



Published in final edited form as:

*Psychol Bull.* 2008 November ; 134(6): 807–828. doi:10.1037/a0013341.

## Emotion-based Dispositions to Rash Action: Positive and Negative Urgency

Melissa A. Cyders and Gregory T. Smith

Department of Psychology, University of Kentucky

### Abstract

Under heightened emotional states, individuals are more inclined to engage in ill-considered or rash actions than at other times. The authors present evidence for the existence of two related traits called positive and negative urgency. The traits refer to individual differences in the disposition to engage in rash action when experiencing extreme positive and negative affect, respectively. The authors provide evidence that these traits are distinct from other dispositions toward rash action, and that they play distinct roles in predicting problem levels of involvement in behaviors such as alcohol consumption, binge eating, drug use, and risky sexual behavior. The authors identify facilitative conditions for the emergence of the urgency traits from neuroscience. Certain gene polymorphisms are associated with low levels of serotonin and high levels of dopamine; that pattern of neurotransmitter activity in a brain system linking the orbitofrontal cortex and the amygdala appears to facilitate development of positive and negative urgency. The authors discuss the implications of this theory.

### Keywords

Impulsivity; emotion; risky behavior; positive urgency; negative urgency

---

We propose that there are two personality traits that refer to emotion-based dispositions to engage in rash actions. They are referred to as positive urgency (the tendency to engage in rash action in response to extreme positive affect) and negative urgency (the tendency to engage in rash action in response to extreme negative affect) (Cyders et al., 2007a; Cyders & Smith, 2007; Fischer, Smith, Spillane, & Cyders, 2005; Smith, Fischer, Cyders, Annus, Spillane, & McCarthy, 2007a; Whiteside & Lynam, 2001, 2003; Whiteside, Lynam, Miller, & Reynolds, 2005).

To support this proposition, we proceed as follows. We first review evidence supporting the existence of the traits and evidence for their utility in accounting for risky behavior. In this section of the paper, we describe empirical support for the urgency traits' distinctness from other traits that dispose individuals to rash action and we consider the urgency traits in relation to comprehensive models of personality. We then provide a theoretical account relating emotion to action that illustrates the relevance of the traits for adaptive and maladaptive functioning. Next, we review a set of findings from neuroscience that, together, may describe the facilitative conditions for the emergence of the urgency traits. We identify a candidate brain system, we consider the roles of serotonin (5HT) and dopamine (DA) neurotransmitter activity in that system, and we discuss evidence that certain gene polymorphisms appear to contribute to the relevant neurotransmitter variability. We then consider the urgency traits in the course

of development. Finally, we discuss the relevance of the trait for clinical disorders and appropriate interventions.

We believe that these proposed traits are important for several reasons. First, they describe a specific process by which emotionality is tied to ill-advised, rash action, one result of which is engagement in risky, potentially harmful, behavior. Although there is clear evidence that the experience of affect relates to many different risky behaviors (Chambless, Cherney, Caputo, & Rheinstein, 1987; Clark, 2005; Krueger et al., 1994; Schuckit & Smith, 2006; Sheppard, Smith, & Rosenbaum, 1988), at present, we have no integrative model to explain this link. In fact, theories of dysfunction tend to separate internalizing syndromes (generally involving mood dysfunction) from externalizing syndromes (generally involving maladaptive, risky behaviors such as drug abuse: Achenbach & Edelbrock, 1978; Krueger & Markon, 2006), and leave the substantial intercorrelation between the internalizing dimension and the externalizing dimension largely unexplained. The concept of urgency involves a specific description of a process linking affect and such behaviors. For the advancement of clinical science, it is crucial to understand the process linking emotionality and risky behaviors.

Second, the model we propose involves understanding maladaptive levels of emotionality and risky behavior in relation to normative human functioning; the urgency traits represent extreme levels of normal human processes. As we describe below, the experience of emotions can be understood as the experience of signals of the need for action. Very high levels of urgency reflect extremes in the natural variability in the disposition to act in response to one's emotional state. Thus, this model may represent another example of the fruitfulness of understanding human functioning, and its maladaptive variants, along a continuum (Widiger & Trull, 2007). To the degree one can do so, one can rely on a considerable body of psychological science to understand dysfunction.

Third, because we can identify facilitative conditions for the emergence of the traits from the fields of neurogenetics, brain functioning, and neurotransmitter functioning, and because we can describe a mechanism by which variation in urgency leads to subsequent variation in risky behavior, the study of positive and negative urgency may take research closer to a complete, integrated account of the emergence of individual differences in an important category of behavior. One basic goal of psychological inquiry is to provide such accounts. Thus, this analysis of the urgency traits provides one example of the kind of integrative theory that is becoming increasingly possible.

## **Evidence for the Existence of Positive and Negative Urgency**

### **Identification of distinct traits in structural analysis**

Research leading to the identification of the urgency traits has stemmed from the recognition that the terms “impulsivity” and “disinhibition” have, in fact, denoted combinations of multiple, separate psychological constructs (Bagby, Joffe, Parker, & Schuller, 1993; Depue & Collins, 1999; Evenden, 1999; Eysenck & Eysenck, 1977; Petry, 2001; Smith et al., 2007a; Whiteside & Lynam, 2001; Zuckerman, 1994). Among the efforts to identify separate constructs within the “impulsivity” umbrella, the work of Whiteside and Lynam (2001) may be particularly informative.

Whiteside and Lynam (2001) conducted their parsing of the construct using a comprehensive model of personality, the five factor model (FFM), to provide a framework for understanding different impulsivity-like constructs. The FFM includes five broad dimensions; neuroticism, extraversion, agreeableness, conscientiousness, and openness to experience (Costa & McCrae, 1992; Digman, 1990; Goldberg, 1990). In some versions of the model, each broad dimension can be understood to describe relations among multiple distinct, but related, lower level

constructs described as facets (such as anxiety, depression, and vulnerability as facets of neuroticism: Costa & McCrae, 1995).

Whiteside and Lynam's (2001) empirical approach was to assemble as many measures of impulsivity as possible and then factor analyze them together, in order to identify the common, underlying dimensions shared by existing measures. In a sense, then, the resulting factor solution was something of a summary of existing perspectives on impulsivity-like traits. They anticipated that the resulting summary could be understood within the five factor framework.

Their factor analysis produced four factors: *sensation seeking* (the tendency to seek out novel and thrilling experiences), *lack of planning* (the tendency to act without thinking), *lack of perseverance* (the inability to remain focused on a task), and *urgency* (the tendency to act rashly in response to distress, or what we here describe as negative urgency). Each factor has an analogue among the facets of the big five personality traits, as represented in Costa and McCrae's (1992) framework. Sensation seeking is analogous to the excitement seeking facet of extraversion, lack of planning is analogous to the deliberation facet of conscientiousness (keyed in the opposite direction), lack of perseverance is analogous to the self-discipline facet of conscientiousness (also keyed in the opposite direction), and urgency is analogous to the impulsiveness facet of neuroticism. Whiteside and Lynam constructed scales to represent each factor. Intercorrelations among those scales ranged from  $-.14$  (sensation seeking and lack of perseverance) through  $.00$  (sensation seeking and lack of planning) to a high of  $.45$  between lack of perseverance and lack of planning. Because the scale scores appeared to be reliable, there appeared to be far more reliable variance unique to each scale than shared with other scales.

Smith et al. (2007a) examined the nature of the distinctions among the four constructs using both comparative factor analysis and multitrait, multimethod matrix (MTMM) approaches. In a sample of 1,886 undergraduates, they compared several, alternative factor structures of measures of the four putative traits. In one model, they tested the hypothesis that indicators of the four traits fall together on a single, common trait (the "impulsivity" model). That hypothesized structure fit the data poorly: Comparative Fit Index (CFI) =  $.58$ ; Tucker-Lewis Fit Index (TLI) =  $.48$ , root mean square error of approximation (RMSEA) =  $.26$ ; standard root mean square residual (SRMR) =  $.19$ . A model in which measures of the four traits were represented as separate but related factors fit much better: CFI =  $.99$ , TLI =  $.98$ , RMSEA =  $.05$ , SRMR =  $.03$ . Ultimately, they endorsed a third model, in which lack of planning and lack of perseverance were facets of an overall "deficits in conscientiousness" factor, and (negative) urgency and sensation seeking were separate factors. That model, which imposed the additional constraint of the higher order factor, produces precisely the same fit indices as the model specifying four separate traits.

They then created interview assessments of each trait and conducted an MTMM analysis. They found strong evidence for convergence across method of assessment (monotrait, heteromethod correlations ranged from  $.56$  to  $.74$ ), low heterotrait, monomethod correlations (ranging from  $.01$  to  $.31$ ) and low heterotrait, heteromethod correlations as well. In a replication, the same authors found monotrait, heteromethod correlations ranging from  $.67$  to  $.83$  and again found good discriminant validity (Smith, Fischer, Cyders, Annus, & Spillane 2007b).

Cyders et al. (2007a) then provided evidence for a fifth disposition to engage in rash action, called positive urgency, i.e., the tendency to act rashly when experiencing extremely positive emotion. They based this hypothesis on the observation that there exists considerable indirect evidence for the existence of such a disposition. First, college students are more likely to drink on days of celebration than during the academic week (Del Boca, Darkes, Greenbaum, & Goldman, 2004; Kornefel, 2002): that drinking tends to be heavy and associated with driving

while under the influence, unwanted sexual intercourse, increased physical violence, and alcohol related injuries and deaths (Del Boca et al., 2004). Second, some individuals drink to enhance an existing positive mood, and do so in ways that lead to drinking-related problems and involvement in other risky behaviors (Cooper, Agocha, & Sheldon, 2000). Third, among pathological gamblers in recovery, positive mood is a temptation to resume gambling (Holub, Hodgins, & Peden, 2005). Fourth, induced positive mood produces increased risk taking (Yuen & Lee, 2003). Fifth, there is evidence that adolescents engage in rash, ill-advised behaviors both when they are distressed and when they are unusually happy (Steinberg, 2004). And sixth, Cyders et al. (2007a) felt that the content domain of positive mood-based rash action was not represented in the “impulsivity” measures factor analyzed by Whiteside and Lynam (2001).

They therefore developed a content valid scale and showed that it was unidimensional through factor analysis. They then factor analyzed their measure of positive urgency together with the four scales referred to above, and obtained a five factor solution. Positive urgency correlated quite modestly with sensation seeking, lack of planning, and lack of perseverance ( $r$ 's ranged from .21 to .28) and it correlated more highly with negative urgency ( $r = .37$ ).

Most recently, Cyders and Smith (2007) reported construction of an interview assessment of positive urgency, good evidence for convergent validity of positive urgency assessment across methods, and good discriminant validity among the five impulsivity-like traits. They then tested several alternative hierarchical structures to the set of five traits. Using both questionnaire and interview data, they found that the following model best summarized the structure of the five traits: one broad factor called urgency, for which positive and negative urgency were facets; one broad factor identifying deficits in conscientiousness, for which lack of planning and lack of perseverance were facets, and sensation seeking as the third trait. Fit indices for this model, for questionnaire and interview assessments respectively, were CFI = .95, .92; TLI = .93, .90; RMSEA = .08, .07; SRMR = .10, .08. The correlations between measures of positive and negative urgency were  $r = .49$  using questionnaires and  $r = .46$  using interviews. Sample items include, for negative urgency, “When I am upset, I often act without thinking,” and for positive urgency, “I tend to lose control when I am in a great mood.”

### Differential correlates of the distinct traits

To date, most research has focused on the relations of these traits to risky behaviors. The logic is that if these traits dispose individuals to rash or ill-considered actions, individual differences in the traits should be associated with, and predict, individual differences in engagement in behaviors associated with risk of harm. Consistent with the separation of the traits structurally, research has shown not only that the five traits do correlate with and predict risky behavior, but that they relate to different aspects of risky behavior (Anestis, Selby, Fink, & Joiner, 2007a; Anestis, Selby, & Joiner, 2007b; Billieux, Rochat, Rebetz, & Van der Linden, 2008; Billieux, Van der Linden, & Ceschi, 2007a; Billieux, Van der Linden, D'Acromont, Ceschi, & Zermatten, 2007b; Cyders et al., 2007a; Cyders, Flory, Rainer, & Smith, 2007b; Cyders & Smith, 2007, in press; Fischer, Anderson, & Smith, 2004; Fischer & Smith, 2004; Fischer & Smith, in press; Fischer, Smith, & Anderson, 2003; Fischer, Smith, Annus, & Hendricks, 2007; Miller, Flory, Lynam, & Leukefeld, 2003; Smith et al., 2007a; Verdejo-Garcia, Bechara, Recknor, & Perez-Garcia, 2007; Whiteside & Lynam, 2003; Whiteside et al., 2005).

Both positive and negative urgency correlate with problem levels of involvement in several risky behaviors, including problem drinking and pathological gambling (Cyders et al., 2007a; Smith et al., 2007a). Negative urgency has been shown to uniquely predict bulimic symptoms, excessive reassurance seeking, drinking alcohol to cope, dependence on cellular phone use, compulsive shopping, and tobacco cravings (Anestis et al., 2007a; Anestis et al., 2007b; Billieux et al., 2007a; Billieux et al., 2007b; Billieux et al., 2008; Fischer et al., 2003; Fischer et al., 2007; Miller et al., 2003). Additionally, negative urgency is the best predictor

of severity of medical, employment, alcohol, drug, family, social, legal, and psychiatric problems in individuals with substance dependence (Verdejo-Garcia et al., 2007).

Although positive urgency is a more recently defined trait, it has shown its own unique predictive relationships as well. Positive urgency prospectively predicts increases in drinking quantity and problems associated with drinking during the first year of college (Cyders et al., 2007b), whereas sensation seeking predicts only increases in drinking frequency. Positive urgency prospectively predicts increases in pathological gambling behaviors (Cyders & Smith, in press) and can differentiate those at risk of pathological gambling from those not at risk (Cyders et al., 2007a). Positive urgency also prospectively predicts risky sexual behavior and illegal drug use during the first year of college (Zapolski, Cyders, Rainer, & Smith, 2007). In each of these studies, positive urgency predicted above and beyond negative urgency, lack of planning, lack of perseverance, and sensation seeking.

The two urgency traits also have different correlates, as predicted by theory. Negative urgency relates to binge eating behavior, but positive urgency does not (Cyders et al., 2007a). Positive urgency relates to risky behavior engaged in while experiencing extreme positive affect, but negative urgency does not (Cyders & Smith, 2007, in press). Negative urgency relates to risky behavior engaged in while experiencing extreme negative affect, but positive urgency does not (Cyders & Smith, 2007). Fischer et al. (2007) showed that negative urgency differentiated eating disordered and substance abusers from controls, whereas Cyders et al. (2007a) found that, in contrast, positive urgency differentiated substance abusers from both eating disordered and control individuals.

The relation between negative urgency and overall markers of subjective distress (such as general neuroticism) in the prediction of risky behaviors has also been investigated recently. Fischer et al. (2007) found that both general neuroticism and negative urgency differentiated among eating disordered women who also had alcohol-related problems and eating disordered women who did not (sensation seeking, lack of planning, and lack of perseverance did not differentiate between the two groups). Most importantly, they found the two predictors interacted: among individuals high in neuroticism, only those high in negative urgency were experiencing significant alcohol-related problems. They concluded that it was not distress alone that accounted for the clinical phenomenon, but rather the propensity to act rashly when distressed. Consistent with that inference, Anestis et al. (2007a) found that, among women who reported difficulty tolerating their distress, only those high in negative urgency had high levels of bulimic symptoms. Concerning the concurrent prediction of problem drinking, Spillane and Smith (2007) found that when negative urgency was included in the prediction model, the influence of neuroticism dropped by a significant amount and became non-significant. They found no interaction between neuroticism and negative urgency, and this set of relationships held for Caucasian and American Indian participants.

Overall, the urgency traits seem to be important predictors of negative consequences from risky and maladaptive actions. The three non-urgency traits we have referred to appear, on the other hand, to play very different roles in risky behaviors. When sensation seeking is considered together with the urgency traits, it consistently predicts, both concurrently and prospectively, the frequency of engaging in risky behaviors (such as drinking and gambling), but it does not relate to problem levels of involvement in those behaviors (Cyders et al., 2007b; Smith et al., 2007a). Lack of planning sometimes adds concurrent predictive power in relation to some risky behaviors (Smith et al., 2007a), but it has not added important prospective predictive power, to date (Cyders et al., 2007b). Lack of perseverance tends to have very few relations with risky behaviors when the other traits are considered (Cyders et al., 2007b; Smith et al., 2007a).

There are some important limitations to the empirical evidence for the urgency traits. First, much of the data has been based on cross-sectional, self-report, and longitudinal analyses. Although this is an important first step in the validation of these traits, more work needs to be done examining these traits utilizing experimental manipulations or ecological momentary reports. Current work is being done to assess these traits in real-life and laboratory settings. However, it is promising that the urgency traits have proven reliable in self-report questionnaires and interviews; that multiple laboratories have replicated cross-sectional, concurrent prediction with the traits, using both normal and clinical samples; and that individual differences in the traits predict subsequent changes in risky behavior involvement. A second limitation is that, because of the relatively recent identification of positive urgency in the research literature, research on this trait has come from a single research laboratory. Attempts to replicate and extend this work by other researchers will constitute important additional steps in validating the construct.

