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DISTINGUISHING AMONG WITHIN-PERSON VARIABILITY: AFFECTIVE INTRA-INDIVIDUAL VARIABILITY, AFFECTIVE PSYCHOLOGICAL FLEXIBILITY, AND HEALTH IN A NATIONAL US SAMPLE

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DISTINGUISHING AMONG WITHIN-PERSON VARIABILITY: AFFECTIVE INTRA-INDIVIDUAL VARIABILITY, AFFECTIVE PSYCHOLOGICAL FLEXIBILITY, AND HEALTH IN A NATIONAL US SAMPLE

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Arts and Sciences at the University of Kentucky

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ABSTRACT OF DISSERTATION

DISTINGUISHING AMONG WITHIN-PERSON VARIABILITY: AFFECTIVE INTRA-INDIVIDUAL VARIABILITY, AFFECTIVE PSYCHOLOGICAL FLEXIBILITY, AND HEALTH IN A NATIONAL US SAMPLE

Affective intra-individual variability (IIV) and affective psychological flexibility (PF) are both types of within-person variability. Affective IIV is defined as the range of emotions experienced by an individual assessed at multiple time points. PF is defined as the ability to vary one's responses in a contextually dependent manner in order to appropriately meet situational demands. Currently, there are no comparisons between affective IIV and PF demonstrating how these constructs might be uniquely different from each other. The current study proposed to examine affective IIV and PF in order to establish discriminant and convergent validity, and stability data for each construct. The National Study of Daily Experiences (NSDE) waves 1 and 2, an 8-day daily diary portion of the Midlife Development in the United States (MIDUS I) and MIDUS II surveys was used for this study (n =793 adults completed both waves of the NSDE). Affective IIV was related to higher mean NA and neuroticism, and lower perceived control. Affective PF was related to lower mean NA, neuroticism, and higher mean PA and perceived control. Higher affective IIV was associated with more psychological distress when assessed concurrently at both waves and predicted more psychological distress and physical ill-health 10 years later. Higher affective PF was related to less psychological distress and physical ill-health when assessed concurrently at wave 1 and less psychological distress and physical ill-health 10 years later. When situational context is included in the calculation of emotional variability, changes in emotional response may represent emotional complexity and increased control rather than emotional lability and are related to better psychological and physical outcomes.

KEYWORDS: within-person variability, intra-individual variability, affective psychological flexibility, physical health, psychological health, MIDUS

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DISTINGUISHING AMONG WITHIN-PERSON VARIABILITY: AFFECTIVE INTRA-INDIVIDUAL VARIABILITY, AFFECTIVE PSYCHOLOGICAL FLEXIBILITY, AND HEALTH IN A NATIONAL US SAMPLE

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To the women in my life who have encouraged, challenged, and supported me along the way: Elzbieta Wala, Jewell Sloan, Karen Billings, Jenn Young, Lise Solberg Nes, and Suzanne Segerstrom. To my mother, Kelly Hardison, who said that if she could teach me how to learn, I could do anything. You were right.

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Chapter 1: Introduction

Within-person variability can be thought of as short-term changes that are more or less reversible and that may be different across individuals (Nesselroade, 2001). Two types of within-person variability, intra-individual variability (IIV) and psychological flexibility (PF), have been associated with different psychological and physical health outcomes. IIV has been traditionally associated with poorer psychological and physical outcomes (Röcke & Brose, 2013), whereas PF may be related to better psychological and physical health outcomes (Kashdan & Rottenberg, 2010). However, there is still fairly limited research into the outcomes of PF and what personality factors may be distinctly related to PF versus IIV. In addition, psychometric data need to establish PF as a distinct construct. Although there is well-established reliability and stability for IIV as an individual difference (Eid & Diener, 1999; Penner, Shiffman, Paty, & Fritzsche, 1994), there is no reliability or stability evidence for PF. Trait analyses of PF that demonstrate stability, over both a measurement burst (such as within-wave) and across time, convergent and discriminant validity would help establish this as an individual difference.

Currently there are no comparisons between IIV and PF demonstrating how these constructs might be different from each other. It would be useful to show a side-by-side comparison of these constructs within one study to establish IIV and PF as distinct constructs.

Within-Person Variability of Affect

Affective IIV may be defined as the range of emotions experienced by an individual assessed at multiple times (Eid & Diener, 1999). IIV is distinct from a person's mean level of response but specifically refers to a person's change in response when measured at different time points. It is important to note, however, that studies examining IIV do not measure different types of situation or the pattern of how the response and situation may be paired, but simply the change of a particular response over time. In IIV studies, it is typically unknown whether the pattern of response is linked to a pattern of situations (e.g., negative or positive events). When assessing affective IIV, it is unknown what the pattern of response may be under different circumstances, such as negative events or positive events, as these situations are not included in the analyses. Thus, IIV is the range or frequency of a response analyzed independent of situation, and it is most commonly operationalized as the individual's standard deviation (iSD) (for an excellent review see Ram & Gerstorf, 2009).

PF has been defined as the ability to vary one's responses in a contextually dependent manner in order to appropriately meet the situational demands (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Cheng, 2001; Fujimura & Okanoya, 2012; Tracey, 2005; Westphal, Seivert, & Bonanno, 2010). This refers to within-person variation where the response is dependent on the situation and is a patterned, predictable response. Affective PF therefore refers to the ability to match one's emotional experience to the situational cue and the ability to switch emotions across different situations (Fujimura & Okanoya, 2012; Waugh, Thompson, & Gotlib, 2011). The key components for operationalizing affective PF are multiple responses matched to multiple situations, a theory of situational fit predicting contextually appropriate responses, and a difference score based on the theory of fit. The difference score can then be used as a between-person variable to predict health outcomes.

