</i> | 511 |
| Sources of Method Bias in Social Science Research and Recommendations on How to Control It <i>Philip M. Podsakoff, Scott B. MacKenzie, and Nathan P. Podsakoff</i> | 539 |
| Neuroscience Methods | |
| Neuroethics: The Ethical, Legal, and Societal Impact of Neuroscience <i>Martha J. Farah</i> | 571 |
| Indexes | |
| Cumulative Index of Contributing Authors, Volumes 53–63 | 593 |
| Cumulative Index of Chapter Titles, Volumes 53–63 | 598 |

Errata

An online log of corrections to *Annual Review of Psychology* articles may be found at <http://psych.AnnualReviews.org/errata.shtml>