In sum, there is clear evidence that positive and negative urgency are distinct from other traits that also dispose individuals to rash action, that they can be measured by both questionnaire and interview, that they account for different aspects of risky behavior than do other traits, and that the two urgency facets have different concurrent and prospective correlates from each other. In part for these reasons, Smith et al. (2007a) concluded that the term “impulsivity” should be retired from the trait lexicon; instead of referring to impulsivity, researchers should identify the specific trait of interest to them. Positive and negative urgency are two of those traits. Below, we argue that they are of particular interest, because they uniquely refer to the impact of emotion on rash action. Before doing so, we first consider urgency's place in comprehensive models of personality.

### Urgency in Relation to Comprehensive Models of Personality

To date, published factor analyses of the urgency traits have addressed their relations to measures of other traits that also dispose individuals to rash action. It is also important to understand how the traits relate to currently existing comprehensive models of personality. We next describe results from a series of factor analyses and regression analyses that relate the urgency traits to the 30 facets of the NEO-PI-R measure of the FFM of personality (Peterson & Smith, 2007). After doing so, we provide a characterization of the role of the two traits in personality functioning.

**Factor analyses relating positive and negative urgency to comprehensive personality structure**—We conducted a series of factor analyses using the questionnaire measures of positive and negative urgency together with the 30 facets of the NEO-PI-R in a sample of 301 college students (Peterson & Smith, 2007). Because these data are not previously published, we provide some detail about the findings.

We began by testing whether the factor structure of the 30 facets was consistent with past findings, in order to confirm that this sample is appropriate for examining the urgency traits' relation to the other factors. We therefore first conducted exploratory factor analyses using principal components analysis with varimax rotation, as is typically done in factor analyses of the NEO-PI-R (McCrae, Zonderman, Costa, & Bond, 1996), in order to confirm that the typical five factor structure would emerge. It did. The first five eigenvalues ranged from 7.42 to 1.74, and both a scree test and parallel analysis supported the five factor solution. Using parallel analysis, we found that the eigenvalue for the sixth factor was smaller than the average eigenvalue produced from 100 factor analyses of random data, and smaller than the eigenvalue at the 95<sup>th</sup> percentile of eigenvalues produced from random data. Loadings on the five were very similar to what has been reported in the past: each of the five factors (neuroticism, extraversion, agreeableness, conscientiousness, and openness to experience) emerged, with the

strongest loadings from their designated facets. There were also cross-loadings of facets on general factors that were highly consistent with previous factor analyses of the measure. For example, the angry hostility facet of neuroticism also loaded, negatively, on agreeableness. The impulsiveness facet of neuroticism, identified as a marker of negative urgency by Whiteside and Lynam (2001), had negative loadings on both conscientiousness and agreeableness in addition to its primary loading on neuroticism. Both the angry hostility and impulsiveness findings were present in the standardization sample (Costa & McCrae, 1992).

There is good evidence that the five broad factors identified in the NEO-PI-R can be summarized along two, higher-order dimensions (Digman, 1997; Markon, Krueger, & Watson, 2005). The first superordinate dimension is called alpha, and is characterized by high levels of emotional instability and disagreeable disinhibition on the one end, and high levels of emotional stability, agreeableness, and conscientiousness on the other end. Digman (1997) described alpha as an abstract, high-level concept that perhaps marks successful or unsuccessful socialization. The second superordinate factor is called beta, and is characterized primarily by positive emotionality. In our second factor analysis, we required a two-factor solution and closely replicated alpha and beta. Because our findings replicated previous findings, we concluded that this sample was appropriate for examining the urgency traits' relation to the NEO-PI-R measure of the FFM.

We thus conducted a principal components analysis, with varimax rotation, in which we included measures of both positive and negative urgency together with the 30 facets. Eigenvalues (7.67 to 1.77) and the scree plot again suggested five factors. There was a sixth factor (eigenvalue = 1.26), and three variables loaded on it: positive urgency (.85), negative urgency (.63), and the impulsiveness facet from neuroticism (.49). Each of the three scales had secondary loadings on, in this order, neuroticism, conscientiousness, and agreeableness. For three reasons, we did not feel it made sense to argue for a sixth factor. First, it did not emerge on the scree test (its eigenvalue was not appreciably greater than that of the 7<sup>th</sup> factor, which was 1.08 and which did not have clear meaning) and, using parallel analysis, its eigenvalue was not greater than the average eigenvalue for 100 factor analyses of random data. Second, this sixth factor never emerged from lexical analyses of language or other analyses. Third, it seems likely that one could artificially force the emergence of a sixth factor by including several scales measuring similar traits, and we likely did so by including measures of positive urgency, negative urgency, and their analogue of impulsiveness from neuroticism.

We therefore next constrained the analysis to produce five factors. The results included the usual five factors. Negative urgency had substantial loadings on three factors: neuroticism (.58), conscientiousness (-.40), and agreeableness (-.37). Positive urgency did as well: conscientiousness (-.39), agreeableness (-.30), and neuroticism (.28). Neither scale loaded significantly on either extraversion or openness to experience. A similar pattern occurred for the impulsiveness facet of the NEO-PI-R: neuroticism (.52), conscientiousness (-.35), and agreeableness (-.25).

From these findings, we conclude that the urgency traits, like the NEO-PI-R impulsiveness facet, share variance with a set of scales measuring aspects of subjective distress, low conscientiousness, and low agreeableness. It would seem artificial to assign them to one or the other of the five domains, but variability on the urgency traits can be understood within the five factor framework. Not surprisingly, when we include the urgency traits and require a two factor solution, the urgency traits fall on the factor labeled alpha (negative urgency = -.74, positive urgency = -.55, impulsivity facet = -.64).

We wish to highlight two aspects of these findings. First, positive urgency did not load on extraversion at the five factor level, nor did it load on beta or positive emotionality (Digman,

1997; Markon et al., 2005) at the two factor level. This finding is consistent with our theoretical model of urgency, which we describe below, and with findings that the two are facets of a common trait. We believe positive and negative urgency are both related to emotionality and affective dyscontrol; hence their relations with both neuroticism/emotional instability and conscientiousness.

Second, positive and negative urgency appear quite similar to alpha: high scores on the urgency traits relate to scores on alpha that reflect emotional instability, low agreeableness, and low conscientiousness. Below, we present a theoretical account of the urgency traits. That account, together with these empirical findings, suggests one possible relationship between the urgency traits and alpha. If alpha marks something of a broad failure of the socialization process, such that individuals are emotionally unstable and comparatively unable to inhibit acting on their impulses, perhaps positive and negative urgency describe a personality process that can contribute to that failure of the socialization process.

### **Relations of the urgency traits to facets of neuroticism and conscientiousness**

—In Whiteside and Lynam's (2001) original factor analysis of impulsivity-like measures, they found that the impulsiveness facet of neuroticism loaded highly on negative urgency. In the factor analyses we described above, we found that impulsiveness, negative urgency, and positive urgency appeared to fall on the same factor and had highly similar patterns of relationships with the other traits included in the NEO-PI-R measure of the FFM. In particular, all three traits covary with markers of high neuroticism and low conscientiousness. We believe the three traits represent emotion-based dispositions toward rash action. But since positive and negative urgency have only recently been identified, we felt it important to consider a different possibility. Perhaps the urgency traits actually represent either simple, additive combinations of other facets of neuroticism and conscientiousness, or interactions between certain neuroticism traits and certain conscientiousness traits.

To address this possibility, we conducted a series of multiple regression analyses (on the Peterson & Smith, 2007 data) to test whether each of the urgency traits had reliable variance unexplained by the sums and interactions of the facets of neuroticism and conscientiousness from the NEO-PI-R. As concurrent predictors, we used five facets of neuroticism (anxiety, depression, vulnerability, self-consciousness, and angry hostility) and all six facets of conscientiousness (competence, order, dutifulness, achievement striving, self-discipline, and deliberation). We did not include the impulsiveness facet of neuroticism, because it is analogous to negative urgency. For each analysis, we compared estimates of the total, reliable variance for the urgency traits to the total variance in the traits that can be explained by linear combinations of the 11 facets and by interactions of each neuroticism facet with each conscientiousness facet. Coefficient alpha estimates of reliability were .89 for negative urgency and .94 for positive urgency; these values estimate the total, reliable variance of the two trait measures.

First, we concurrently predicted negative urgency with the five neuroticism facets ( $R^2 = .31$ ) and then with the six conscientiousness facets ( $R^2 = .28$ ). These correlations indicate that 58% (.89 - .31) of the variance in negative urgency was reliable but unrelated to the five neuroticism facets, and 61% was reliable but unrelated to the six conscientiousness facets. We then concurrently predicted positive urgency from the same two sets of traits. The five neuroticism traits explained 9% of the variance in positive urgency; thus, 85% of the trait's variance was reliable but unrelated to the five neuroticism traits. The six conscientiousness traits explained 17% of the variance in positive urgency, indicating that 77% of the trait's variance is reliable but unrelated to those six traits.



We also concurrently predicted the two traits with all five neuroticism and all six conscientiousness facets entered together. For negative urgency,  $R^2 = .44$ ; thus, 45% of the negative urgency variance was reliable but unexplained by the 11 traits. For positive urgency,  $R^2 = .22$ ; 72% of the positive urgency variance was reliable but unexplained by the set of traits.

We then predicted the two traits with the interactions of each of the five neuroticism traits with each of the five conscientiousness traits. We used the standard approach in which one centers the predictors and tests the interaction after the main effects were entered (Cohen, Cohen, West, & Aiken, 2003). For negative urgency, only 1 of 30 interactions was significant. Angry hostility interacted with deliberation to explain an additional 3% of the negative urgency variance. For positive urgency, again 1 of 30 interactions was significant. Again, angry hostility interacted with deliberation, this time explaining an additional 1% of the positive urgency variance.

Lastly, we predicted the two traits with overall neuroticism scores (removing impulsiveness), overall conscientiousness scores, and their interaction. The main effects of overall neuroticism and conscientiousness together explained 33% of the variance in negative urgency, and 11% of the variance in positive urgency. The interaction was significant for negative urgency; the joint effect of neuroticism and conscientiousness explained an additional 3% of the variance in that trait. The interaction was not significant in the concurrent prediction of positive urgency; it explained no additional variance. Thus, 53% of the variance in negative urgency and 83% of the variance in positive urgency was reliable but distinct from the two broad traits and their interaction.

The measures of positive and negative urgency have a great deal of reliable variance that is not explained by the set of neuroticism and conscientiousness facets, or by their interaction. In fact, the majority of the reliable variance of each of the two measures does not overlap with these other measures. Based on these findings, it does not appear to be the case that the urgency traits represent combinations of neuroticism and conscientiousness. Instead, they appear more closely tied to the impulsiveness facet of neuroticism.<sup>1</sup>

To conclude this section of the paper: we have shown that “impulsivity” researchers have identified several, distinct dispositions to engage in rash action. Two of those traits are positive and negative urgency, which refer to emotion-based dispositions to rash action. Each of the two urgency traits is unidimensional, and each has a distinct concurrent and prospective predictive role. The traits do not fall neatly onto a single dimension within the FFM of personality. Consistent with their proposed definition as emotion-based dispositions to rash action, they relate to both neuroticism and conscientiousness. They are not combinations of neuroticism and conscientiousness traits, either additively or interactively. That the urgency traits relate to both broad personality domains, and to the superordinate dimensions alpha,

<sup>1</sup>The urgency traits do not appear to be represented in other comprehensive models of personality, but analogs to urgency have been recognized in measures of temperament and measures of impulsivity. One comprehensive model is that represented by the Multidimensional Personality Questionnaire (MPQ; Tellegen, in press). The MPQ control versus impulsiveness scale, which is part of higher-order constraint, falls on the lack of planning dimension in factor analysis (Whiteside & Lynam, 2001); it appears to involve low conscientiousness, rather than emotion. The MPQ stress reaction scale items refer to feeling worried, rattled, nervous, lonely, fearful, miserable, worthless, guilty, and so on: it does not appear closely related to rash action. None of the other MPQ scales appear to tap the urgency content. The six factor HEXACO Personality Inventory (Lee & Ashton, 2004) also includes a low-conscientiousness disposition to rash action, called prudence, but no emotion-based disposition to rash action. Zuckerman's five factor model includes impulsive sensation seeking (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). The impulsive sensation seeking items appear analogous to lack of planning and sensation seeking (Fischer, Smith, & Cyders, 2008), although the boredom susceptibility subscale of Zuckerman's (1994) sensation seeking scale falls on lack of perseverance in factor analysis (Whiteside & Lynam, 2001). Buss and Plomin (1975) developed a comprehensive scale to reflect the four temperament domains described in their theory: emotionality, activity, sociability, and impulsivity. Factor analyses of their impulsivity scale identified four factors, one of which (called inhibitory control) loaded highly on Whiteside and Lynam's (2001) negative urgency factor (the other three loaded on sensation seeking, lack of planning, and lack of perseverance: Braithwaite, Duncan-Jones, Bosly-Craft, & Goodchild, 1984). Among impulsivity measures, Barratt's attentional impulsivity loaded highly on Whiteside and Lynam's negative urgency, while his other two subscales loaded on lack of planning (Patton, Stanford, & Barratt, 1995).

provides descriptive information consistent with the proposed definition of urgency. In the next section of the paper, we elaborate our theoretical account of urgency.

## The Theory of Urgency

To present our theory of urgency, we first consider the relationship between emotion and action. We then consider extreme emotion and its impact on risky action. We then present our analysis of how urgency, as a disposition to rash action, leads to increased rates of risky, potentially harmful behaviors.

### Emotion and Behavior

The experience of emotion facilitates action. It has long been recognized that emotional processing appears to prepare the body for action (Frijda, 1986; Lang, 1993; Saami, Mumme, & Campos, 1998). In fact, to emote means, literally, to prepare for action (Maxwell & Davidson, 2007). Researchers have theorized that the relationship between emotional experiences and actions involve activation of the motor cortex by limbic structures (Morgenson, Jones, & Yim, 1980).

Some investigations have used neuroimaging techniques to document increased activity in motor areas of the brain during emotional processing (Bremner et al., 1999; Rauch et al., 1996), and nonhuman studies suggest the emotion-action interface may involve connections between the amygdala and the anterior cingulate cortex (ACC: Devinsky, Morrel, & Vogt, 1995). In addition, spinal reflexes appear to be enhanced when individuals observe either pleasant or unpleasant affective stimuli (Bonnet, Bradley, Lang, & Requin, 1995). Most recently, Hajcak et al. (2007) found that emotionally arousing stimuli, whether of positive or negative valence, increase motor cortex excitability. The authors theorized that there may be individual difference in emotional reactivity that may relate to differences in the amount of activation of the motor cortex areas (Hajcak et al., 2007).

Emotion's facilitation of action is fundamentally adaptive. Emotions lead one to focus on one particular set of needs or stimuli, out of all the possible stimuli to which one could conceivably attend. One takes action to meet the need identified by the emotion. Pinker (1997) makes this point by noting that "Most artificial intelligence researchers believe that freely behaving robots . . . will have to be programmed with something like emotions merely for them to know at every moment what to do next" (p. 374).

Consider an example. The typical experience of negative affect involves feeling anxiety, worry, sadness, fear, vulnerability, and/or anger. When there are important, perhaps in the extreme even survival-threatening problems, the capacity to experience these feelings, and the accompanying focus on the problem at hand (Depue, 1996; Hajcak et al., 2007), is adaptive. It leads to problem-solving action. When the threat is removed or minimized, the negative affect recedes. Although the experience of emotional states likely plays a number of roles, our focus here is on their adaptive role in signaling the need for action.

To the degree that emotions facilitate actions to meet needs, it is perhaps generally true that more intense needs tend to be associated with the experience of more intense affective states. The difference between the typical level of fear associated with the experience of combat and that associated with, for example, snow skiing, reflects (albeit imperfectly) the difference in risk in the two situations, and hence differences in the need to alter some aspect of the situation to reduce the risk. We suggest that if the experience of more extreme emotions is likely to be associated with more pronounced needs, it is likely also associated with more unusual, or perhaps extreme, behavioral choices. Intensely negative experiences of fear may propel an individual to take radical steps to alter their current situation, whether through some version

of flight or some version of fight. Intensely positive experiences of attraction or of sexual need may propel an individual to take the risky step of approaching someone to try to initiate a romantic relationship.

Thus, the experience of intense emotions may lead one to focus more heavily on one's immediate situation. At times, such as in the examples just given, a focus on the immediate can be fruitful and adaptive. However, there are also times in which an emotion-driven focus on the immediate may not be adaptive, and may in fact be ill-advised or even rash. A focus on one's current anger at one's boss, or one's sense of sexual attraction to a colleague can, in the absence of a co-occurring focus on one's long-term interests and goals, increase the likelihood of rash acts. And, intense emotions do tend to interfere with rational, advantageous decision making (Bechara, 2004, 2005; Dolan, 2007; Driesbach, 2006; Shiv, Loewenstein, & Bechara, 2005), sometimes leading to a reduced focus on one's long-term interests and an increased focus on the immediate (Davidson, 2003).