Studies examining affective IIV suggest that higher IIV is related to higher distress (Gruber, Kogan, Quoidbach, & Mauss, 2013), depression (Peter Kuppens, Van Mechelen, Nezlek, Dossche, & Timmermans, 2007), neuroticism (Eid & Diener, 1999), and lower agreeableness and extraversion (Timmermans, Van Mechelen, & Kuppens, 2010). In contrast, studies examining affective PF indicate that higher PF is related to higher resilience (Waugh et al., 2011) and higher heart rate variability (HRV) (Fujimura & Okanoya, 2012).

Theories of Affective Psychological Flexibility

A number of theories indicate that the optimal experience of positive and negative affect should depend on the situational context. Some research suggests that NA and PA are opposite ends of the same spectrum (Feldman-Barrett & Russell, 1998; Russell & Carroll 1999), whereas other research suggests that NA and PA may be orthogonal (Cacioppo & Bernston, 1994; Watson & Clark, 1997). It has been suggested that the relationship of NA and PA itself may vary depending on the situation (Davis, Zautra, & Smith, 2004), switching between a bipolar relationship and an orthogonal relationship. The following three theories describe the relationship between NA and PA dimensions in situational context.

The Emotional Congruency Model (Congruent Variability) theory of affective PF suggests that it is most adaptive to experience emotions congruent with the situation. That is, positive affect (PA) in positive situations and negative affect (NA) in negative situations, as well as more ability to switch between these different emotions, ought to be related to higher well-being (Fujimura & Okanoya, 2012; Waugh et al., 2011). In this model, higher NA is positively correlated with more negative events, and PA is negatively correlated with more negative events. Conversely, higher PA is positively correlated with more positive events, and NA is negatively correlated with more positive events. This analysis assumes NA and PA are bipolar, with NA at one end of the scale and PA at the other.

However, PA and NA are not always bipolar, such that one experiences one type of emotion in the absence of the other, but may instead be orthogonal (Cacioppo & Bernston, 1994; Watson & Clark, 1997). The Maintenance of Emotional Complexity Model (Complexity Variability) of affective PF assumes an orthogonal relationship between NA and PA where PA may be experienced in the presence of NA during negative events. In this model, the ability to experience positive affect during a stressor may buffer against the development of depressive symptoms (Fredrickson, Tugade, Waugh, & Larkin, 2003), as well as decreasing the cardiovascular recovery time experienced during negative events (Tugade & Fredrickson, 2004). In this model, it is thought to be most adaptive to experience congruent emotions with the situational stimuli (i.e., PA in positive situations and NA in negative situations). However, in contrast to the Emotional Congruency Model, Maintenance of Emotional Complexity states that even though there should be an increase in NA in negative situations, one should also maintain the ability to experience PA in negative situations. That is, PA is resilient to negative events and should not be inversely correlated with more frequent negative events. This model assumes that the level of NA should depend on the situation, whereas the level of PA should remain stable across situations.

The Dynamic Model of Affect (Dynamic Variability) theory of affective PF specifies that the relationship between PA and NA depends on the presence of negative events (Zautra, Smith, Affleck, & Tennen, 2001). Under non-stressful conditions, it is thought that people receive the most benefit from having uncorrelated levels of PA and NA, as they can obtain the maximum amount of information about a situation when their emotional responses on one dimension are not limited by the experience or lack of experience on the other dimension. This increase in emotional information may be thought of as emotional complexity. Because there is more information to process with greater emotional complexity, this results in greater cognitive demand. Whereas the Maintenance of Emotional Complexity Model states that emotional complexity should remain stable across situations, the Dynamic Model of Affect states that emotional complexity is adaptive under non-stressful situations but maladaptive under higher stress situations in which cognitive resources are scarce. In stressful situations, adopting a simpler representation of one's affective experience reduces cognitive load, freeing up resources for managing the stressful situation. A second benefit comes as NA and PA become more bipolar: those with increased PA under stress (and therefore less NA) experience greater well-being. The relationship between the amount of NA experienced and stress is therefore determined by the level of PA a person experiences. Under this model, in stressful situations, one may experience greater negative affect with a lessening of PA. Conversely, presence of PA during a stressful situation would be related to less NA during that situation as affect becomes more unidimensional. The Dynamic Model of Affect suggests that the inverse relationship between PA and NA is stronger during stressful situations and weaker during non-stressful situations. This third theory of affective PF states that the ability to switch between ways of processing emotion (bipolar during high stressors versus more complex processing of orthogonal relationship during low stressors) is an adaptive use of resource allocation.

Operationalizing these different theories of affective PF allows one to determine which theory is the best predictor of psychological and physical health. This contributes to the current body of research and furthers our knowledge of what kind of affective PF is adaptive.

Trait Analyses

Affective IIV and PF may be considered traits that can distinguish between people. However, there is scant research to date identifying the psychometric properties of affective PF. There is also a need to establish discriminant and convergent validity for each construct. It is important to determine that affective PF is a distinct trait, and that it contributes to our ability to predict outcomes over and above what is already being measured.