There are three important implications of this line of reasoning for the current proposal. First, emotion's facilitation of a focus on the immediate has a fundamentally adaptive basis: one is oriented to meet one's needs, whether with respect to avoiding immediate threats or pursuing immediately available opportunities. But the second implication is that when one is experiencing emotions very intensely, the loss of available cognitive resources and the interference with rational decision making increases the likelihood that one's actions will be ill-advised or rash. As a result, the likelihood of ill-considered, risky behavior is increased. The third implication is that acts in response to the immediate are likely to be reinforcing, whether involving negative reinforcement such as reduction of, or distraction from, distress (Heatherton & Baumeister, 1991) or positive reinforcement such as gratification of an urge. Even if such behaviors are associated with risk, or are inconsistent with one's long-term interests, they provide immediate reinforcement.

### Emotion and Risky Behavior

Although the core precipitant of an emotion is a need, and meeting the need often requires some form of action, direct efforts to meet the need triggering an emotional experience are often difficult. Contextual and other factors often preclude immediate action to meet a need; it is particularly true that in the short term needs are often not met. Because individuals cannot always engage promptly in action that addresses the precipitating need, they engage in other actions that perhaps lessen the intensity of their emotional state (Larsen, 2000) or provide some alternative source of reward. Some of those strategies are adaptive, in the sense that they do not undermine pursuit of longer-term goals (Davidson, 2003). For example, when distressed, cognitive review of one's situation to evaluate the precipitant of the distress differently or to develop a strategy to address the precipitant at a later time, physical activities such as taking walks or exercising, meditation, "counting one's blessings," and many other strategies are likely consistent with individuals' longer-term goals (Linehan, 1993). For intense attraction or sexual needs, perhaps cognitive mediation to consider whether acting on the need is in one's best long-term interests may often be valuable. Strategies such as these may help one modulate the intensity of one's emotional experience in a way that facilitates one's return to a focus on more long-term considerations (Davidson, 2003; Larsen, 2000).

However, as noted above, intense emotions can undermine rational, advantageous decision making (Bechara, 2004, 2005; Dolan, 2007; Driesbach, 2006; Shiv et al., 2005). It also appears to be true that attempts to regulate negative emotions can impair one's ability to continue self-control behaviors (Muraven & Baumeister, 2000; Tice & Bratslavsky, 2000; Tice, Bratslavsky, & Baumeister, 2001). Thus, it is not surprising that individuals engage in other strategies to manage intense emotions that are ill-considered and maladaptive, in that they work against one's long-term interests. For example, heavy alcohol use may be used to manage emotion.

Daily diary studies of alcohol use indicate that individuals drink more on days when they experience anxiety and stress (Swendson et al., 2000). Indeed, negative affect states have been shown to correlate with a greater frequency of many maladaptive, addictive behaviors, including alcohol and drug abuse (Colder & Chassin, 1997; Cooper, 1994; Cooper et al., 2000; Martin & Sher, 1994; Peveler & Fairburn, 1990). This pattern also is true of bulimic behaviors; individuals tend to participate in more binge eating and purging behaviors on days during which they experienced negative emotions (Agras & Telch, 1998; Smyth et al., 2007). Emotions such as shame, guilt, anger, depression, loneliness, stress, anxiety, boredom, and rejection are often cited as triggers for binge and purge episodes (Jeppson, Richards, Hardman, & Granley, 2003). For bulimic women, engaging in binge eating produces a decline in the earlier negative emotion (Smyth et al., 2007). Because actions like these do appear to reduce negative affect, they are reinforced and thus become more likely in the future.

There is also considerable evidence that individuals engage in heavy and high-risk drinking as part of celebrations or in response to very positive emotions (Del Boca et al. 2004; Kornefel, 2002). More generally, very positive affect increases risk-taking behaviors, including drug use, sexual encounters and gambling (Cyders & Smith, in press; Holub et al., 2005; Kahn & Isen, 1993; Yuen & Lee, 2003; Zapolski et al., 2007).

There is evidence that mild increases in positive affect can improve problem solving skills (Isen 1984, 1987), such as cognitive flexibility (Isen & Daubman, 1984; Isen, Niedenthal & Cantor, 1992), verbal fluency (Phillips, MacLean, & Allen, 2002), and problem solving (Green & Noice, 1988; Isen, Daubman & Nowicki, 1987). However, even mild increases in positive affect do have some cost. Increased positive affect appears to interfere with one's orientation toward the pursuit of one's long-term goals, to increase one's distractibility (Dreisbach & Goschke, 2004), and to make one more optimistic about positive outcomes of a situation (Nygren, Isen, Taylor, & Dulin, 1996; Wright & Bower, 1992). These actions may in part reflect the reduced rationality described above.

And more pronounced emotional arousal (whether positive or negative) tends to lead one to have less discriminative use of information (Forgas, 1992; Forgas & Bower, 1987; Gleicher & Weary, 1991), which can then lead to poor decision-making outcomes (Slovic, Finucane, Peters, & MacGregor, 2004). It therefore appears that both strongly felt positive affect and strongly felt negative affect can lead to ill-advised action inconsistent with long-term goals.

In sum, heightened emotionality appears to be accompanied by a greater likelihood of engaging in ill-considered acts, some of which entail risk. The regular experience of heightened emotionality may increase a person's risk for more frequent engagement in such behaviors, and those behaviors tend to be reinforced, even if they are inconsistent with one's long-term interests.

### **Urgency and Risky Behaviors**

Positive and negative urgency are personality traits that represent individual differences in the tendency to engage in ill-considered, rash action when experiencing intense emotion. The tendency to engage in rash action increases the likelihood of repeated involvement in potentially harmful or risky behaviors (Fischer et al., 2005) in the following way. Both rash actions spurred by negative emotion, such as yelling at one's boss, and rash actions spurred by a positive mood, such as excessive celebratory drinking, provide immediate reinforcement.

They therefore become more likely in the future: even ill-considered or rash actions become reinforced. Some rash actions involve risk, and those risky behaviors are also reinforced; as a result, one comes to engage in risky behaviors with greater frequency. We believe it is also true that, on each occasion in which this takes place, one has missed an opportunity to engage

in a more adaptive response to one's intense emotion; one then has fewer experiences in which adaptive responses to intense emotion are reinforced. The result is an increasing reliance on risky behaviors in response to intense emotions.

In summary, we have provided empirical evidence for the existence of positive and negative urgency, and we have offered a theoretical framework to understand the operation of the trait. We next argue that the facilitative conditions for the emergence of the urgency traits have been identified in brain system, neurotransmitter, and neurogenetic research. Examining evidence relating to urgency at each of these levels is important for two reasons. First, if the theory that there are individual differences in an emotion-based disposition to rash action is correct, there should be identifiable, analogue processes in the brain. Second, to be able to describe an empirically defensible pathway from gene polymorphism to variation in neurotransmitter activity within key brain systems to the emergence of phenotypic personality traits, which themselves influence the likelihood of certain behavioral choices, is to offer something close to an integrated account of the emergence of individual differences in an important category of behavior. One basic goal of psychological inquiry is to provide such accounts. Thus, this analysis of urgency provides one example of the kind of integrative theory that is becoming increasingly possible, given advances in genetic research, neuroscience, and trait theory.

Specifically, our claim is that certain gene polymorphisms make certain patterns of neurotransmitter activity more likely, and that when those patterns occur in certain brain regions, they make it more likely that an individual will develop the urgency traits. As we have argued above, development of the urgency traits makes it more likely that individuals will engage in rash actions when experiencing intense emotion, which makes it more likely that individuals will engage in risky behaviors, which makes it more likely they will come to rely on such behaviors for affect management and thus experience personal harm. Thus, we are describing a series of hypothesized steps from gene to behavior, with presumably moderate effect sizes, at best, at each step. We therefore would not expect to find high levels of association between gene polymorphisms and trait scores.

To describe these facilitative conditions for the urgency traits, we first provide evidence for the operation of a specific brain pathway that is closely tied to emotion-based rash action. We then review evidence that an identified pattern of the functioning of two neurotransmitters in that brain system facilitates rash or ill-considered action. Once we have described that process, we consider gene polymorphisms that may relate to the levels of the relevant neurotransmitters.

### **Brain Pathways Related to Emotion-Based Action**

We begin by describing a specific brain system involved in emotion and action. We then review a theory connecting emotion-based rash action to this brain system and the empirical evidence supporting it. Then, we review evidence that an identified pattern of the functioning of two neurotransmitters in that brain system facilitates rash or ill-considered action. Once we have described that process, we consider gene polymorphisms that may relate to the levels of the relevant neurotransmitters.

There are extensive connections among polymodal sensory systems, the amygdala, the orbitofrontal cortex (OFC) and its medial sector (the ventromedial prefrontal cortex, or VM PFC: Bechara, 2005), and other areas of the prefrontal cortex (PFC: Barbas, 2007). The amygdala appears to be heavily involved in the experience of negative affect; more broadly, it is thought to play a role in directing attention to emotionally salient stimuli, particularly stressful or disturbing stimuli (Davidson, 2003). The OFC appears to be involved in the modulation of emotion-based reactivity (Davidson, 2003). The nature of the connections among these regions suggests reciprocal influences between the amygdala and the OFC/VM PFC (with influences from other areas of the PFC) in processing emotion-laden experiences

and preparing for action (Barbas, 2007; Bechara, Tranel & Damasio, 2000; Ghashghaei & Barbas, 2002; LeDoux, 2000; Lewis & Todd, 2007). Both the OFC and the amygdala receive direct projections from neurons in sensory areas (Barbas, 2007). The OFC also receives both direct projections from the amygdala and indirect projections from the amygdala through the anterior cingulate cortex (ACC, which is also responsive to emotionally significant stimuli: LeDoux, 1995; Lewis & Todd, 2005), and it has projections back to the amygdala. The OFC receives projections from the lateral PFC as well.

This pattern of connections is consistent with reciprocal influences between these brain regions that has been described as vertical integration and appears to reflect both “top down” and “bottom up” processing (Lewis & Todd, 2007). Concerning “bottom up” processing, the amygdala appears to provide information about the emotional significance of sensory input, thereby influencing activity in the OFC. Thus, the emotional significance of events influences subsequent cortical activity (one engages in cognitive processing about that which is emotionally important). At the same time, projections from the amygdala to the striatum, the nucleus accumbens, and the ventral tegmental area enhance the activation of both limbic and cortical structures, thus contributing further to both action and emotional experience (Cardinal, Parkinson, Hall, & Everitt, 2002). In short, “upward” pathways from the amygdala to higher level cortical areas help orient one to what is important and help one prepare possible behavioral responses.

Concerning “top down” processes, the OFC appears to exhibit a regulating effect on the amygdala and the brain stem (Bechara, 2005; Ghashghaei & Barbas, 2002; Hariri, Drabant, & Weinberger, 2006; Lewis & Todd, 2007). The OFC can interrupt the direct connection between emotion and response: OFC activity overrides emotional responses, apparently by providing information and a bias toward long-term, goal-directed behavior (Lewis & Todd, 2007).

To summarize this reciprocal relationship: the amygdala appears to harness cortical activity according to the emotional meaning of stimuli, and the cortex initiates and modulates amygdala responses based on perceptions of expected outcomes of possible actions (Barbas, 2007; Bechara, 2005; Cardinal et al., 2002; Lewis & Todd, 2007). The result is attention to important stimuli together with a capacity to respond in ways consistent with one's long-term goals.

Davidson and his colleagues (Davidson, 1998, 2000, 2003; Davidson & Irwin, 1999; Davidson, Putnam, & Larson, 2000) have provided considerable empirical support for a closely related model of OFC and amygdala functioning that helps explain the affective basis for both risky behavior and for inhibitory control over risky behavior. The model is as follows.

At times, the experience of intense emotion, and its accompanying potential actions, is inconsistent with one's long-term goals. The OFC, perhaps particularly the left VM PFC, provides a biasing signal to avoid immediate reward, and thus maintain one's pursuit of one's longer-term goals. Davidson (2003) refers to this process as affect-guided planning and anticipation: with healthy left VM PFC functioning, one gains access to the emotion associated with anticipated outcomes consistent with one's long-term goals. The ability to do so is, Davidson argues, the hallmark of adaptive, emotion-based decision making. At times, long-term affect-guided planning is difficult: the experience of intense emotions unrelated to one's long-term interests may disrupt processing with regard to those interests (Gray, 1999; Preston, Buchanan, Stansfield, & Bechara, 2007). But healthy functioning of the left VM PFC helps one maintain an affective connection to one's longer-term goals, and thus plan accordingly.

Activation of the left VM PFC appears to facilitate two processes simultaneously. The first of those is that it maintains representations of behavioral reinforcement contingencies in working memory; thus maintaining awareness of the consequences of prospective actions (Thorpe, Rolls, & Madison, 1983). The second is that it inhibits amygdalar activity (Davidson, 1998),

thus shortening the time course of the experience of negative affect and attention to stressful stimuli.

Because negative affect stimulates autonomic nervous system (ANS) activity, which provides support for action in response to distress, prolonged negative affect leads to prolonged ANS arousal (Davidson, 2000). Perhaps a greater duration of ANS arousal increases the likelihood of affect-triggered action. Activity in the amygdala appears to facilitate this process. And activation of the left VM PFC, in turn, appears to provide some inhibition to amygdalar activity and hence to this state of affairs.

There is a great deal of behavioral evidence in support of this model. For example, damage to the OFC, and perhaps damage specifically to the VM PFC, results in affective lability and rash action. In card-playing tasks characterized by uncertainty concerning the experience of rewards and penalties, normal controls begin to develop skin conductance responses (SCR's), indicative of arousal and affective responding, in anticipation of card choices that may be punishing. Individuals with PFC damage, and with OFC damage in particular, do not; they do not appear to have the normal anticipatory affective response to potential punishment (Bechara, 2004; Bechara, Tranel, Damasio, & Damasio, 1996; Cardinal et al., 2002). Interestingly, normal individuals develop anticipatory SCR when pondering a choice that turned out to be risky, before they knew explicitly that it was a risky choice, whereas OFC-damaged patients do not develop anticipatory SCR's, even when they eventually can articulate which choices are risky (Bechara, Damasio, Tranel, & Damasio, 1997). Thus, OFC damage appears to impair affective anticipation of potential risk to one's actions.

Bechara, Damasio, Damasio, and Anderson (1994) described OFC-damaged individuals as oblivious to the future consequences of their actions, but sensitive to immediate reinforcement and punishment. Thus, their actions tend to be guided by immediate consequences only. These patients had otherwise retained their intellectual capacities, including abstract reasoning skills. They could even describe possible future consequences in realistic language. They appeared simply to lack the anticipatory affect that others have; thus perhaps lacking the affect-guided anticipation described by Davidson (2003).

Interestingly, the case of Phineas Gage is relevant here. As is well known, after a tamping iron spiked through his face, skull, and brain, he underwent a personality transformation. He became affectively labile, irreverent, rash in his actions, and undependable; in stark contrast to his previous personality. Damasio, Grabowski, Frank, Galaburda, and Damasio (1994) applied modern neuroimaging techniques to his skull, in order to estimate the location of his lesion. The lesion appeared to have been in his PFC, including his OFC, causing defects in decision making and the processing of emotion. Perhaps Gage's behavior changes may thus be an example of the effects of lesions in the brain system that facilitates disruptions in affect-guided planning.

In addition to the experimental evidence cited above, and the dramatic case example of Phineas Gage, there are other examples of rash action accompanying lesions in the PFC. For instance, Spinella (2007) found that PFC lesions led to dyscontrolled sexual behavior. To anticipate the following discussion, it seems to us that low levels of affect-guided planning appear analogous to high levels of the urgency traits.

Although studies of the effects of lesions in the OFC, and more specifically in the VM PFC, are crucial for understanding the potential role of this brain region in emotion-based rash action, it is more relevant to our trait claim to note that there are individual differences in activity in these brain areas. In a recent fMRI investigation of reactive aggression, Lotze, Veit, Anders, and Birbaumer (2007) found that VM PFC activation correlated positively with SCR during observation of a suffering opponent, apparently associated with compassion for that opponent.

This finding is consistent with the view that VM PFC activity contributes to an affective connection with the consequences of one's actions. But there were individual differences in VM PFC activity. In particular, individuals scoring high in psychopathy showed little VM PFC activation: they appeared not to be disturbed by the suffering of the opponent.

It is thus possible that individuals high in psychopathy have reduced VM PFC functioning, and hence lack an affective connection to the consequences of their actions. Other studies have also documented similar OFC functioning deficits among psychopaths (Blair et al., 2006; Mitchell, Colledge, Leonard, & Blair, 2002). Integrative analyses of these data have suggested that the deficit underlying psychopathy involves the integrated functioning of the amygdala and the medial OFC (Blair, 2007; Mitchell et al., 2002). Perhaps psychopaths tend to act on their immediate affects and urges in ways not modulated by an emotional connection with the implications of their actions for themselves and others; indeed, this description is quite close to the original one provided by Cleckley (1976).

Of particular importance for the present argument is that a consensus view of psychopathy (determined empirically, based on both expert ratings and research findings) based on the FFM describes psychopaths as being high on the neuroticism trait of impulsiveness, which is an analogue of negative urgency (Lynam & Widiger, 2007). Psychopaths do experience intense emotions associated with gratifying their needs, but they lack an affective connection to the consequences of their actions and hence the long-term implications of those actions for themselves. As a result, they act in ill-advised ways. Thus, demonstrations of associations between the OFC/VM PFC-amygdala system and psychopathy is quite consistent with our claim of an association between this system and the urgency traits.