Stability

Affective IIV appears to be a stable trait when assessed over a period of up to 2 months, with reliability estimates between .46-.90 (Eid & Diener, 1999, Penner et. al, 1994). However, only one study has examined stability data for PF to date. In a study of emotion regulation, those with greater emotional regulation flexibility reported better psychological adjustment 3 years later, with a test-retest correlation of .45 (Westphal et al., 2010). Therefore, further analysis of the stability (both within-wave and across time) of affective PF may strengthen the identification of this as an individual difference.

Convergent Validity

Affective IIV has been positively related to higher distress, depression, anxiety, and neuroticism, and lower extraversion, agreeableness, optimism, and self-esteem, and poorer cognitive aging, and may capture the concept of negative emotional lability (Eid & Diener, 1999; Gruber et al., 2013; P. Kuppens, Van Mechelen, Nezlek, Dossche, & Timmermans, 2007; Ram, Gerstorf, Lindenberger, & Smith, 2011; Timmermans et al., 2010). In contrast, affective PF has been positively related to higher HRV and higher resiliency (Fujimura & Okanoya, 2012; Waugh et al., 2011; Westphal et al., 2010), and may be related to lower neuroticism, and higher self-regulation and resiliency (Kashdan & Rottenberg, 2010). Because affective PF requires a person to implement responses depending on the situation, affective PF may be related to perceived control over the environment or environmental constraints that would hinder goal pursuit (Prenda & Lachman, 2001; Kashdan & Rottenberg, 2010).

The ability to attend to a situation and switch between responses is inherently a self-regulatory task. Some laboratory studies suggest a relationship between affective PF and self-regulatory ability. Self-regulatory ability can be characterized by baseline levels of HRV (Segerstrom & Solberg Nes, 2007), and people with higher HRV showed better congruence between image and rated affect when there was a positive-positive image pairing (Fujimura & Okanoya, 2012). People with higher HRV also showed more differentiation in startle reflex to positive, neutral, and negative images, suggesting that those with more self-regulatory ability may also have greater affective flexibility (Ruiz-Padial, Sollers, Vila, & Thayer, 2003).

Other evidence suggests that affective PF requires self-regulation. Affect regulation flexibility may affect cognitive capacity. Either enhancing or suppressing affective expression in the laboratory resulted in memory deficits (Bonanno et al., 2004). This is consistent with previous research indicating that regulating affect and executive control both require regulatory resources, and engaging in one aspect impairs function on a subsequent task (Hagger et al., 2010; Schmeichel, 2007).

Therefore affective PF may be related to measures of regulation, such as HRV and perceived control, whereas affective IIV may be related to measures of emotional lability, such as neuroticism. The relationship of affective PF to these personality traits has not been empirically tested to date and would be a useful addition to the current knowledge of affective PF.

Predictive and Discriminant Validity

If affective IIV and PF are truly distinct constructs, then they ought to predict different outcomes. Affective IIV is distinctly different from mean levels of emotional expression, and affect means and personality factors only explain 52% of the variance of emotional IIV (Eid & Diener, 1999). Little is known about affective PF. To date, there are no known longitudinal studies showing an effect of affective PF on psychological and physical outcomes.

Aims and Hypotheses

The current study proposed to examine affective IIV and PF side-by-side in order to establish these as distinct constructs with distinct features and outcomes. In addition, the current study tested which theory of affective PF is most adaptive, furthering knowledge of emotional flexibility in general. The specific aims of the study were to:

1. Operationalize affective IIV and PF, based on the separate theories of affective PF, compare means and correlations within and between constructs, and report stability coefficients for both affective IIV and PF.
2. Establish discriminant and convergent validity for affective IIV and PF. In line with previous research, it was hypothesized that affective IIV would be positively related to greater neuroticism, lower extraversion and agreeableness, lower HRV, and lower trait measures of self-control and perceived control. It was hypothesized that higher affective PF would be positively related to lower neuroticism, greater extraversion and agreeableness, higher HRV, and higher trait measures of self-control and

perceived control. Additionally, it was hypothesized that affective IIV and PF would be distinctly different from and uncorrelated with each other.

3. Establish predictive validity for affective IIV and PF. It was hypothesized that greater affective IIV would be related to poorer psychological and physical health. In contrast, it was hypothesized that affective PF would be related to better psychological and physical health.

Chapter 2: Methods

Participants

The data used for this study are from the National Study of Daily Experiences (NSDE) waves 1 and 2, an 8-day daily diary portion of the Midlife Development in the United States (MIDUS I) and MIDUS II surveys. Participants were recruited for the first wave of NSDE after completing the MIDUS I. NSDE wave 2 was completed approximately 10 years after wave 1. There were 793 adults who completed both waves of the NSDE. A subset of the NSDE wave 1 and 2 participants also completed the MIDUS II biomarker study (N=298).

Mean age of the participants for the final study sample was 46.7 years (SD =12.5; range 24-74); gender was 55.9% women; race was 92.6% Caucasian, 3.5% African American, and 3.3% other. Education level was 33.5% high school diploma or less, 30.1% at least some college, and 36.1% bachelor's degree or post-graduate education. Sample characteristics for measures at Wave 1 and 2 are in Table 2.1.

Procedure

MIDUS I: Respondents (N=3032) were drawn from a random-digit-dial (RDD) sample of English-speaking adults aged 25-74 and completed a telephone interview and mail questionnaire.

NSDE wave 1: There were 8 consecutive nightly telephone interviews during which participants (N=1500) were asked about their daily experiences over the previous 24 hours (Almeida, Wethington, & Kessler, 2002). NSDE data collection consisted of 40 separate flights of interviews with approximately 33 participants within each flight. The first day of study for each interview flight was staggered across the day of the week to control for possible confound of study day and day of week. Participants completed an average of 7.2 of the 8 interviews. Participants were given $25 for their participation. The initial wave of NSDE data collection was conducted from March 1996 to March 1997.