More generally, it appears to be the case that patterns of neurotransmitter activity may help explain individual differences in activity within this brain system. Both bottom-up and top-down interactions between the amygdala and the OFC appear to occur through the use of neuromodulators, such as 5HT and DA (Lewis & Todd, 2007). Therefore, to describe a mechanism by which individual differences in the activity of this system operate, and hence possibly contribute to the emergence of individual differences in urgency, we next consider key, relevant aspects of neurotransmitter functioning.

### **The Contribution of Neurotransmitter Activity to this Process**

To understand the contributions of 5HT and DA activity to emotion-based action in general, and to the urgency traits in particular, it is important to appreciate that 5HT activity appears often to modulate DA activity (Spont, 1992). The interaction of these two neuromodulators, particularly in the OFC – amygdala brain system, appears to influence the level of rational, inhibitory control over appetitive drives or approach behaviors (Spont, 1992; Zald & Depue, 2001). We first review relevant evidence for the activity of each neurotransmitter considered singly, before considering evidence of their interaction along with a brief discussion of the structural means by which 5HT activity appears to modulate DA activity.

**The Role of 5HT**—Numerous authors have reported that 5HT activity influences ill-advised action that appears to be emotion-based. Low levels of 5HT are associated with greater rates of ill-considered behaviors that often involve risk, together with greater levels of negative affect, irritability, and positive affect. This relationship has been demonstrated in both correlational and experimental designs (Cools, Blackwell, Menzies, Cox, & Robbins, 2005; Depue & Collins, 1999; Frankle et al., 2005; Krakowski, 2003; Morgan, Impallomeni, Pirona, & Rogers, 2006; Spont, 1992; Winstanley, Dalley, Theobald, & Robbins, 2004; Winstanley, Eagle, & Robbins, 2006; Winstanley, Theobald, Dalley, Glennon, & Robbins, 2004; Zald & Depue, 2001).



Interestingly, low levels of 5HT are related to what is called “impulsive aggression” in monkeys, but not to “planful aggression” (Frankle et al., 2005). Aggressive monkeys who use their aggression well, and thus end up at the top of the group hierarchy, do not have lower 5HT levels. Aggressive monkeys who use aggression in ill-advised, unsuccessful ways and who also have other poor social skills, do have lower 5HT levels. Animal researchers have demonstrated that the PFC brain region shows a high concentration of 5HT receptors in monkeys whose behavior is socially adapted, and low 5HT receptor levels in aggressive, socially uncooperative animals (Raleigh & Brammer, 1993). Frankle et al. (2005) found that low 5HT, particularly in the ACC, is associated with “impulsive aggression” and impaired regulation of negative emotions. In addition, selective 5HT reuptake inhibitors, which serve to increase overall levels of 5HT in the synaptic cleft, have been very effective in regulating emotion, decreasing depression (Arroll et al., 2005) and reducing risky behaviors in a variety of clinical disorders, including borderline personality disorder (Barbe, Rubovsky, Venturini-Andreoli, & Andreoli, 2005).

Of course, the function of any neurotransmitter, including 5HT, is complicated and contextual. For example, different 5HT transporters have been shown to have different and sometimes opposing effects on risky behaviors. It appears that reduction in 5HT available for the very common 5HT<sub>2c</sub> receptor sites and for 5HT<sub>1a</sub> receptor sites tends to be associated with the classic increased emotionality/increased risky behavior effect, whereas reduced 5HT for the less common 5HT<sub>2a</sub> receptor sites has the opposite effect (Carli, Baviera, Invernizzi, & Balducci, 2006). Winstanley et al. (2004) found that 5HT<sub>2A</sub> and 5HT<sub>2C</sub> receptors differentially affect behavior; depletion of 5HT in the 5HT<sub>2A</sub> receptor results in higher levels of risky behavior, whereas depletion of 5HT at the 5HT<sub>2C</sub> receptor results in lower levels of risky behavior.

In sum, it appears generally to be true that low levels of 5HT are associated with increased levels of emotion-based engagement in rash or ill-considered behaviors. When 5HT levels are reduced experimentally, one tends to see increases in emotion-based rash acts. It is thus quite plausible that variation in levels of 5HT for 2c and 1a receptor sites, particularly in the key areas of the PFC, facilitate the emergence of variation in the trait of urgency.

**The Role of DA**—DA appears also to play a role in emotionality and rash action. Unusually high levels of DA are associated with the three dimensions of borderline personality disorder: emotional dysregulation, “impulsivity,” and cognitive-perceptual impairment (Friedel, 2004) and are thought to be a central factor influencing the ill-considered behaviors observed in ADHD (Winstanley et al., 2006). They have been associated with both behavioral disinhibition (Cardinal & Everitt, 2004) and with high levels of novelty seeking (Stuettgen, Hennig, Reuter, & Netter, 2005). High levels of DA have repeatedly been associated with a tendency to act, or to engage in approach behaviors (Depue, 1995; Depue & Collins, 1999; Spont, 1992; Zald & Depue, 2001) and with increasing reward-seeking and risk-taking behaviors (Spear, 2000).

These DA effects appear to occur primarily in relation to D2 and D4 receptor sites within the prefrontal cortex (Winstanley et al., 2004). There is some evidence that the DAD2 receptors might serve to increase rates of rash action by decreasing the value of delayed rewards (Limosin et al., 2003). DA is very much involved in the amygdala to OFC circuit, and high levels of DA activity, particularly DA available to DAD2 and DAD4 receptors, is associated with high rates of rash or ill-considered acts (Floresco & Tse, 2007). (Interestingly, activation of the DAD1 receptors appears to lead to the opposite effect: an increase in the capacity to delay reinforcement: van-Gaalen, Brueggeman, Bronius, Schoffemeer, & Vanderschuren, 2006; van-Gaalen, van-Koten, Schoffemeer, & Vanderschuren, 2006.)

**The Interaction of 5HT and DA**—Most important for the present argument is the evidence that 5HT and DA interact. Serotonergic systems, which appear important for information processing, have been found to influence certain dopaminergic pathways that may underlie approach behaviors (Patterson & Newman, 1993; Spont, 1992). It appears that 5HT activity, which may contribute to affect-guided planning (Davidson, 2003), tends to inhibit high levels of disposition to act that are reflected in uninhibited DA activity. Authors have suggested that 5HT's inhibiting influence on DA reflects a process in which information processing reduces one's propensity to act, perhaps as one considers appropriate actions in light of newly arriving information and important long-term goals (Davidson, 2003; Spont, 1992). Low levels of 5HT, then, imply a failure to inhibit the approach tendencies characteristic of high levels of DA. One result may be an overall reduction in affect-guided planning and accompanying higher rates of rash, ill-considered acts.

Structurally, 5HT activity modulates DA activity both directly and indirectly. Concerning direct effects, there are 5HT receptors on some DA neurons: for those neurons, reception of 5HT reduces the rate of reception of DA (Daw, Kakade, & Dayan, 2002; Fink & Gothbert, 2007; Howell, Czoty, & Byrd, 1997). Concerning indirect effects, 5HT can bind to neurons in other locations that might otherwise be activated by DA firing, thus reducing that possible activation (Howell et al., 1997).

Depue (1995) summarized the interaction of low levels of 5HT and high levels of DA as involving (a) exaggerated response to stimulus conditions eliciting DA facilitation; (b) greater sensitivity to current reward stimuli; (c) increased pursuit of sanctuary from stress and conflict, including both active avoidance and impulsive acts; (d) impulsive behavior from over-reactivity to reward plus active avoidance; (e) frequent, varied attempts to experience the increased magnitude and frequency of DA-related reward, such as through drugs and tobacco, and (f) irritability-hypersensitivity.

Overall, there is considerable evidence that variation in levels of 5HT in areas of the PFC, and therefore of levels of DA in the amygdala – OFC pathway, are associated with variation in ill-advised, rash, or risky acts. It may therefore be the case that this source of individual differences in the operation of this brain system creates conditions facilitative of the emergence of individual differences in positive and negative urgency. Certain gene polymorphisms appear to relate to variability in 5HT and DA levels; because they may therefore contribute to the neurotransmitter and brain system variability we have described, we consider them next.

### The Possible Role of Gene Polymorphisms

It appears to be the case that one contributor to variability in 5HT and DA levels is gene polymorphisms. The action of the neurotransmitters is influenced, in part, by variation among individuals in at least four target genes: the serotonin transporter gene (5HTTLPR) and dopamine receptors genes DRD2, DRD3, and DRD4. The 5HTTLPR gene is triallelic. It has one short allele, *s*, and two long alleles, *L<sub>g</sub>* and *L<sub>a</sub>* (Beitchman et al., 2006). The *s* and the *L<sub>g</sub>* alleles tend to be relatively low-expressing (they are present less often), and they are associated with lower brain levels of 5HT (Beitchman et al., 2006; Hu et al., 2006; Hu et al., 2005; Lakatos et al., 2003). The *a1* allele on the D2 dopamine receptor gene is associated with a reduced number of DA receptors, and hence more brain DA (Noble, 2003). Similarly, the 7-repeat allele on the D4 receptor gene and the *a1* and *a2* alleles on the D3 receptor gene are all associated with higher levels of emotional reactivity and emotion-based rash action (Auerbach, Faroy, Ebstein, Kahana, & Levine, 2001; Lakatos et al., 2003; Munafó et al., 2003; Oniszczenko & Dragan, 2005).

Researchers have attempted to understand the behavioral expression of these polymorphisms in different ways; some emphasize behaviors such as impulsive (but not planned) aggression

and others focus on disorders such as alcohol dependence (Davidson et al., 2000; Noble, 2003). From our point of view, each of these putative behavioral phenotypes can occur as an expression of emotion-based rash action. It therefore seems possible that these gene polymorphisms, perhaps through their influence on neurotransmitter levels, contribute to individual differences in the urgency traits.

In summary, there appears to be relatively well-developed evidence that brain connections between the left OFC/VM PFC and the amygdala contribute to the inhibition of actions in response to immediate, affectively felt needs, when those actions conflict with individuals' long-term interests and goals. It appears that low levels of 5HT and resulting high levels of DA in this pathway may reduce this useful function, resulting in higher rates of rash actions in response to current emotions. It may be the case that the presence of certain alleles in the 5HT transporter gene and in three DA receptor genes contributes to low 5HT and high DA levels.

Taken together, these findings suggest that facilitative conditions for the emergence of individual differences in urgency can be identified at the neurogenetic, neurotransmitter, and brain system levels. It is possible that gene polymorphisms contribute to low 5HT and high DA in the OFC – amygdala pathway, which undermine affect-guided planning and lead to actions not in one's long-term interests. Thus, characteristically low 5HT and high DA levels in this brain region may contribute to formation of the urgency traits. To date, though, no studies have tested relations among the gene polymorphisms, the neurotransmitter activity in this brain system, and measures of the urgency traits. Doing so constitutes an important next step in validation this proposition.

Having considered facilitative conditions for the emergence of urgency at the neurobiological level, we next describe how individual differences in urgency are likely to emerge in development. We first argue that aspects of temperament anticipate the emergence of the urgency traits. We then apply person-environment transaction theory to describe the likely stability of urgency tendencies from temperament to personality. We then consider urgency in adolescence; we suggest the likelihood that there is a developmentally limited spike in urgency during the adolescent years.

### **Temperament Anticipating Urgency**

Temperament has been defined as “individual differences in reactivity and self-regulation assumed to have a constitutional basis” (Rothbart, Ahadi, & Evans, 2000a, p. 123), and early temperament is thought to provide the substrate of subsequently emerging personality (Caspi, 1998; Eisenberg, Fabes, Guthrie, & Reiser, 2000). The dimensions identified by temperament researchers are thought to provide a basis, presumably in interaction with the environment, for the development of specific personality traits.

Investigations of infant temperament consistently find positive associations between emotionality and positive anticipation/approach behaviors, including tendencies to engage in rash or ill-advised behaviors (Rothbart et al., 2000a). Behavioral studies find that rash behavior and low inhibitory control are related to both indicators of positive affectivity (smiling and laughter) and negative affectivity (anger/frustration and aggression: Rothbart, Derryberry, & Hershey, 2000b; Rothbart, Derryberry, & Posner, 1994; Rothbart, Ziaie, & O'Boyle, 1992). For example, infants' positive affectivity and rates of approach behavior have been shown to relate to subsequent rash actions, higher anger, frustration, and aggression (Rothbart et al., 2000b). The same authors also found that proneness to anger at 10 months of age predicted subsequent high activity, positive anticipation, anger/frustration, high-intensity pleasure, rash behavior, and aggression. Thus, from infancy, high levels of emotionality tend to be associated with high levels of ill-considered, rash action.

Relatedly, infants differ in their ability to modify the intensity and duration of an emotion; some children are better at using behavioral strategies, such as gaze aversion, self-soothing, or proximity seeking to a caregiver in order to modify an emotional experience. It appears that infants are born with varying predispositions to adaptively and effectively use emotion regulation strategies to some extent (Buss & Goldsmith, 1998). These characteristics may be precursors to later individual differences in emotional lability and emotion regulation skills. Together, this constellation of individual differences in reactivity appears to anticipate the later emergence of positive and negative urgency.

At present, we have not yet tested an empirical model describing the specific developmental process by which temperament leads to urgency. There is no identified, developmental sequence from one factor of temperament to the urgency traits, nor is such a one-to-one association either likely or necessary for the theory of urgency. However, most temperament models emphasize both emotionality and the capacity for behavioral regulation (Eisenberg et al., 2000; Rothbart et al., 2000a), the latter of which can perhaps be considered a disposition not to engage in rash action. There is some lack of certainty as to how the two dimensions are related in infants and children. Possibilities considered by researchers are (a) emotionality and behavioral regulation are so highly correlated that one tends not to find independent effects of each, (b) each provides additive behavioral prediction over the other among infants and children, or (c) the two interact as well (Eisenberg et al., 1995; Eisenberg et al., 2000; Rothbart et al., 2000a; Rothbart & Bates, 1998). There is some, albeit limited, evidence for additive and interactive effects (Eisenberg et al., 2000).

One possible developmental model is that emotionality and behavioral regulation (Eisenberg et al., 2000) constitute separable, temperamental facilitative conditions for the emergence of the personality traits of positive and negative urgency. Perhaps individuals high on both temperament dimensions are more likely to develop the traits than are others. There are, of course, many other possibilities. We next consider the likely stability from temperament to personality, from the perspective of person-environment transaction theory.

**Temperament-Personality Stability**—There is evidence for considerable stability of individual differences described by temperament and personality models across the life span (Caspi & Roberts, 2001; Kagan, 2003; Roberts & DelVecchio, 2000). The concept of person-environment transactions offers a fruitful perspective for understanding this stability (Caspi, 1993; Caspi & Roberts, 2001; Smith, Williams, Cyders, & Kelley, 2006; Widiger & Smith, in press).

Authors have identified three forms of person-environment transactions: evocative, reactive, and selective. First, individuals of different temperaments tend to evoke different reactions from others. Friendly individuals tend to elicit friendly responses, and hostile individuals tend to elicit hostile responses (Ghaed & Gallo, 2006). In either case, one's initial temperament or personality bias tends to be confirmed by what one elicits from others: friendly responses from others reinforce one's friendliness, and hostile responses from others seem to confirm the basis for one's hostility. Second, individuals of different temperaments react to the same event differently from each other, and in fact appear to learn different things, even when they experience the same event (Caspi, 1993; Smith et al., 2006). Individuals high in negative affectivity are likely to perceive more events as stressful and anxiety-provoking than are even-tempered individuals, and are thus more likely to come to anticipate stressful events in the future. Again, one's initial bias appears to be confirmed by what one perceives.

Third, as individuals get older and come to have more control over their lives, they tend to select environments that are comfortable for their temperament and personality. For example, individual differences in sensation seeking influence career choices (Nicholson, Soane,

Fenton-O'Creevy, & Willman, 2005). By choosing environments that “fit” their personalities, individuals choose environments in which actions based on their personalities are more likely to be reinforced. Researchers have contended that these processes contribute to the stability of personality: individuals’ perspectives tend to be confirmed and reinforced (Caspi & Roberts, 2001).

**Possible Pathways for the Development of the Urgency Traits**—One can see the likelihood that a temperamental disposition toward emotionality and poor behavioral regulation might well lead to an increasing predilection for emotion-based rash action over time. Emotional, poor-regulated children appear to engage in more ill-considered behavior, and they evoke more negative, controlling behavior from adults and others (Ge, Conger, & Elder, 1996; Ge, Lorenz, & Conger, 1994; O'Connor, Deater-Deckard, & Fulker, 1998). They are more likely to react with strong emotions and accompanying decreased behavioral control to the negative behavior they experience from others (Rothbart, 1989). Thus, a combination of evocative and reactive person-environment transactions likely contributes to the emergence of stable propensities toward emotion-based rash action.

It may also be true that individual differences in emotionality and behavioral regulation affect the degree to which individuals learn adaptive emotion regulation strategies. If one is born with a predisposition to experience emotional states in unusually intense ways (Larsen, Billings, & Cutler, 1996), one would tend to experience more occasions in which one is less able to take full advantage of one's cognitive resources than would other individuals (Muraven & Baumeister, 2000; Tice et al., 2001). As a result, one might have more difficulty than others in learning to respond adaptively to a given affective change.