MIDUS II: The longitudinal component of the MIDUS II study included only those participants that had also completed the first MIDUS study (N=1803). Respondents completed a telephone interview and mail questionnaire.

NSDE wave 2: Study design was similar to NSDE 1, with 8 consecutive nightly interviews, and interview flights consisted of approximately 20 participants per flight (N=793). Participants were given $25 for their participation.

MIDUS II biomarkers: A subset of participants who completed the MIDUS II wave was recruited to provide biomarker data. Of the participants who completed both NSDE wave 1 and 2, there were 298 participants who also completed the biomarker study. Participants reported to one of 3 GCRC data collection sites (UCLA, University of Wisconsin or Georgetown University) for 3 days of data collection, with the protocol standardized across sites. Psychosocial experience was assessed on day 1 of the study, and the psychophysiological experimental protocol was performed on day 2 of the study, including a resting measure of heart rate variability (HRV).

Measures

Variables Used for Convergent and Discriminant Validity

Personality variables were taken from the MIDUS I and MIDUS II study for each participant. In order to assess the personality traits of neuroticism, extraversion, agreeableness, conscientiousness and openness to experience, adjectives were selected from existing trait lists and inventories (Bem, 1981; Goldberg, 1992; John, 1990; Trapness & Wiggins, 1990), and the following scales validated for the MIDUS study (Lachman & Weaver 1997).

Neuroticism*:* Participants indicated how well in general each item (moody, worrying, calm (reversed), nervous) described them using a 4-point scale (0=not at all, 3= a lot). The average rating across all four items was used as the neuroticism score. Cronbach's alpha for the current study was .74.

Extraversion: Participants indicated how well in general each item (outgoing, friendly, lively, active, talkative) described them using a 4-point scale (0=not at all, 3= a lot). The average rating across all five items was used as the extraversion score. Cronbach's alpha for the current study was .79.

Agreeableness: Participants indicated how well in general each item (helpful, warm, caring, softhearted, sympathetic) described them using a 4 point scale (0=not at all, 3= a lot). The average rating across all four items was used as the agreeableness score. Cronbach's alpha for the current study was .81.

Conscientiousness: Participants indicated how well in general each item (organized, responsible, careless (reversed), hardworking) described them using a 4 point scale (0=not at all, 3= a lot). The average rating across all four items was used as the conscientiousness score. Cronbach's alpha for the current study was .58.

Openness to Experience: Participants indicated how well in general each item (creative, imaginative, intelligent, curious, broad-minded, sophisticated, adventurous) described them using a 4 point scale (0=not at all, 3= a lot). The average rating across all seven items was used as the openness to experience score. Cronbach's alpha for the current study was .76.

Perceived Control: The Sense of Control scale has two subscales: personal mastery and perceived constraints. The combined scale of Perceived Control has been used to assess the effects of control on health in a number of previous studies (Prenda & Weaver 1998). Participants indicated how well in general each item described them using a 7-point scale (1=strongly agree, 7=strongly disagree) as a measure of perceived control. The average rating across all 12 items was used as the perceived control score. Cronbach's alpha for the current study sample study was .60.

Self-control scale (MIDUS II biomarker): The Self-Control Scale is a measure of perceived cognitive and emotional control (Markus & Kitayama, 1991; Gross & John, 2003). Participants indicated how well in general each item described them using a 7-point scale (1=strongly disagree, 7=strongly agree) The average rating across all 12 items was used as the self-control score. Cronbach's alpha for the current study sample study was .71.

Heart Rate Variability (MIDUS II biomarker): ECG signals were collected at a sampling rate of 500 Hz and then digitized and analyzed for R waves (National

Instruments). Spectral analysis of the RR interval series were calculated using Fourier transforms, identifying the high frequency HRV (HF-HRV) band at 0.15-0.40 Hz (DeBoer, Karemaker, & Stackee, 1984). Baseline measurement of HRV was recorded for 11 minutes, and divided into 2 epochs of 300 sec for analysis.

Variables Used for Predictive Validity

Variables used for predictive validity analyses were taken from the MIDUS I and II samples.

General Mental Health (MIDUS I and II): Participants reported in general, how they would rate their mental or emotional health, on a 5-point scale (1=excellent, 5=poor).

Depression (MIDUS I and II): Participants indicated whether or not they had experienced symptoms over a two week period in the past 12 months, with a yes/no response (Wang, Berglund, & Kessler, 2000). The depression scale was a 7-item scale (lose interest in most things, feel more tired out or low on energy than is usual, lose your appetite, have more trouble falling asleep than usual, have more trouble concentrating than usual, feel down on yourself, no good, or worthless, think a lot about death). The total number of "yes" responses was used as the depression score. Cronbach's alpha for the current study was .51.

Anxiety (MIDUS I and II): Participants indicated how often over the past 12 months they experienced symptoms using a 4-point scale (1=most days, 4=never) (Wang, Berglund, & Kessler, 2000). The scale had 10 items (were restless because of your worry, were keyed up, on edge, or had a lot of nervous energy, were irritable because of your worry, had trouble falling asleep, had trouble staying asleep because of your worry, had trouble remembering things because of your worry, were low on energy, tired easily because of your worry, had sore or aching muscles because of tension). The sum of responses was used as the anxiety score. Cronbach's alpha for the current study was .88.