For these reasons, we believe the literature on early temperament together with the developmental personality literature on person-environment transactions describes a plausible pathway for the emergence of individual differences in emotion-based disposition toward rash action. Having outlined this pathway, we want to emphasize the caveat that there are substantial limits to the stability of individual differences. In Kagan's (1994, 2003) classic research on the stability of reactivity in infants, he found that only one-third of the highly reactive infants become very fearful and later earn the label inhibited, and only one-third of the low-reactive infants later earn the label uninhibited. This finding helps clarify the limits on the developmental stability of personologic individual differences; the findings suggest stability should not be understood deterministically (Kagan, 2003), but rather probabilistically.

### **The Role of Positive and Negative Urgency During Adolescence**

We believe there is striking circumstantial evidence that positive and negative urgency play an important role in adolescence. It seems likely that the normative adolescent experience involves a developmentally limited increase in levels of urgency, and also that there are important individual differences in the urgency traits during these years (Spear, 2000). We next briefly review the relevant adolescent development literature.

**Heightened Emotionality and Disposition Toward Rash Action During Adolescence**—Adolescents tend to experience greater emotional volatility than do children or adults (Larson & Richards, 1994), including heightened negative affect (Allen & Matthews, 1997; Brooks-Gunn, Graber, & Paikoff, 1994; Compas, Hinden, & Gerhard, 1995; Nelson et al., 2002; Rutter, Graham, & Chadwick, 1976; Spear, 2000; Vazquez, 1998; Walker, Perrin, Vale & Rivier, 1986), and accompanying increases in the rates of rash action, particularly when experiencing intense emotions (Arnett, 1992; Luna & Sweeney, 2004; Maggs & Hurrelmann, 1995; Moffitt, 1993; Nelson et al., 2002; Steinberg, 2004). There is reason to think that

substantial drops in 5HT binding during adolescence is associated with this process (Depue & Spoont, 1986).

MRI studies of the structural maturation of the human brain indicate that the prefrontal cortex (PFC) appears to mature last, and not until around age 20, and adolescence is characterized by reduced PFC activity, which likely leads to difficulties in inhibiting impulses, weighing the consequences of decisions, prioritizing, and strategizing among adolescents (Giedd, 2004; Lewis, Cruz, Eggan, & Erickson, 2004; Luna & Sweeney, 2004; Spear, 2000). In addition, there is less integration across brain systems in adolescence: the synaptic pruning and increased myelination that make possible rapid communication among brain regions is not yet as fully developed as it is in adults (Luna & Sweeney, 2004; Spear, 2000). Incomplete brain integration indicates less complete communication between inhibitory and appetitive systems; researchers have referred to this state as “dynamic late maturation throughout the neocortex” (Luna & Sweeney, 2004).

The implication of incomplete PFC development and incomplete brain integration is that adolescents’ ability to engage in affect-guided planning, so as to inhibit impulses and consider consequences before acting, is less consistent than that of adults. It appears to be particularly true that adolescents appear less able to consider consequences, to plan, and to inhibit actions in “hot” situations, i.e., under states of heightened emotionality (Luna & Sweeney, 2004; Nelson et al., 2002; Steinberg, 2004). Researchers have described ill-considered actions by adolescents who are both very happy and very distressed. Steinberg (2004), in his analysis of risk taking during adolescent years, observes that much of the difficulty adolescents have in resisting peer pressure, regulating their emotions and considering future consequences of their actions becomes magnified during states of positive arousal.

Taken together, these findings suggest that the normative adolescent experience is characterized by developmentally heightened levels of positive and negative urgency. Adolescents experience increased levels of emotionality and they show a particular deficit in inhibition during periods when they are highly emotional. They lack the full brain maturation necessary to engage in affect-guided planning; they are more likely than individuals of other ages to engage in emotion-based rash action. Indeed, it has been reported that 80% of 11.5 to 15 year olds exhibited one or more reckless behaviors during the preceding month (Arnett, 1992; Maggs & Hurrelmann, 1995; Moffitt, 1993).

It is possible that an adolescent spike in urgency actually has its roots in evolutionarily-driven adaptive functions. Although full consideration of this possibility is beyond the scope of this paper, it does appear to be the case that adolescence-limited increases in emotionality and risk-taking occur across species (Spear, 2000). Adolescents of multiple species find they are more distressed by their current circumstances, are more likely to take risks when distressed, are more reactive to their parents, are eager to see new things and take risks, and are compelled to do so with same-age peers (Spear, 2000). As a set, these changes may help enable adolescents to take on the next, crucial developmental step: leave the natal home (Spear, 2000). Humans move from childhood, when leaving home is unthinkable, to adolescence, when leaving home is possible and often desirable. Unfortunately, this apparently normative pattern does not appear to fit the context now faced by human adolescents. Their apparent experience of these tendencies generally does not, and likely should not, propel them from home. Perhaps the typical means for them to express these tendencies in the absence of their original *raison d’être* tend toward the maladaptive.

In addition, although this pattern appears normative, there are individual differences in the degree to which adolescents appear to engage in emotion-based rash action and risky behavior. Some adolescents experience addiction; some engage in early sex, homicide, or suicide; others

engage in non-planful aggression; and there is a heightened rate of accidents during adolescence (Grunbaum, Lowry, & Kann, 2001; Irwin, 1987, 1993, Windle & Windle, 2005).

The possibility of positive and negative urgency's role in both normative and dysfunctional adolescence requires formal testing. Given evidence for personality stability, and given the likelihood that some rash actions may tend to be reinforced due to their short-term benefits, it may be the case that high levels of urgency during adolescence predict both (a) high levels of urgency in adulthood and (b) a relative failure to develop more adaptive responses to intense emotion. Thus, it may be the case that individual differences in the experience and expression of urgency during adolescence contribute to individual differences in developmental trajectories beyond the adolescent years.

It seems clear that low levels of affect-guided planning, or high levels of positive and negative urgency, are likely to be associated with negative outcomes for individuals. In fact, it appears to be the case that the urgency traits are operative in some psychiatric disorders. Formal recognition of the traits may thus help inform intervention efforts.

## Urgency and Psychopathology

### Urgency and Diagnosable Disorders

Emotion-based rash action is either directly or indirectly implicated in the diagnostic criteria for a number of disorders as defined in the DSM-IV (American Psychiatric Association, 1994). The urgency traits appear to tie most directly to borderline personality disorder (BPD). BPD is a personality disorder characterized affective lability and rash or ill-considered acts, such as suicide attempts, self-harm, substance abuse, risky sex, and others (APA, 1994; Brodsky, Malone, Ellis, Dulit, & Mann, 1997; Duberstein & Conwell, 1997; Hueston, Mainous, & Schilling, 1996; Shea, Widiger, & Klein, 1992; Trull, Sher, Minks-Brown, Durbin, & Burr, 2000).

Research on the personality traits underlying BPD has indicated that emotion dysregulation/negative affectivity and rash actions characterize the behavior of individuals diagnosed with BPD (Ball, Tennen, Poling, Kramzler, & Rounsaville, 1997; Gurvits, Koenigsberg, & Siever, 2000; Linehan, 1993; Paris, 2000; Siever & Davis, 1991; Silk, 2000; Trull, 1992, 2001; Trull et al., 2000). In addition, BPD appears also to be characterized by low 5HT and high DA (Barbe et al., 2005; Friedel, 2004). As we discuss further below, well-validated clinical interventions identify BPD patients' risky behaviors as responses to their intense affect, and so focus on providing skills in affect management in order to reduce the harm such patients bring on themselves (Linehan, 1993).

Although urgency-like traits are not included in diagnostic criteria for most addictive behaviors, we believe the urgency traits can play an important role in such behaviors. Binge eating behavior characteristic of bulimia nervosa, heavy alcohol and drug use, and pathological gambling behaviors have all been shown to occur during periods of intense emotion for many individuals (Agras & Telch, 1998; Bandura, 1969; Colder & Chassin, 1997; Fischer et al., 2004; Fischer, Smith, & Anderson, 2003; Heatherton & Baumeister, 1991; Smyth et al., 2007; Swendson et al., 2000). Addictive behaviors have been described as reinforcing due to their self-medicating properties (particularly for alcohol and drug use: Bandura, 1969) and because they can distract one from a source of distress (Heatherton & Baumeister, 1991). Positive and negative urgency concurrently and prospectively predict problem drinking and illegal drug use, and positive urgency prospectively predicts risky sexual behavior (Cyders et al., 2007b; Zapolski et al., 2007). Negative urgency uniquely identifies eating disordered women who also have alcohol use disorders (Fischer et al., 2007).

Evidence supporting this contention also comes from learning theory. Adolescent girls who endorse the expectancy that eating can help manage their negative affect are more likely to begin and increase their binge eating during middle school (Smith, Simmons, Flory, Annus, & Hill, 2007c), and that expectancy differentiates bulimic women from others (Hohlstein, Smith, & Atlas, 1998). Adolescents who hold expectancies that drinking will reduce tension/distress and provide global improvement to their lives are more likely to begin problem drinking during middle school (Christiansen, Smith, Roehling, & Goldman, 1989).

There are, of course, other forms of dysfunction that may relate to high levels of the urgency traits. For example, it may be the case that hypomanic or manic states, characterized as they are by rash, ill-considered acts, represents something of an extreme expression of positive urgency. This and other possibilities merit investigation.

In sum, the current understanding of BPD is quite consistent with the possibility that individuals with that disorder are high on the urgency traits. Concerning addictive behaviors, there is growing evidence to support the view that the urgency traits play an important role.

### Urgency and Psychological Interventions

**Distress Tolerance Skill Training**—There is a growing body of clinical interventions that appear closely tied to the concept of urgency. For example, to the degree that individuals with BPD, or those engaging in addictive behaviors, are characterized by rash action based on intense emotions, an appropriate intervention may be to teach them to tolerate their extreme emotional states without immediate action, so as to avoid ill-chosen behaviors. This focus is most notably found in Dialectical Behavior Therapy for Borderline Personality Disorder (DBT; see Linehan, 1993).

One main focus of DBT is teaching individuals to respond adaptively to the experience of extreme emotional states, referred to in this treatment as Distress Tolerance Skills. These skills are taught in order to reduce the rash actions in which individuals diagnosed with BPD often engage. These behaviors range from suicidal gestures and attempts, heavy drinking, drug use, eating binges and purging, angry outbursts, reckless driving, risky sexual experience, and excessive spending (Linehan, 1993). Distress tolerance skills focus on engaging in more adaptive emotion-regulation actions, such as distracting oneself through watching a movie, soothing oneself through taking a hot bath, and improving the moment through prayer (Linehan, 1993). It is thought that these skills help manage the intense affect, thus facilitating individuals' return to their emotional set point, at which time they are more able to make decisions with their long-term interests in mind.

Recently, distress tolerance skill training has been applied effectively to disorders other than BPD, including drug/alcohol use and eating disorders. In each case, the focus is on learning to participate in other, more adaptive activities when distressed instead of engaging in the addictive behavior (Robins & Chapman, 2004). Clyne and Blampied (2004) provided training in emotion recognition and management, problem solving, assertiveness training, relaxation, and stress management to 11 women with binge eating disorder. This intervention appears to address the tendency for emotion-based rash action directly. The treatment reduced binge eating frequency, stress, and depression over the course of 11 sessions; no participant met criteria for binge eating disorder at follow-up.

We are unaware of interventions designed to help individuals avoid rash actions when experiencing extremely positive affect; perhaps such individuals are less likely to come to clinical attention. However, because individuals do participate in risky behaviors and may tend not to consider their long-term goals while experiencing extremely positive affect, an intervention should be developed to help individuals high in positive urgency maintain



attention on their long-term goals and avoid risky or dangerous behaviors. The particular contours of such an intervention need to be worked out. It seems unlikely that efforts to dampen the extremely positive mood through distraction would be welcomed by clients, but creative efforts to argue that maintenance of one's positive mood would be facilitated by careful consideration of the consequences of prospective actions might prove useful. Certainly further theoretical development and empirical research is necessary in this area.

Pharmacologic interventions that address the balance of 5HT and DA may serve a distress tolerance function. For example, SSRIs have been recommended as a first-line treatment for both the affective dysregulation and behavioral dyscontrol symptoms of BPD (Grossman, 2002; Soloff, 2000). Because 5HT and DA interact, it is likely that SSRIs are effective at treating emotion-based risky behavior because as the levels of 5HT in the brain are regulated, the DA levels are also stabilized. Perhaps, by increasing 5HT, and thus reducing DA levels, these drugs tend to reduce the propensity for rash action in patients. If so, they may actually facilitate the learning of adaptive emotion regulation and coping skills in the long run.

**Urgency-based Interventions as Distinct from Sensation Seeking-based Interventions**—Many prevention and intervention efforts with risk-taking adolescents have been based on the view that high levels of sensation seeking place adolescents at significant risk (Palmgreen & Donohew, 1993). Positive and negative urgency are both structurally and predictively distinct from sensation seeking; whereas sensation seeking increases risk for frequently engaging in risky behaviors, the urgency traits increase risk for problem levels of involvement in those behaviors (Cyders et al., 2007a; Cyders & Smith, 2007; Fischer, Anderson & Smith, 2004; Smith et al., 2007a). The two traits require different interventions.

For adolescents high in sensation seeking, researchers have developed media prevention messages with high “sensation value,” meaning they elicit unusually high levels of sensory arousal; these messages encourage alternative, safer means of seeking sensation (Stephenson, 2003). They have been effective in reducing substance use among high sensation seeking adolescents, and the effects were largely specific to that group (Everett & Palmgreen, 1995; Lorch, Palmgreen, & Donohew, 1994; Palmgreen, Donohew, & Lorch, 2001, 2002; Palmgreen & Donohew, 1993; Stephenson et al., 1999; Stephenson, Morgan, & Lorch, 2002). These efforts reflect an important success in selective prevention.

It seems unlikely that these kinds of prevention efforts would be effective for high-urgency adolescents; learning alternative ways to seek sensation would not address their affect-based risk. Instead, training on how to tolerate intense affect, analogous to distress tolerance training, may prove beneficial for this group of adolescents (Baer, Fischer, & Huss, 2005; Clyne & Blampied, 2004; Linehan, 1993; Robins & Chapman, 2004). Perhaps early exposure to affect tolerance training could reduce the rates of rash action among high-urgency adolescents, thus (a) reducing their risk for problem levels of involvement in risky behaviors and (b) providing them more opportunities to learn effective coping strategies. Thus, identification of urgency as distinct from sensation seeking may lead to an effective prevention tool for a group of high-risk adolescents who are not sensation seekers.

Additionally, individuals high in positive urgency would likely not benefit from interventions designed at redirecting thrill-seeking into more adaptive venues. These individuals often make poor decisions while in a positive affective state because they likely fail to maintain awareness of their long-term goals and because they may be biased to assume positive outcomes from their actions (Driesbach, 2006; Wright & Bower, 1992; Nygren et al., 1996). Therefore, these individuals would likely benefit from skills that would teach them to maintain access to their long-term goals, even when focused on immediate needs and pleasures. Additionally, they

would likely benefit from interventions aimed at education about the role of emotions, even positive ones, in risky behaviors.

## Summary

We have made the following argument. The experience of emotions facilitates action (Frijda, 1986; Lang, 1993; Saami et al., 1998). This process is fundamentally adaptive: emotional experience signals the presence of a need that the individual must meet. The more intense the need is, the more intensely felt is the emotion. If the experience of more intense emotions is likely to be associated with more pronounced needs, it is likely also associated with more unusual behavioral choices (such as may follow from intense fear or intense sexual attraction). Although this process is adaptive, there is evidence that extreme emotions, and efforts to regulate them, interfere with rational decision making and tax cognitive resources, thus increasing the likelihood of ill-considered behavior (Tice et al., 2001).

There are individual differences in the propensity to engage in ill-considered behaviors when experiencing intense emotion; these individual differences appear to be reflected in a broad trait called urgency, and its two facets; positive urgency (the tendency to engage in rash actions when experiencing extreme positive affect) and negative urgency (the tendency to engage in rash actions when experiencing extreme negative affect). The repeated tendency to engage in rash, ill-considered action when experiencing intense emotions increases the likelihood that one will engage in risky behaviors, and do so at problem levels. The urgency traits are structurally distinct from other dispositions to rash action (such as sensation seeking or a failure to plan) and predict different aspects of risky behavior from them. Positive and negative urgency are positively correlated with traits measuring subjective distress/neuroticism and negatively correlated with traits measuring conscientiousness and agreeableness.

The precursors to the urgency traits are recognizable in temperament research. Adolescence appears to be characterized by a developmentally limited increase in urgency; within that trend, individual differences in urgency among adolescents may be important for explaining both adolescent risky behavior and developmental trajectories following adolescence. Facilitative conditions for the emergence of the urgency traits are recognizable in a brain system relating the OFC to the amygdala, which has been shown to be involved in long-term planning in the face of intense emotion; high levels of urgency may be more likely among individuals with low levels of 5HT and high levels of DA operating in that brain system. Gene polymorphisms on the 5HT transporter gene and on three DA receptor genes (D2, D3, and D4) may influence the levels of the neurotransmitters. Figure 1 depicts the hypothesized process.