Psychological Well-Being (MIDUS II): The psychological well-being scale was composed of six 7-item subscales: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance (Ryff, 1989). Participants indicated how much in general how much the items described them using a 7-point scale (1=strongly agree, 7=strongly disagree). The average of the subscales was used as the total well-being score. Cronbach's alpha for the current study was .71.

General Health (MIDUS I and II): Participants reported in general how they would rate their physical health, on a 5-point scale (1=excellent, 5=poor).

Chronic conditions (MIDUS I and II): Participants indicated the number of chronic health conditions experienced in the past 12 months. The sum of conditions endorsed was used.

Activity of Daily Living Scale (MIDUS I and II): Participants rated how much their health limited them in doing, activities related to daily living, (e.g. "bending, kneeling, or stooping," "walking several blocks," "moderate activities, e.g., vacuuming"), using a 4-point scale (1=a lot, 4=not at all). The mean of the items were used. Cronbach's alpha for the current study was .92.

Prescription Medications (MIDUS I and II): Participants reported the number of medications taken over the past 30 days.

Chronic Pain (MIDUS II): Participants indicated whether or not they had experienced chronic pain in the last 12 months with a yes/no response.

Composite Scores for Outcome Variables

In order to reduce the number of separate analyses, which may contribute to Type I error, composite scores were made of the variables for psychological and physical health. Composite scores were made for psychological distress using the general mental health, depression, anxiety and psychological well-being scales. Composite scores were made for physical ill-health using the scales for general health, chronic conditions, activities of daily living, and number of medications. All scales were re-scored such that higher scores indicated higher physical ill-health or psychological distress. Scales were standardized and then averaged to form the physical health and psychological distress scores.

The Cronbach's alpha for the physical ill-health outcome variable for Wave 1 was α=.74 (N=777), and α=.78 (N=693) for Wave 2. The Cronbach's alpha for the psychological distress outcome variable for Wave 1 was α=.59 (N=753), and α= .66 (N=714) for Wave 2. Correlations between components of the physical ill-health outcome can be found in Table 2.2 and for psychological distress in Table 2.3.

Separate regression analyses were used for affective IIV and PF to predict psychological distress and physical ill-health concurrently (waves 1 and 2) as well as longitudinally (at wave 2 from at wave 1 affective IIV and PF) controlling for mean levels of affect. Separate models were run for the individual measures of affective IIV and PF to determine the effect of affective IIV and PF on psychological distress and physical ill-health. Additionally, a model was run including all affective

IIV and PF measures together in order to determine if one model predicts health over and above the other measures. Chronic pain may itself be considered a stressor and was used in the development of the Dynamic Model of Affect (Davis et al., 2004). Therefore, analyses were conducted examining the effects of chronic pain on affective IIV and PF.

Affective IIV

$$\text{Psychological distress} = \beta_0 + \beta_{1\,\text{mean affect}} + \beta_{3\,\text{IIV in affect}} + \beta_{2\,\text{chronic pain}} + \beta_{4\,\text{IIV in affect*chronic pain}} + \varepsilon_i$$

$$\text{Physical ill-health} = \beta_0 + \beta_{1\,\text{mean affect}} + \beta_{3\,\text{IIV in affect}} + \beta_{32\text{chronic pain}} + \beta_{4\,\text{IIV in affect*chronic pain}} + \varepsilon_i$$

Affective PF

$$\text{Psychological distress} = \beta_0 + \beta_{1\,\text{mean affect}} + \beta_{3\,\text{PF in affect}} + \beta_{2\,\text{chronic pain}} + \beta_{4\,\text{PF in affect*chronic pain}} + \varepsilon_i$$

$$\text{Physical ill-health} = \beta_0 + \beta_{1\,\text{mean affect}} + \beta_{3\,\text{PF in affect}} + \beta_{2\,\text{chronic pain}} + \beta_{4\,\text{PF in affect*chronic pain}} + \varepsilon_i$$

Construction of Affective IIV and PF Variables

Daily Events: The number of negative (NSDE 1 and 2) and positive (NSDE 2) events was reported for each day (Almeida, Wethington, & Kessler, 2002).

Positive and Negative Affect: Positive and negative affect scales were developed for the MIDUS studies using items derived from a number of validated measures of affect (Mroczek & Kolarz, 1998). Cronbach's alphas for PA and NA in the MIDUS studies were .91 and .87 respectively. These PA and NA scales were used to calculate IIV and PF in affect in NSDE 1 and 2. PA was measured using the 1-item version of the MIDUS PA scale in NSDE wave 1, and both the 1-item and the 6-item version of the MIDUS PA scale in NSDE wave 2.

Negative Affect*:* Participants indicated how well in general each item (restless or fidgety, nervous, worthless, so sad nothing could cheer you up, everything was an effect, hopeless) described them using a 5-point response scale (0=none of the time, 4=all of the time). The average rating across all 6 items was used as the negative affect score.

Positive Affect: Participants indicated how well in general the 1 item (How often do you feel in good spirits) as well as the 6-item (in good spirits, cheerful, extremely happy, calm and peaceful, satisfied, full of life; NSDE2) positive affect subscale described them using a 5-point response scale (0=none of the time, 4=all of the time*).* Variables were calculated using both the 1 item and full scale PA measure in Wave 2 and all analyses were conducted comparing both PA measures. There were no significant differences in outcomes between the two variations of PA measurement. Therefore, to be consistent with Wave 1, results reported are those using the 1 item PA measurement in calculation of affective IIV and PF.