There are validated clinical interventions that appear to address the process of engaging in emotion-based rash action. These kinds of interventions may provide an additional tool, beyond well-validated interventions for sensation seekers, for clinicians seeking to reduce rates of rash, potentially harmful behaviors.

## Conclusion

We believe that this theoretical effort is important for several reasons. First, it offers a specific means by which emotionality relates to risky behaviors. A number of researchers have very fruitfully distinguished between internalizing and externalizing disorders (Krueger & Markon, 2006), yet the correlation between the internalizing and externalizing dimensions is quite strong. Identification of the urgency traits enables a direct assessment of an emotion-based disposition to rash action. To the degree that rash action leads to problem levels of involvement in risky behaviors, recognition of the urgency traits may lead to better understanding of the correlation between the two dimensions.

More broadly, this theoretical work may have implications for efforts to develop more complete explanations for the emergence of individual differences in behavior. We believe that rapid advances in the fields of molecular genetics, brain neurochemistry, brain structure, and precise trait definition are making it far more possible to understand the facilitative conditions for the emergence of important psychological traits than ever before. That we were able to identify well-validated programs of research pointing to relevant brain systems, the neurotransmitter activity within those systems, and gene polymorphisms related to the neurotransmitter activity—and tie those to research distinguishing urgency from other traits—provides an example of what is becoming increasingly possible.

Additionally, we point to two implications of this research for clinical intervention: first, recognizing the integration of emotionality and rash action may clarify for clinicians the nature of some individuals' dispositions to engage in risky behaviors. Second, interventions for those who participate in risky behaviors in response to extreme emotional states will likely differ from interventions for those who do so to seek new stimulation. In order to effectively treat individuals who engage in risky behaviors, a clinician must understand how emotions can lead to rash and ill-advised action. Treating such an individual for risk-taking without a focus on how emotion plays a role will be incomplete and will likely not yield therapeutic gains.

Of course, there are many questions yet to be answered that could shed further light on the value of our proposal. Does urgency operate in controlled, laboratory settings in ways predicted by our theory? Studies that manipulate emotional experiences for individuals high and low in negative and positive urgency might provide useful tests of whether high-urgency individuals do engage in more rash action when experiencing intense emotions. Is it true, as we have suggested, that adolescence is characterized by a developmentally limited increase in urgency? Do high levels of urgency retard the development of effective coping strategies? At what age can individual differences in the trait of urgency, as distinct from temperament, be identified? There are many such questions. Pending their answer, we believe that identification of the traits of positive and negative urgency helps clarify the personality connection between emotionality and rash action, and provides theoretically and clinically useful information for understanding reasons why individuals engage in risky, potentially harmful behaviors.

## Acknowledgments

Portions of this research were supported by NIAAA award 5 F31 AA 016265-03 to Melissa Cyders, under the supervision of Gregory Smith, and NIAAA award 1 RO1 AA 016166 to Gregory Smith. The authors thank Drs. Mark Fillmore, Nancy Grant-Harrington, and Richard Milich for their helpful comments on a previous draft of this manuscript.

## References

- Achenbach TM, Edelbrock CS. The classification of child psychopathology: A review and analysis of empirical efforts. *Psychological Bulletin* 1978;85:1275–1301. [PubMed: 366649]
- Agras WS, Telch CF. The effects of caloric deprivation and negative affect on binge eating in obese binge-eating disordered women. *Behavior Therapy* 1998;29:491–503.
- Allen MT, Matthews KA. Hemodynamic responses to laboratory stressors in children and adolescents: The influences of age, race, and gender. *Psychophysiology* 1997;34:329–339. [PubMed: 9175447]
- American Psychiatric Association. *Diagnostic and statistical manual of mental disorders*. Vol. 4th ed.. Author; Washington, DC: 1994.
- Anestis MD, Selby EA, Fink EL, Joiner TE. The multifaceted role of distress tolerance in dysregulated eating behaviors. *International Journal of Eating Disorders* 2007a;40:718–726. [PubMed: 17868125]
- Anestis MD, Selby EA, Joiner TE. The role of urgency in maladaptive behaviors. *Behaviour Research and Therapy* 2007b;45:3018–3029. [PubMed: 17923108]

- Arnett J. The soundtrack of recklessness: Musical preferences and reckless behavior among adolescents. *Journal of Adolescent Research* 1992;7:313–331.
- Arroll B, Macgillivray S, Ogston S, Reid I, Sullivan F, Williams B, et al. Efficacy and tolerability of tricyclic antidepressants and SSRIs compared with placebo for treatment of depression in primary care: A meta-analysis. *Annals of Family Medicine* 2005;3:449–456. [PubMed: 16189062]
- Auerbach JG, Faroy M, Ebstein R, Kahana M, Levine J. The association of the dopamine D4 receptor gene (DRD4) and the serotonin transporter promoter gene (5-HTTLPR) with temperament in 12-month-old infants. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 2001;42:777–783.
- Baer RA, Fischer S, Huss DB. Mindfulness and acceptance in the treatment of disordered eating. *Journal of Rational Emotive and Cognitive Behavior Therapy* 2005;23:281–300.
- Bagby RM, Joffe RT, Parker JDA, Schuller DR. Re-examination of the evidence for the DSM-III personality disorder clusters. *Journal of Personality Disorders* 1993;7:320–328.
- Ball S, Tennen H, Poling J, Kramzler HR, Rounsaville BJ. Personality, temperament, and character dimensions and the DSM-IV personality disorders in substance abusers. *Journal of Abnormal Psychology* 1997;106:545–553. [PubMed: 9358685]
- Bandura A. Social learning of moral judgments. *Journal of Personality and Social Psychology* 1969;11:275–279. [PubMed: 5784267]
- Barbas H. Specialized elements of orbitofrontal cortex in primates. *Linking Affect to Action: Critical Contributions of the Orbitofrontal Cortex* 2007;1121:10–32.
- Barbe RP, Rubovszky G, Venturini-Andreoli A, Andreoli A. The treatment of borderline personality disorder patients with current suicidal behaviour. *Clinical Neuropsychiatry: Journal of Treatment Evaluation* 2005;2:283–291.
- Bechara A, Damasio A, Damasio H, Anderson SW. Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition* 1994;50:7–15. [PubMed: 8039375]
- Bechara A, Damasio H, Tranel D, Damasio AR. Deciding advantageously before knowing the advantageous strategy. *Science* 1997;275:1293–1294. [PubMed: 9036851]
- Bechara A, Tranel D, Damasio H, Damasio AR. Failure to respond autonomically to anticipated future outcomes following damage to prefrontal cortex. *Cerebral Cortex* 1996;6:215–225. [PubMed: 8670652]
- Bechara A, Tranel D, Damasio H. Characterization of the decision-making deficit of patients with ventromedial prefrontal cortex lesions. *Brain* 2000;123:2189–2202. [PubMed: 11050020]
- Bechara A. The role of emotion in decision-making: Evidence from neurological patients with orbitofrontal damage. *Brain and Cognition* 2004;55:30–40. [PubMed: 15134841]
- Bechara A. Decision making, impulse control and loss of willpower to resist drugs: a neurocognitive perspective. *Nature Neuroscience* 2005;8:1458–1463.
- Beitchman JH, Baldassarra L, Mik H, De Luca V, King N, Bender D, et al. Serotonin transporter polymorphisms and persistent, pervasive childhood aggression. *American Journal of Psychiatry* 2006;163:1103–1105. [PubMed: 16741214]
- Billieux J, Rochat L, Rebetz MML, Van der Linden M. Are all facets of impulsivity related to self-reported compulsive buying behavior? *Personality and Individual Differences* 2008;44:1432–1442.
- Billieux J, Van der Linden M, Ceschi G. Which dimensions of impulsivity are related to cigarette craving? *Addictive Behaviors* 2007a;32:1189–1199. [PubMed: 16997490]
- Billieux J, Van der Linden M, D'Acremont M, Ceschi G, Zermatten A. Does impulsivity relate to perceived dependence on and actual use of the mobile phone? *Applied Cognitive Psychology* 2007b; 21:527–537.
- Blair KS, Newman C, Mitchell DGV, Richell RA, Leonard A, Morton J, Blair RJR. Differentiating among prefrontal substrates in psychopathy: Neuropsychological test findings. *Neuropsychology* 2006;20:153–165. [PubMed: 16594776]
- Blair RJR. Dysfunctions of medial and lateral orbitofrontal cortex in psychopathy. *Annals of the New York Academy of Science* 2007;1121:461–479.
- Bonnet M, Bradley MM, Lang PJ, Requin J. Modulation of spinal reflexes: Arousal, pleasure, action. *Psychophysiology* 1995;32:367–372. [PubMed: 7652113]

- Braithwaite V, Duncan-Jones P, Bosly-Craft R, Goodchild M. A psychometric investigation of the usefulness of the EASI-III Temperament Survey in the Australian general population. *Australian Journal of Psychology* 1984;36:85–95.
- Bremner JD, Staib LH, Kaloupek D, Southwick SM, Soufer R, Charney DS. Neural correlates of exposure to traumatic pictures and sound in Vietnam combat veterans with and without posttraumatic stress disorder: A positron emission tomography study. *Biological Psychiatry* 1999;45:806–816. [PubMed: 10202567]
- Brodsky BS, Malone KM, Ellis SP, Dulit RA, Mann JJ. Characteristics of borderline personality disorder associated with suicidal behavior. *American Journal of Psychiatry* 1997;154:1715–1719. [PubMed: 9396951]
- Brooks-Gunn J, Graber JA, Paikoff RL. Studying links between hormones and negative affect: Models and measures. *Journal of Research on Adolescence* 1994;4:469–486.
- Buss KA, Goldsmith HH. Fear and anger regulation in infancy: Effects on the temporal dynamics of affective expression. *Child Development* 1998;69:359–374. [PubMed: 9586212]
- Buss, AH.; Plomin, R. *A Temperament Theory of Personality Development*. John Wiley & Sons; New York: 1975.
- Cardinal RN, Everitt BJ. Neural and psychological mechanisms underlying appetitive learning: Links to drug addiction. *Current Opinion in Neurobiology* 2004;14:156–162. [PubMed: 15082319]
- Cardinal RN, Parkinson JA, Hall J, Everitt BJ. Emotion and motivation: The role of the amygdala, ventral striatum, and prefrontal cortex. *Neuroscience and Biobehavioral Reviews* 2002;26:321–352. [PubMed: 12034134]
- Carli M, Baviera M, Invernizzi RW, Balducci C. Dissociable contribution of 5-HT-sub(1A) and 5-HT-sub(2A) receptors in the medial prefrontal cortex to different aspects of executive control such as impulsivity and compulsive perseveration in rats. *Neuropsychopharmacology* 2006;31:757–767. [PubMed: 16192987]
- Caspi, A. Why maladaptive behaviors persist: Sources of continuity and change across the life course.. In: Funder, DC.; Parke, RD.; Tomlinson-Keasey, C.; Widaman's, K., editors. *Studying lives through time: Personality and development*. American Psychological Association; Washington, DC: 1993. p. 343-376.
- Caspi, A. *Personality development across the life course*. John Wiley & Sons Inc.; Hoboken, NJ: 1998.
- Caspi A, Roberts BW. Personality development across the life course: The argument for change and continuity. *Psychological Inquiry* 2001;12:49–66.
- Chambless D, Cherney J, Caputo G, Rheinstein B. Anxiety disorders and alcoholism: A study with inpatient alcoholics. *Journal of Anxiety Disorders* 1987;1:29–40.
- Christiansen BA, Smith GT, Roehling PV, Goldman MA. Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of Consulting and Clinical Psychology* 1989;57:93–99. [PubMed: 2925979]
- Clark LA. Temperament as a unifying basis for personality and psychopathology. *Journal of Abnormal Psychology* 2005;114:505–521. [PubMed: 16351374]
- Cleckley, H. *The Mask of Sanity*. Vol. 5th ed.. Mosby; St. Louis, MO: 1976.
- Clyne C, Blampied NM. Training in emotion regulation as a treatment for binge eating: A preliminary study. *Behaviour Change* 2004;21:269–281.
- Cohen, J.; Cohen, P.; West, SG.; Aiken, LS. *Applied multiple regression/correlation analysis for the behavioral sciences*. Vol. 3rd ed.. Lawrence Erlbaum Associates Publishers; Mahwah, NJ, US: 2003.
- Colder CR, Chassin L. Affectivity and impulsivity: Temperament risk for adolescent alcohol involvement. *Psychology of Addictive Behavior* 1997;11:83–97.
- Compas BE, Hinden BR, Gerhard DA. Adolescent development: Pathways and processes of risk and resilience. *Annual Review of Psychology* 1995;46:265–293.
- Cools R, Blackwell A, Clark L, Menzies L, Cox S, Robbins TW. Tryptophan depletion disrupts the motivational guidance of goals-directed behavior as a function of trait impulsivity. *Neuropsychopharmacology* 2005;30:1362–1373. [PubMed: 15770237]
- Cooper ML. Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment* 1994;6:117–128.

- Cooper ML, Agocha VB, Sheldon MS. A motivational perspective on risky behaviors: The role of personality and affect regulatory processes. *Journal of Personality* 2000;68:1059–1088. [PubMed: 11130732]
- Costa, PT.; McCrae, RR. Revised NEO Personality Inventory manual. Psychological Assessment Resources; Odessa, FL: 1992.
- Costa PT, McCrae RR. Domains and facets: Hierarchical personality assessment using the revised NEO personality inventory. *Journal of Personality Assessment* 1995;64:21–50. [PubMed: 16367732]
- Cyders, MA.; Flory, K.; Rainer, S.; Smith, GT. Prospective study of the integration of mood and impulsivity to predict increases in maladaptive action during the first year of college.. Paper presented at the annual meeting of the Research Society on Alcoholism; Chicago, IL. Jul. 2007b
- Cyders MA, Smith GT. Mood-based rash action and its components: Positive and negative urgency and their relations with other impulsivity-like constructs. *Personality and Individual Differences* 2007;43:839–850.
- Cyders MA, Smith GT. Clarifying the role of personality dispositions in risk for increased gambling behavior. *Personality and Individual Differences*. in press
- Cyders MA, Smith GT, Spillane NS, Fischer S, Annus AM, Peterson C. Integration of impulsivity and positive mood to predict risky behavior: Development and validation of a measure of positive urgency. *Psychological Assessment* 2007a;19:107–118. [PubMed: 17371126]
- Damasio H, Grabowski TJ, Frank R, Galaburda AM, Damasio AR. The return of Phineas Gage: Clues about the brain from the skull of a famous patient. *Science* 1994;264:1102–1105. [PubMed: 8178168]
- Davidson, RJ. Prefrontal cortex and amygdala contributions to emotion and affective style. Psychology Press/Taylor & Francis (UK); Hove, England: 1998.
- Davidson RJ. Pharmacotherapy of generalized anxiety disorder. *Journal of Clinical Psychiatry* 2000;62:46–50. [PubMed: 11414551]
- Davidson RJ. Darwin and the neural basis of emotion and affective style. *Annals of the New York Academy of Science* 2003;1000:316–336.
- Davidson RJ, Irwin W. The functional neuroanatomy of emotion and affective style. *Trends in Cognitive Sciences* 1999;3:11–21. [PubMed: 10234222]
- Davidson RJ, Putnam KM, Larson CL. Dysfunction in the neural circuitry of emotion regulation—a possible prelude to violence. *Science* 2000;289:591–594. [PubMed: 10915615]
- Daw ND, Kakade S, Dayan P. Opponent interactions between serotonin and dopamine. *Neural Networks* 2002;15:603–616. [PubMed: 12371515]
- Del Boca FK, Darkes J, Greenbaum PE, Goldman MS. Up close and personal: Temporal variability in the drinking of individual college students during their first year. *Journal of Consulting and Clinical Psychology* 2004;72:155–164. [PubMed: 15065951]
- Depue RA. Neurobiological factors in personality and depression. *European Journal of Personality* 1995;9:413–439.
- Depue, RA. A neurobiological framework for the structure of personality and emotion: Implications for personality disorders.. In: Clarkin, JF.; Lenzenweger, MF., editors. *Major theories of personality disorder*. Guilford Press; New York: 1996. p. 347-390.
- Depue RA, Collins PF. Neurobiology of the structure of personality: DA, facilitation of incentive motivation, and extraversion. *Behavioral and Brain Sciences* 1999;22:491–569. [PubMed: 11301519]
- Depue RA, Spont M. Conceptualizing a 5HT trait: A behavioral dimension of constraint. *Annals of the New York Academy of Sciences* 1986;487:47–62. [PubMed: 2436540]
- Devinsky O, Morrel MJ, Vogt BA. Contributions of anterior cingulate cortex to behaviour. *Brain: A Journal of Neurology* 1995;118:279–306. [PubMed: 7895011]
- Digman JM. Personality structure: Emergence of the Five Factor model. *Annual Review of Psychology* 1990;41:417–440.
- Digman JM. Higher-order factors of the Big Five. *Journal of Personality and Social Psychology* 1997;73:1246–1256. [PubMed: 9418278]
- Dolan RJ. The human amygdale and orbital prefrontal cortex in behavioural regulation. *Philosophical Transactions of the Royal Society B-Biological Sciences* 2007;362:787–799.