Affective Intra-Individual Variability

Affective IIV was calculated as the individual's standard deviation (iSD) for positive affect (PA) and negative affect (NA) across the 8 days at each wave (Figure 2.1).

NA IIV = iSD(NA)

PA IIV = iSD(PA)

Emotional Congruency Model (Congruent Variability) of Affective PF

According to this model, NA should be positively related with increased stressors and PA should be negatively related with increased stressors, i.e., as stressors decrease, PA should increase and was calculated at both waves.

Because the study nested days within people, multilevel modeling was used to determine each individual's estimate for the relationship between affect and high stress (negative events = 1) versus low stress (negative events = 0) days using SAS PROC MIXED.

NA for person j on day i was modeled as a function of the person j's intercept, stressors on day i, and unexplained variance:

$NA_{ij} = \beta_{0j} + \beta_{1j}\,(stressors_{ij}) + \varepsilon_{ij}$

PA for person j on day i was modeled as a function of the person j's intercept, stressors on day i, and unexplained variance:

$PA_{ij} = \beta_{0j} + \beta_{1j}\,(stressors_{ij}) + \varepsilon_{ij}$

Best model fit indicated allowing an individual's intercept to be random for the relationships between both NA and stressors and PA and stressors, which suggested that people vary in their relationships between affect and events.

$B_{1j} = \gamma_{1j}(stressors_{ij}) + \upsilon_{ij}$

Affective flexibility was defined as the ability to change the level of affect, both NA and PA, to match the level of stressor. A difference score was calculated between the person's individual estimate and the maximum change in the level of affect predicted by the theory on high and low stress days. The theoretical maximum change was calculated as:

$\beta_{\text{theoretical max change}} = B(SD_{event}/SD_{affect})$ where $SD_{affect} = 1$ (standardized affect score)

The standardized beta weight was scaled -1 to 1 where:

$B_{max} = 1/SD_{event}$; $B_{min} = -1/SD_{event}$

Theoretical maximum change in slope: $\beta_{\text{theoretical max change}} = B_{max} - B_{min}$

The relationship between NA and stressors should be positively related, and the relationship between PA and stressors should be negatively related. Therefore the individual's beta weight for PA and stressors was subtracted from the inverse of the theoretical maximum change. To account for the different direction in relationships for NA and stressors and PA and stressors, the absolute values were taken for these difference scores and summed (Figure 2.2).

Congruent Variability PF= $|[\beta_{\text{theoretical max change}} - (\beta_{1j}\ NA)]| + |[-\beta_{\text{theoretical max change}} - (\beta_{1j}\ PA)]|$

Congruency of NA and PA with positive events was calculated for wave 2. Each person's individual estimate for the relationship of NA and positive events and PA and positive events was calculated as above.

NA for person j on day i was modeled as a function of the person j's intercept, positive events on day i, and unexplained variance:

$NA_{ij} = \beta_{0j} + \beta_{1j}\ (\text{positive events}_{ij}) + \varepsilon_{ij}$

PA for person j on day i was modeled as a function of the person j's intercept, positive events on day i, and unexplained variance:

$PA_{ij} = \beta_{0j} + \beta_{1j}\ (\text{positive events}_{ij}) + \varepsilon_{ij}$

Best model fit indicated allowing an individual's intercept to be random, for the relationships between both NA and positive events and PA and positive events, which suggest that people vary in their relationships between affect and positive events.

$B_{1j} = \gamma_{1j}(\text{positive events}_{ij}) + \upsilon_{ij}$

The theoretical maximum change was calculated as:

$\beta_{\text{theoretical max change}} = B(SD_{\text{event}}/SD_{\text{affect}})$

To account for the different direction in relationships for NA and positive events and PA and positive events, the absolute values were taken for these difference scores and summed. In order to be comparable to affective IIV, the difference score will be reverse scored, such that the higher the score, the higher the affective PF.

Congruent Variability PF for positive events = $(|[-\beta_{\text{theoretical max change}} - (\beta_{1j}\ \text{NA})]| + |[\beta_{\text{theoretical max change}} - (\beta_{1j}\ \text{PA})]|)*(-1)$

Maintenance of Emotional Complexity Model (Complexity Variability) of Affective PF

According to this model of affective flexibility, increased NA should be positively related with increased stressors, similar to Congruent Variability. In contrast, PA should have no relationship to level of stress at all, i.e., PA is resilient under stress. This model assumes that PA remains unaffected by levels of stress. Each person's individual estimate for the relationship of NA and stressor and PA and stressor was calculated as for Congruent Variability. The theoretical maximum change in the level of affect for NA was calculated as for Congruent Variability. However, according to Complexity Variability, PA should be resilient under stress, and unaffected by number of stressors. Therefore the ideal theoretical relationship between PA and stressors is 0. Because the maximum range for NA and stressors is twice as large as the maximum range for PA and stressors the term for PA and stressors was weighted by a factor of 2 (Figure 2.3). The difference score between the person's individual estimate and that predicted by theory on high versus low stress days is calculated as:

Complexity Variability PF = $(|[\beta_{\text{theoretical max change}} - (\beta_{1j}\ NA)]| + |[0 - (\beta_{1j}\ PA)]| *2)*(-1)$

In order to be comparable to affective IIV, the difference score will be reverse scored, such that the higher the score, the higher the affective PF.

Dynamic Model of Affect (Dynamic Variability) of Affective PF

The Dynamic Model of Affect theory of affective flexibility states that the inverse relationship between NA and PA should become stronger on high stress days, and become weaker on low stress days. Multilevel modeling was used to determine each individual's estimate for the relationship between NA and PA on low stress days (negative events = 0) and high stress days (negative events = 1) using SAS PROC MIXED.

NA for person j on day i was modeled as a function of the person j's intercept, PA on day i, and unexplained variance for both low stress days and high stress days:

Non-stress day $NA_{ij} = \beta_{0j} + \beta_{1j}$ (non-stress day PA_{ij})$+\varepsilon_{ij}$

Stress day $NA_{ij} = \beta_{0j} + \beta_{1j}$ (stress day PA_{ij})$+\varepsilon_{ij}$

Best model fit indicated that a person's NA-PA slope should be random on non-stress days, indicating that people vary in their relationships between NA and PA on non-stress days. However, allowing a person's NA-PA slope to be random was not indicated for high stress days, suggesting that the relationship between NA and PA on high stress days is consistent across people. Dynamic Variability theory predicts that the greater the difference between high versus low stress days, the higher the affective PF. Thus, the individual's difference score between the relationship of NA and PA on low stress days versus high stress days was used as a measure of affective PF, with higher scores indicating greater flexibility (Figure 2.4).

$$\text{Dynamic Variability PF} = (\beta_{1j} \text{ non-stress day}) - (\beta_{1j} \text{ stress day})$$

Means, Correlations and Stability Across Time for Affective IIV and PF

Means, standard deviations, ranges, and test-retest correlations for each affective IIV and PF variable can be found in Table 2.4. NA IIV and Dynamic Variability PF appear to have the highest stability across a ten-year period ($r = .37$, $p < .01$, $r = .38$, $p < .01$, respectively). NA IIV, PA IIV, Congruent Variability PF, and Complexity Variability PF were positively correlated with each other and were inversely correlated with Dynamic Variability PF at both Wave 1 and Wave 2 (Table 2.5).

Within-Wave Stability of Affective IIV and PF

Bootstrapping principles were used to obtain estimates of within-wave stability of the affective IIV and PF variables. A randomly selected subset of 4 days of data was used to calculate affective IIV and PF variables and was correlated with scores calculated on the other 4 days of data. Random sampling with replacement was used to obtain 1000 resamples of the data and provide within-wave stability estimates and confidence intervals (CI) for the observed data (Yung & Chan, 1999; Ram 2011; Ram 2013). Overall, the within-wave stability of all of the affective IIF and PF variables were low. However, the within-wave stabilities were higher in wave 1 than in wave 2 (Table 2.4). NA IIV and Dynamic Variability had the highest within-wave stabilities at both waves (wave 1: r=.58 95% CI=.49-.67 , r=.61 95% CI=.47-.71, wave 2: r=.56 95% CI=.49-.64 , r=.50 95% CI=.39-.58). Due to the low within-wave stability estimates of PA IIV, Congruent Variability PF, and Complexity Variability PF at wave 2 the results from wave 2 should be interpreted with caution and may represent spurious results.

Tables for Chapter 2: Methods

Table 2.1 Sample Characteristics

	Wave 1		Wave 2		
Variable	Mean (SD)	Range	Mean (SD)	Range	Correlation between Wave 1 and 2
Age	46.71 (12.48)	24-74	55.82 (12.46)	34-84	
Negative Affect (NA) across all days	.19 (.23)	0-1.70	.19 (.26)	0-2.37	.40*
Positive Affect (PA) across all days	4.15(.59)	1.5-5	3.01(.61)	.14-4.00	.51*
Negative Events (NE) across all days	.42(.26)	0-1	.44(.27)	0-1	.47*
Personality Variables:					
Neuroticism	2.18 (.63)	1-4	2.03 (.61)	1-4	.62*
Extraversion	3.22 (.56)	1.2-4	3.09 (.58)	1.2-4	.71*
Agreeableness	3.48 (.48)	1.6-4	3.44 (.50)	1.8-4	.67*
Conscientiousness	3.44 (.43)	1.5-4	3.46 (.43)	1-4	.63*
Openness	3.02 (.50)	1.57-4	2.89 (.54)	1-29	.72*
Perceived Control	5.60 (.95)	1.67-7	5.52 (1.00)	1.92-7	.58*
Self-control Scale (N=298)			4.95 (.52)	3.3-6.3	
HRV (N=298)			4.81 (1.24)	.99-8.38	

*P < 0.01

Table 2.1 (continued). Sample Characteristics

	Wave 1		Wave 2		
Variable	Mean (SD)	Range	Mean (SD)	Range	Correlation between Wave 1 and 2
Physical Health:					
General Health	2.33 (.89)	1-5	2.18 (1.07)	1-5	.46*
Chronic Conditions	2.23 (2.24)	0-13	2.37 (2.38)	0-17	.54*
RX medications	.69 (1.04)	0-6	1.60 (1.68)	0-12	.47*
Activity of Daily Living	1.48 (.68)	1-4	1.78 (.86)	1-4	.52*
Chronic Pain	.25 (.44)	0-1	.37 (.48)	0-1	.22*
Psychological Distress:					
General Mental Health	2.07 (.89)	1-5	1.82 (.86)	1-5	.41*
Depression	.53 (1.66)	0-7	.50 (1.62)	0-7	.25*
Anxiety	.12 (.82)	0-10	.09 (.69)	0-7	.19*
Scale of Psychological Well Being	7.04 (2.25)	3-16.50	7.30 (.241)	3-17	.74*

*p < 0.01

Table 2.2 Correlations between variables for physical ill-health for Wave 1 and Wave 2