- Dreisbach G, Goschke T. How positive affect modulated cognitive control: reduced perseveration at the cost of increased distractibility. *Journal of Experimental Psychology – Learning Memory and Cognition* 2004;30:343–353.
- Driesbach G. How positive affect modulates cognitive control: The costs and benefits of reduced maintenance capability. *Brian and Cognition* 2006;60:11–19.
- Duberstein PR, Conwell Y. Personality disorders and completed suicide: A methodological and conceptual review. *Clinical Psychology: Science and Practice* 1997;4:359–376.
- Eisenberg N, Fabes RA, Guthrie IK, Reiser M. Dispositional emotionality and regulation: Their role in predicting quality of social functioning. *Journal of Personality and Social Psychology* 2000;78:136–157. [PubMed: 10653511]
- Eisenberg N, Fabes RA, Murphy B, Maszk P, Smith MC, Karbon M. The role of emotionality and regulation in children's social functioning: A longitudinal study. *Child Development* 1995;66:1360–1384. [PubMed: 7555221]
- Evenden J. Impulsivity: A discussion of clinical and experimental findings. *Journal of Psychopharmacology* 1999;13:180–192. [PubMed: 10475725]
- Everett MW, Palmgreen PP. Influences of sensation seeking, message sensation value, and program context on effectiveness of anticocaine public service announcements. *Health Communication* 1995;7:225–248.
- Eysenck SBG, Eysenck HJ. The place of impulsiveness in a dimensional system of personality description. *British Journal of Social and Clinical Psychology* 1977;16:57–68. [PubMed: 843784]
- Fink KB, Gothbert M. 5-HT receptor regulation of neurotransmitter release. *Pharmacological Reviews* 2007;59:360–417. [PubMed: 18160701]
- Fischer S, Anderson KG, Smith GT. Coping with distress by eating or drinking: The role of trait urgency and expectancies. *Psychology of Addictive Behaviors* 2004;18:269–274. [PubMed: 15482082]
- Fischer S, Smith GT. Deliberation affects risk taking beyond sensation seeking. *Personality and Individual Differences* 2004;36:527–537.
- Fischer S, Smith GT. Binge eating, problem drinking, and pathological gambling: Linking behavior to shared traits and social learning. *Personality and Individual Differences*. in press
- Fischer S, Smith GT, Anderson KG. Clarifying the role of impulsivity in bulimia nervosa. *International Journal of Eating Disorders* 2003;33:406–411. [PubMed: 12658670]
- Fischer S, Smith GT, Annus AM, Hendricks M. The relationship of neuroticism and urgency to negative consequences of alcohol use in women with bulimic symptoms. *Personality and Individual Differences* 2007;43:1199–1209.
- Fischer S, Smith GT, Cyders MA. Another look at impulsivity: A meta-analytic review comparing specific dispositions to rash action in their relationship to bulimic symptoms. Manuscript submitted for publication. 2008
- Fischer, S.; Smith, GT.; Spillane, N.; Cyders, MA. Urgency: Individual differences in reaction to mood and implications for addictive behaviors.. In: Clark, AV., editor. *The Psychology of Mood*. Nova Science Publishers; New York: 2005. p. 85-107.
- Floresco SB, Tse M. Dopaminergic regulation of inhibitory and excitatory transmission in the basolateral amygdala- prefrontal cortical pathway. *The Journal of Neuroscience* 2007;27:2045–2057. [PubMed: 17314300]
- Forgas, JP. Affect in social judgments and decisions: A multiprocess model.. In: Zanna, M., editor. *Advances in experimental social psychology*. Academic Press; San Diego, CA: 1992. p. 227-275.
- Forgas JP, Bower GH. Mood effects on person-perception judgments. *Journal of Personality and Social Psychology* 1987;53:53–60. [PubMed: 3612493]
- Frankle WG, Lombardo I, New AS, Goodman M, Talbot PS, Huang Y, et al. Brain 5HT transporter distribution in subjects with impulsive aggressivity: A positron emission study with <sup>1</sup>C-McN 5652. *American Journal of Psychiatry* 2005;162:915–923. [PubMed: 15863793]
- Friedel RO. DA dysfunction in borderline personality disorder: A hypothesis. *Neuropsychopharmacology* 2004;29:1029–1039. [PubMed: 15039763]
- Frijda, NH. *The Emotions*. Cambridge University Press; New York: 1986.

- Ge X, Conger RD, Elder GH. Coming of age too early: Pubertal influences on girls' vulnerability to psychological distress. *Child Development* 1996;67:3386–4000. [PubMed: 9071784]
- Ge X, Lorenz FO, Conger RD. Trajectories of stressful life events and depressive symptoms during adolescence. *Developmental Psychology* 1994;30:467–483.
- Ghaed SG, Gallo LC. Distinctions among agency, communion, and unmitigated agency and communion according to the interpersonal circumplex, five-factor model, and social-emotional correlates. *Journal of Personality Assessment* 2006;86:77–88. [PubMed: 16436022]
- Ghashghaei HT, Barbas H. Pathways for emotion: Interactions of prefrontal and anterior temporal pathways in the amygdala of the rhesus monkey. *Neuroscience* 2002;115:1261–1279. [PubMed: 12453496]
- Giedd JN. Structural magnetic resonance imaging of the adolescent brain. *Annals of the New York Academy of Sciences* 2004;1021:77–85. [PubMed: 15251877]
- Gleicher F, Weary G. Effect of depression on quantity and quality of social inferences. *Journal of Personality and Social Psychology* 1991;61:105–114. [PubMed: 1890581]
- Goldberg LR. An alternative “description of personality”: The Big-Five factor structure. *Journal of Personality and Social Psychology* 1990;59:1216–1229. [PubMed: 2283588]
- Gray JR. A bias towards short-term thinking in threat-related negative emotional states. *Personality and Social Psychology Bulletin* 1999;25:65–75.
- Green TR, Noice H. Influence of positive affect upon creative thinking and problem-solving in children. *Psychological Reports* 1988;63:895–898.
- Grossman R. Psychopharmacologic treatment of patients with borderline personality disorder. *Psychiatric Annals* 2002;32:357–370.
- Grunbaum JA, Lowry R, Kann L. Prevalence of health-related behaviors among alternative high school students as compared with students attending regular high schools. *Journal of Adolescent Health* 2001;29:337–343. [PubMed: 11691595]
- Gurvits IG, Koenigsberg HW, Siever LJ. Neurotransmitter dysfunction in patients with borderline personality disorder. *Psychiatric Clinics of North America* 2000;23:27–40. [PubMed: 10729929]
- Hajcak G, Molnar C, George MS, Bolger K, Koola J, Nahas Z. Emotion facilitates action: A transcranial magnetic stimulation study of motor cortex excitability during picture viewing. *Psychophysiology* 2007;44:91–97. [PubMed: 17241144]
- Hariri AR, Drabant EM, Weinberger DR. Imaging genetics: Perspectives from studies of genetically driven variation in serotonin function and corticolimbic affective processing. *Biological Psychiatry* 2006;59:888–897. [PubMed: 16442081]
- Heatherton TF, Baumeister RF. Binge eating as an escape from self-awareness. *Psychological Bulletin* 1991;110:86–108. [PubMed: 1891520]
- Hohlstein LA, Smith GT, Atlas JG. An application of expectancy theory to eating disorders: Development and validation of measures of eating and dieting expectancies. *Psychological Assessment* 1998;10:49–58.
- Holub A, Hodgins DC, Peden NE. Development of the temptations for gambling questionnaire: A measure of temptation in recently quit gamblers. *Addiction Research & Theory* 2005;13:179–191.
- Howell LL, Czoty PW, Byrd LD. Pharmacological interactions between serotonin and dopamine on behavior in the squirrel monkey. *Psychopharmacology* 1997;13:40–48. [PubMed: 9181634]
- Hu X, Oroszi G, Chun J, Smith TL, Goldman D, Schuckit MA. An expanded evaluation of the relationship of four alleles to the level of response to alcohol and the alcoholism risk. *Alcohol: Clinical and Experimental Research* 2005;29:8–16.
- Hu X, Lipsky RH, Guanshan Z, Longina AA, Taubman J, Greenberg BD, et al. Serotonin transporter promoter gain-of-function genotypes are linked to obsessive-compulsive disorder. *American Journal of Human Genetics* 2006;78:815–826. [PubMed: 16642437]
- Hueston WJ, Mainous AG, Schilling R. Patients with personality disorders: Functional status, health care utilization, and satisfaction with care. *The Journal of Family Practice* 1996;42:54–60. [PubMed: 8537806]
- Irwin, CE. *Adolescent social behavior and health*. Jossey-Bass; San Francisco: 1987.



- Irwin, CE. Adolescence and risk taking: How are they related?. In: Bell, NJ.; Bell, RW., editors. Adolescent risk taking. Sage Publications; Thousand Oaks, CA: 1993. p. 7-28.
- Isen AM. The influence of positive affect on risk-preference. *Bulletin of the Psychonomic Society* 1984;22:296–296.
- Isen AM. Positive affect, cognitive-processes, and social behavior. *Advances in Experimental Social Psychology* 1987;20:203–253.
- Isen AM, Daubman KA. The influence of affect on categorization. *Journal of Personality and Social Psychology* 1984;47:1206–1217.
- Isen AM, Daubman KA, Nowicki GP. Positive affect facilitates creative problem-solving. *Journal of Personality and Social Psychology* 1987;52:1122–1131. [PubMed: 3598858]
- Isen AM, Niedenthal PM, Cantor N. An influence of positive affect on social categorization. *Motivation and Emotion* 1992;16:65–78.
- Jeppson JE, Richards PS, Hardman RK, Granley HM. Binge and purge processes in bulimia nervosa: A qualitative investigation. *Eating Disorders: The Journal of Treatment and Prevention* 2003;11:115–128.
- Kagan J. On the nature of emotion. *Monographs of the Society for Research in Child Development* 1994;59:7–24. [PubMed: 7984168]
- Kagan J. Biology, context, and development inquiry. *Annual Review of Psychology* 2003;54:1–23.
- Kahn BE, Isen AM. The influence of positive affect on variety seeking among safe, enjoyable produces. *Journal of Consumer Research* 1993;20:257–270.
- Kornefel, S. Study says celebrations fuel drinking.. *The State News*. Nov 12002 [April 5, 2004]. from <http://www.statenews.com/article.phtml?pk=13529>
- Krakowski M. Violence and 5HT: Influence of impulse control, affect regulation, and social functioning. *Journal of Neuropsychiatry and Clinical Neurosciences* 2003;15:294–305. [PubMed: 12928505]
- Krueger RF, Markon KE. Reinterpreting comorbidity: A model-based approach to understanding and classifying psychopathology. *Annual Review of Clinical Psychology* 2006;2:111–133.
- Krueger R, Schmutte P, Caspi A, Moffitt T, Campbell K, Silva P. Personality traits are linked to crime among men and women: Evidence from a birth cohort. *Journal of Abnormal Psychology* 1994;103:328–338. [PubMed: 8040502]
- Lakatos K, Nemoda Z, Birkas E, Ronai Z, Kovacs E, Ney K, et al. Association of D4 dopamine receptor gene and serotonin transporter promoter polymorphisms with infants' response to novelty. *Molecular Psychiatry* 2003;8:90–97. [PubMed: 12556912]
- Lang, PJ. The motivational organization of emotion: Affect reflex connections.. In: van Goozen, S.; van der Poll, NE.; Sergeant, JA., editors. *The Emotions: Essays on Emotion Theory*. Erlbaum; Hillsdale, NJ: 1993. p. 61-96.
- Larsen RJ. Toward a science of mood regulation. *Psychological Inquiry* 2000;11:129–141.
- Larsen RJ, Billings DW, Cutler SE. Affect intensity and individual differences in informational style. *Journal of Personality* 1996;64:185–207. [PubMed: 8656315]
- Larson RW, Richards MH. Family emotions: Do young adolescents and their parents experience the same states? *Journal of Research on Adolescence* 1994;4:567–583.
- Ledoux JE. Emotion – Clues from the brain. *Annual Review of Psychology* 1995;46:209–235.
- LeDoux JE. Emotion circuits in the brain. *Annual Review of Neuroscience* 2000;23:155–184.
- Lee K, Ashton MC. Psychometric properties of the HEXACO personality inventory. *Multivariate Behavioral Research* 2004;39:329–358.
- Lewis MD, Todd RM. Getting emotional - A neural perspective on emotion, intention, and consciousness. *Journal of Consciousness Studies* 2005;12:210–235.
- Lewis MD, Todd RM. The self-regulating brain: Cortical-subcortical feedback and the development of intelligent action. *Cognitive Development* 2007;22:406–430.
- Lewis DA, Cruz D, Eggen S, Erickson S. Postnatal development of prefrontal inhibitory circuits and the pathophysiology of cognitive dysfunction in schizophrenia. *Annals of the New York Academy of Sciences* 2004;1021:64–76. [PubMed: 15251876]

- Limosin F, Loze JY, Dubertret C, Gouya L, Ades J, Rouillon F, et al. Impulsiveness as the intermediate link between the DA receptor D2 gene and alcohol dependence. *Psychiatric Genetics* 2003;13:127–129. [PubMed: 12782972]
- Linehan, MM. *Cognitive-behavioral treatment of borderline personality disorder*. Guilford Press; New York: 1993.
- Lorch EP, Palmgreen P, Donohew L. Attention, need for sensation, and health communication campaigns. *The American Behavioral Scientist* 1994;38:310–322.
- Lotze M, Veit R, Anders S, Birbaumer N. Evidence for a different role of the ventral and dorsal medial prefrontal cortex for social reactive aggression: An interactive fMRI study. *NeuroImage* 2007;34:470–478. [PubMed: 17071110]
- Luna B, Sweeney JA. The emergence of collaborative brain function: fMRI studies of the development of response inhibition. *Annals of the New York Academy of Sciences* 2004;1021:296–309. [PubMed: 15251900]
- Lynam DR, Widiger TA. Using a general model of personality to identify the basic elements of psychopathy. *Journal of Personality Disorders* 2007;21:160–178. [PubMed: 17492919]
- Maggs, JL.; Hurrelmann, K. *Health impairments in adolescence: The biopsychosocial “costs” of modern life-style*. Walter De Gruyter; Oxford, England: 1995.
- Markon KE, Krueger RF, Watson D. Delineating the structure of normal and abnormal personality: An integrative hierarchical approach. *Journal of Personality and Social Psychology* 2005;88:139–157. [PubMed: 15631580]
- Martin A, Sher K. Family history of alcoholism, alcohol use disorders, and the five factor model of personality. *Journal of Studies on Alcohol* 1994;50:81–90. [PubMed: 8189730]
- Maxwell JS, Davidson RJ. Emotion as motion - Asymmetries in approach and avoidant actions. *Psychological Science* 2007;18:1113–1119. [PubMed: 18031420]
- McCrae RR, Zonderman AB, Costa PT, Bond MH. Evaluating replicability of factors in the Revised NEO Personality Inventory: Confirmatory factor analysis versus Procrustes rotation. *Journal of Personality and Social Psychology* 1996;70:552–566.
- Miller J, Flory K, Lynam D, Leukefeld C. A test of the four-factor model of impulsivity-related traits. *Personality and Individual Differences* 2003;34:1403–1418.
- Mitchell DGV, Colledge E, Leonard A, Blair RJR. Risky decisions and response reversal: is there evidence of orbitofrontal cortex dysfunction in psychopathic individuals? *Neuropsychologia* 2002;40:2013–2022. [PubMed: 12207998]
- Moffitt T. Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review* 1993;100:674–701. [PubMed: 8255953]
- Morgan MJ, Impallomeni LC, Pirona A, Rogers RD. Elevated impulsivity and impaired decision-making in abstinent ecstasy (MDMA) users compared to polydrug and drug-naïve controls. *Neuropsychopharmacology* 2006;31:1562–1573. [PubMed: 16292322]
- Morgenson GJ, Jones DL, Yim CY. From motivation to action: functional interface between the limbic system and the motor system. *Progress in Neurobiology* 1980;14:69–97.
- Munafó MR, Clark TG, Moore LR, Payne E, Walton R, Flint J. Genetic polymorphisms and personality in healthy adults: A systematic review and meta-analysis. *Molecular Psychiatry* 2003;8:471–484. [PubMed: 12808427]
- Muraven M, Baumeister RF. Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin* 2000;126:247–259. [PubMed: 10748642]
- Nelson CA, Bloom FE, Cameron JL, Amaral D, Dahl RE, Pine D. An integrative, multidisciplinary approach to the study of brain-behavior relations in the context of typical and atypical development. *Development and Psychopathology* 2002;14:499–520. [PubMed: 12349871]
- Nicholson N, Soane E, Fenton-O’Creavy M, Willman P. Personality and domain-specific risk taking. *Journal of Risk Research* 2005;8:157–176.
- Noble EP. D2 dopamine receptor gene in psychiatric and neurologic disorders and its phenotypes. *American Journal of Medical Genetics Part B (Neuropsychiatric Genetics)* 2003;116B:103–125. [PubMed: 12497624]

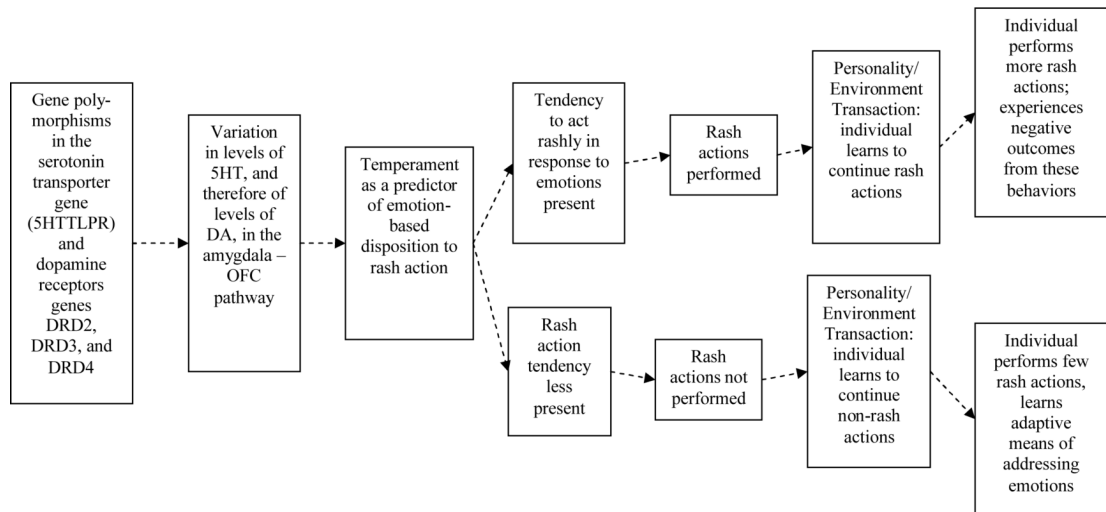
- Nygren TE, Isen AM, Taylor PJ, Dulin J. The influence of positive affect on the decision rule in risk situations: Focus on outcome (and especially avoidance of loss) rather than probability. *Organizational Behavior and Human Decision Processes* 1996;66:59–72.
- O'Connor TG, Deater-Deckard K, Fulker D. Genotype-environment correlations in late childhood and early adolescence: Antisocial behavioral problems and coercive parenting. *Developmental Psychology* 1998;34:970–981. [PubMed: 9779743]
- Oniszczenko W, Dragan WL. Association between dopamine D4 receptor exon III polymorphism and emotional reactivity as a temperamental trait. *Twin Research and Human Genetics* 2005;8:633–637. [PubMed: 16354504]
- Palmgreen, P.; Donohew, L. Effective mass media strategies for drug abuse prevention campaigns: the SENTAR approach. In: Bukoski, WJ.; Sloboda, Z., editors. *Handbook of Drug Abuse Prevention: Theory, Science, and Practice*. Kluwer/Plenum; New York: 1993. p. 27-43.
- Palmgreen P, Donohew L, Lorch EP. Television campaigns and adolescent marijuana use: Tests of sensation seeking targeting. *American Journal of Public Health* 2001;91:292–296. [PubMed: 11211642]
- Palmgreen, P.; Donohew, L.; Lorch, EP. Television campaigns and sensation seeking targeting of adolescent marijuana use: A controlled time series approach. In: Hornik, RC., editor. *Public health communication: Evidence for behavior change*. Lawrence Erlbaum Associates; Mahwah, NJ: 2002. p. 35-56.
- Paris J. Childhood precursors of borderline personality disorder. *Psychiatric Clinics of North America* 2000;23:77–88. [PubMed: 10729932]
- Patterson MC, Newman JP. Reflectivity and learning from aversive events: Toward a psychological mechanism for the syndromes of disinhibition. *Psychological Review* 1993;100:716–736. [PubMed: 8255955]
- Patton JH, Stanford MS, Barratt ES. Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology* 1995;51:768–774. [PubMed: 8778124]
- Peterson CM, Smith GT. Factor analyses of NEO-PI-R and UPPS-R Impulsivity scale in relation to positive urgency. 2007Unpublished raw data
- Petry N. Substance abuse, pathological gambling, and impulsiveness. *Drug and Alcohol Dependence* 2001;63:29–38. [PubMed: 11297829]
- Peveler R, Fairburn C. Eating disorders in women who abuse alcohol. *British Journal of Addiction* 1990;85:1633–1638. [PubMed: 2289064]
- Phillips LH, MacLean RDJ, Allen R. Age and the understanding of emotions: *Neuropsychol*. 2002
- Pinker, S. *How the Mind Works*. W. W. Norton & Company; New York: 1997.
- Preston SD, Buchanan TW, Stansfield RB, Bechara A. Effects of anticipatory stress on decision making in a gambling task. *Behavioral Neuroscience* 2007;121:257–263. [PubMed: 17469915]
- Raleigh MI, Brammer GL. Individual differences in serotonin-2 receptors and social behavior in monkeys. *Social Neuroscience Abstracts* 1993;19:592.
- Rauch S, van der Kolk BA, Fislser R, Alpert NM, Orr SP, Savage CR. A symptom provocation study of posttraumatic stress disorder using positron emission tomography and script-driven imagery. *Archives of General Psychiatry* 1996;53:380–387. [PubMed: 8624181]
- Roberts BW, DeVecchio WF. The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin* 2000;126:3–25. [PubMed: 10668348]
- Robins CJ, Chapman AL. Dialectical behavior therapy: Current status, recent developments, and future directions. *Journal of Personality Disorders* 2004;18:73–89. [PubMed: 15061345]
- Rothbart, MK. Behavioral approach and inhibition. In: Reznick, JS., editor. *Perspectives on behavioral inhibition*. University of Chicago Press; Chicago, IL, US: 1989. p. 139-157.
- Rothbart MK, Ahadi SA, Evans DE. Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology* 2000a;78:122–135. [PubMed: 10653510]
- Rothbart, MK.; Bates, JE. *Temperament*. John Wiley & Sons Inc.; Hoboken, NJ: 1998.
- Rothbart, MK.; Derryberry, D.; Hershey, K. Stability of temperament in childhood: Laboratory infant assessment to parent report at seven years. In: Molfese, VJ.; Molfese, DL., editors. *Temperament*

and personality development across the life span. Lawrence Erlbaum Associates Publishers; Mahwah, NJ: 2000b. p. 85-119.

- Rothbart, MK.; Derryberry, D.; Posner, MI. A psychobiological approach to the development of temperament.. In: Bates, JE.; Wachs, TD., editors. Temperament: Individual differences at the interface of biology and behavior. American Psychological Association; Washington, DC: 1994. p. 83-116.
- Rothbart, MK.; Ziaie, H.; O'Boyle, CG. Self-regulation and emotion in infancy.. In: Eisenberg, N.; Fabes, RA., editors. Emotion and its regulation in early development. Jossey-Bass; San Francisco: 1992. p. 7-23.
- Russell JA. Core affect and the psychological construction of emotion. *Psychological Review* 2003;110:145–172. [PubMed: 12529060]
- Rutter M, Graham P, Chadwick OF. Adolescent turmoil: Fact or fiction? *Journal of Child Psychology and Psychiatry* 1976;17:35–56. [PubMed: 1249139]
- Saami, C.; Mumme, DL.; Campos, JJ. Emotional development: Action, communication, and understanding. John Wiley & Sons Inc.; Hoboken, NJ: 1998.
- Schuckit MA, Smith TL. An evaluation of the level of response to alcohol, externalizing symptoms, and depressive symptoms as predictors of alcoholism. *Journal of Studies on Alcohol* 2006;67:215–227. [PubMed: 16562403]
- Shea MT, Widiger TA, Klein MH. Comorbidity of personality disorders and depression: Implications for treatment. *Journal of Consulting and Clinical Psychology* 1992;60:857–868. [PubMed: 1460149]
- Sheppard D, Smith GT, Rosenbaum G. Use of MMPI subtypes in predicting completion of a residential alcoholism treatment program. *Journal of Consulting and Clinical Psychology* 1988;56:590–596. [PubMed: 3198818]
- Shiv B, Loewenstein G, Bechara A. The dark side of emotion in decision-making: When individuals with decreased emotional reactions make more advantageous decisions. *Cognitive Brain Research* 2005;23:85–92. [PubMed: 15795136]
- Siever LJ, Davis KL. A psychobiological perspective on the personality disorders. *American Journal of Psychiatry* 1991;148:1647–1658. [PubMed: 1957926]
- Silk K. Overview of biologic factors. *Psychiatric Clinics of North America* 2000;23:61–75. [PubMed: 10729931]
- Slovic P, Finucane ML, Peters E, MacGregor DG. Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis* 2004;24:311–322. [PubMed: 15078302]
- Smith GT, Fischer S, Cyders MA, Annus AM, Spillane NS, McCarthy DM. On the validity of discriminating among impulsivity-like traits. *Assessment* 2007a;14:155–170. [PubMed: 17504888]
- Smith, GT.; Fischer, S.; Cyders, MA.; Annus, AM.; Spillane, NS. Toward a comprehensive model of multiple dispositions to rash action.. Paper presented at the annual international meeting of the Research Society on Alcoholism; Chicago, IL. Jul. 2007b
- Smith GT, Simmons JR, Flory K, Annus AM, Hill KK. Thinness and eating expectancies predict subsequent binge-eating and purging behavior among adolescent girls. *Journal of Abnormal Psychology* 2007c;116:188–197. [PubMed: 17324029]
- Smith GT, Williams SF, Cyders M, Kelley S. Reactive personality-environment transactions and the transition to adulthood. *Developmental Psychology* 2006;42:877–887. [PubMed: 16953693]
- Smyth JM, Heron KE, Sliwinski MJ, Wonderlich SA, Crosby RD, Mitchell JE, et al. Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting and Clinical Psychology* 2007;75:629–638. [PubMed: 17663616]
- Soloff PH. Psychopharmacology of borderline personality disorder. *Psychiatric Clinics of North America* 2000;23:169–192. [PubMed: 10729938]
- Spear LP. Neurobehavioral changes in adolescence. *Current Directions in Psychological Science* 2000;9:111–114.
- Spillane NS, Smith GT. A theory of reservation-dwelling American Indian alcohol use risk. *Psychological Bulletin* 2007;133:395–418. [PubMed: 17469984]

- Spinella M. The role of prefrontal systems in sexual behavior. *International Journal of Neuroscience* 2007;117:369–385. [PubMed: 17365121]
- Spoont MR. Modulatory role of 5HT in neural information processing: Implications for human psychopathology. *Psychological Bulletin* 1992;112:330–350. [PubMed: 1454898]
- Steinberg L. Risk taking in adolescence: What changes, and why? *Annals of the New York Academy of Sciences* 2004;1021:51–58. [PubMed: 15251873]
- Stephenson MT. Mass media strategies targeting high sensation seekers: What works and why. *American Journal of Health Behavior* 2003;27:S233–S238. [PubMed: 14672384]
- Stephenson MT, Morgan SE, Lorch EP. Predictors of exposure from an anti-marijuana media campaign: Outcome research assessing sensation seeking targeting. *Health Communication* 2002;14:23–43. [PubMed: 11853208]
- Stephenson MT, Palmgreen P, Hoyle RH, Donohew L, Lorch EP, Colon SE. Short-term effects of an anti-marijuana media campaign targeting high sensation seeking adolescents. *Journal of Applied Communication Research* 1999;27:175–195.
- Stuettgen MC, Hennig J, Reuter M, Netter P. Novelty seeking but not BAS is associated with high DA as indicated by a neurotransmitter challenge test using mazindol as a challenge substance. *Personality and Individual Differences* 2005;38:1597–1608.
- Swendson JD, Tennen H, Carney MA, Affleck G, Willard A, Hromi A. Mood and alcohol consumption: An experience sampling test of the self-medication hypothesis. *Journal of Abnormal Psychology* 2000;109:198–204. [PubMed: 10895557]
- Tellegen, A. MPQ Manual. University of Minnesota Press; Minneapolis, Mn: in press
- Thorpe ET, Rolls SJ, Madison SP. Responses of striatal neurons in the behaving monkey: I. Head of the caudate nucleus. *Behavioural Brain Research* 1983;7:179–210. [PubMed: 6830651]
- Tice DM, Bratslavsky E. Giving in to feel good: The place of emotion regulation in the context of general self-control. *Psychological Inquiry* 2000;11:149–59.
- Tice DM, Bratslavsky E, Baumeister RF. Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology* 2001;80:53–67. [PubMed: 11195891]
- Trull TJ. Relationships of borderline features to parental mental illness, childhood abuse, Axis I disorder, and current functioning. *Journal of Personality Disorders* 1992;15:19–32. [PubMed: 11236812]
- Trull TJ. Structural relations between borderline personality disorder and putative etiological correlates. *Journal of Abnormal Psychology* 2001;110:471–481. [PubMed: 11502090]
- Trull TJ, Sher K, Minks-Brown C, Durbin J, Burr R. Borderline personality disorder and substance use disorders: A review and integration. *Clinical Psychology Review* 2000;20:235–253. [PubMed: 10721499]
- van-Gaalen MM, Brueggeman RJ, Bronius PFC, Schoffelmeer ANM, Vanderschuren LJMJ. Behavioral disinhibition requires DA receptor activation. *Psychopharmacology* 2006;187:73–85. [PubMed: 16767417]
- van-Gaalen MM, van-Koten R, Schoffelmeer ANM, Vanderschuren LJMJ. Critical involvement of DArgic neurotransmission in impulsive decision making. *Biological Psychiatry* 2006;60:66–73. [PubMed: 16125144]
- Vazquez DM. Stress and the developing limbic-hypothalamic-pituitary-adrenal axis. *Psychoneuroendocrinology* 1998;23:663–700. [PubMed: 9854741]
- Verdejo-Garcia A, Bechara A, Recknor EC, Perez-Garcia M. Negative emotion-driven impulsivity predicts substance dependence problems. *Drug and Alcohol Dependence* 2007;91:213–219. [PubMed: 17629632]
- Walker CD, Perrin M, Vale W, Rivier C. Ontogeny of the stress response in the rat: Role of the pituitary and the hypothalamus. *Endocrinology* 1986;118:1445–1451. [PubMed: 3004915]
- Whiteside SP, Lynam DR. The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences* 2001;30:669–689.
- Whiteside SP, Lynam DR. Understanding the role of impulsivity and externalizing psychopathology in alcohol abuse: Applications of the UPPS Impulsive Behavior Scale. *Experimental and Clinical Psychopharmacology* 2003;11:210–217. [PubMed: 12940500]

- Whiteside SP, Lynam DR, Miller JD, Reynolds SK. Validation of the UPPS impulsive behavior scale: A four-factor model of impulsivity. *European Journal of Personality* 2005;19:559–574.
- Widiger, TA.; Smith, GT. Personality and psychopathology.. In: John, O.; Robins, RW.; Pervin, L., editors. *Handbook of Personality: Theory and Research*. Vol. Third Edition. Guilford; NY: in press
- Widiger TA, Trull TJ. Plate tectonics in the classification of personality disorder: Shifting to a dimensional model. *American Psychologist* 2007;62:71–83. [PubMed: 17324033]
- Windle, M.; Windle, RC. Alcohol consumption and its consequences among adolescents and young adults.. In: Galanter, M., editor. *Recent developments in alcoholism: Volume 17*. Kluwer Academic/Plenum Publishers; New York: 2005. p. 67-83.
- Winstanley CA, Dalley JW, Theobald DEH, Robbins TW. Fractionating impulsivity: Contrasting effects of central 5-HT depletion on different measures of impulsive behavior. *Neuropsychopharmacology* 2004;29:1331–1343. [PubMed: 15054475]
- Winstanley CA, Eagle DM, Robbins TW. Behavioral models of impulsivity in relation to ADHD: Translation between clinical and preclinical studies. *Clinical Psychology Review* 2006;26:379–395. [PubMed: 16504359]
- Winstanley CA, Theobald DEH, Dalley JW, Glennon JC, Robbins TW. 5-HT<sub>2A</sub> and 5-HT<sub>2C</sub> receptor antagonists have opposing effects on a measure of impulsivity: Interactions with global 5-HT depletion. *Psychopharmacology* 2004;176:376–385. [PubMed: 15232674]
- Wright WF, Bower GH. Mood effects on subjective-probability assessment. *Organizational Behavior and Human Decision Processes* 1992;52:276–291.
- Yuen KSL, Lee TMC. Could mood state affect risk-taking decisions? *Journal of Affective Disorders* 2003;75:11–18. [PubMed: 12781345]
- Zald DH, Depue RA. Serotonergic functioning correlates with positive and negative affect in psychiatrically healthy males. *Personality and Individual Differences* 2001;30:71–86.
- Zapolski, TBC.; Cyders, MA.; Rainer, S.; Smith, GT. Examination of the relationship between positive urgency, drug use, and risky sex.. Paper presented at the annual meeting of the American Psychological Association; San Francisco, CA. Aug. 2007
- Zuckerman, M. Behavioral expressions and biosocial bases of sensation seeking. Cambridge University Press; New York: 1994.
- Zuckerman M, Kuhlman DM, Joireman J, Teta P, Kraft M. A comparison of three structural models for personality: The Big Three, the Big Five, and the alternative five. *Journal of Personality and Social Psychology* 1993;65:757–768.



**Figure 1.** Developmental path of trait urgency to participation in a wide range of risky and problematic behaviors. Arrows with dotted lines are used to reflect the probabilistic nature of the hypothesized associations.