	Wave 1			Wave 2		
	1	2	3	1	2	3
1. General Health						
2. Chronic Conditions	.38			.44		
3. RX medications	.32	.50		.34	.57	
4. Activity of Daily Living	.46	.47	.34	.53	.52	.43

All correlations are significant $p < 0.01$

Table 2.3 Correlations between variables for psychological distress for Wave 1 and Wave 2

	Wave 1			Wave 2		
	1	2	3	1	2	3
1. General Mental Health						
2. Depression	.28			.39		
3. Anxiety	.16	.28		.32	.33	
4. Scale of Psychological Well Being	.39	.27	.20	.41	.29	.23

All correlations are significant $p < 0.01$

Table 2.4 Means, SD, Range, and Stability for Affective IIV and PF

	Wave 1			Wave 2			
Variability Term	Mean (SD)	Range	Within-Wave Stability Estimate (95% CI)	Mean (SD)	Range	Within-Wave Stability Estimate (95% CI)	Test-Retest Correlation
NA IIV	.16 (.16)	0 – 1.07	.58 (.49-.67)	.16 (.13)	0 - .99	.56 (.49-.64)	.37*
PA IIV	.46 (.35)	0 – 2	.39 (.29-.48)	.48 (.33)	0 – 1.81	.37 (.30-.44)	.19*
Congruency Variability PF negative events	7.77 (.40)	4.42 – 8.40	.66 (.56-.76)	7.95 (.42)	4.67 – 9.02	.36 (.25-.46)	.28*
Congruency Variability PF positive events	-	-	-	8.54 (.16)	7.68 – 9.02	.48 (.39-.57)	-
Complexity Variability PF	4.45 (.30)	1.75 – 5.03	.56 (.41-.66)	4.38 (.33)	1.72 – 5.46	.20 (.06-.33)	.30*
Dynamic Variability PF	.29 (.28)	-1.83 - .60	.61 (.47-.71).	.40 (.31)	-3.71 - .78	.50 (.39-.58)	.38*

*P < 0.01 NA = Negative Affect, PA = Positive Affect, IIV= Intra-Individual Variability, Congruency Variability PF = Emotional Congruency Model, Complexity Variability PF= Maintenance of Emotional Complexity Model, Dynamic Variability PF = Dynamic Model of Affect

Table 2.5 Correlations Between Affective IIV and PF for Wave 1 (below diagonal) and Wave 2 (above diagonal)

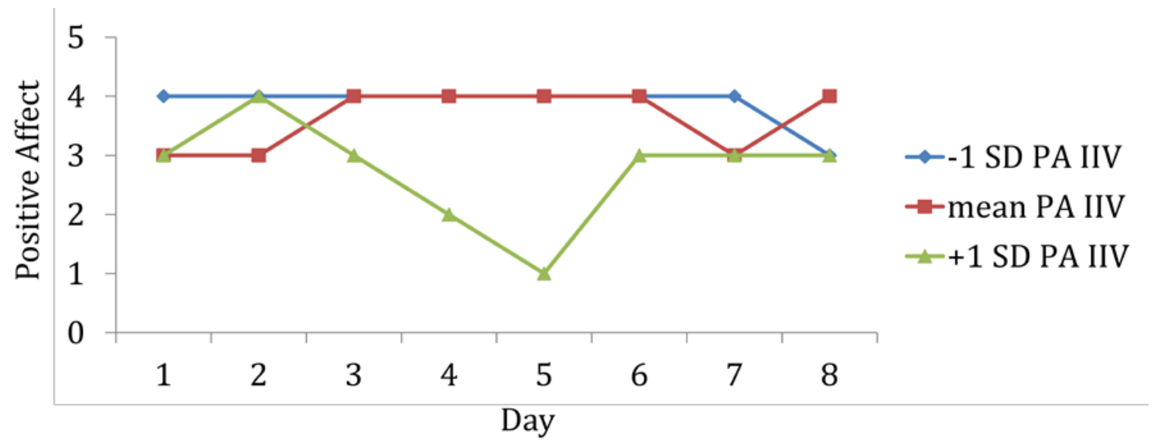
	1	2	3	4	5	6	7	8
1. NA mean	-	-.50*	.71*	.26*	.64*	.42*	.60*	-.81*
2. PA mean	-.66*	-	-.48*	-.38*	-.44*	-.72*	-.28*	.23*
3. NA IIV	.80*	-.51*	-	.37*	.74*	.27*	.66*	-.56*
4. PA IIV	.25*	-.34*	.39*	-	.35*	.34*	.13*	-.13*
5. Congruency Variability PF negative events	.81*	-.58*	.78*	.30*	-	.24*	.73*	-.33*
6. Congruency Variability PF positive events	-	-	-	-	-	-	.12*	-.17*
7. Complexity Variability PF	.74*	-.30*	.72*	.15*	.85*	-	-	-.34*
8. Dynamic Variability PF	-.68*	.17*	-.58*	-.13*	-.41*	-	-.47*	-

* $P < 0.01$ NA = Negative Affect, PA= Positive Affect, IIV= Intra-Individual Variability, Congruency Variability PF = Emotional Congruency Model, Complexity Variability PF= Maintenance of Emotional Complexity Model, Dynamic Variability PF = Dynamic Model of Affect

Figures for Chapter 2: Methods

Figure 2.1 Affective Intra-individual Variability: PA IIV

1a. PA IIV



1b. Relationship of PA IIV and Situation

Figure 2.2 Congruency Variability PF: Emotional Congruency Model

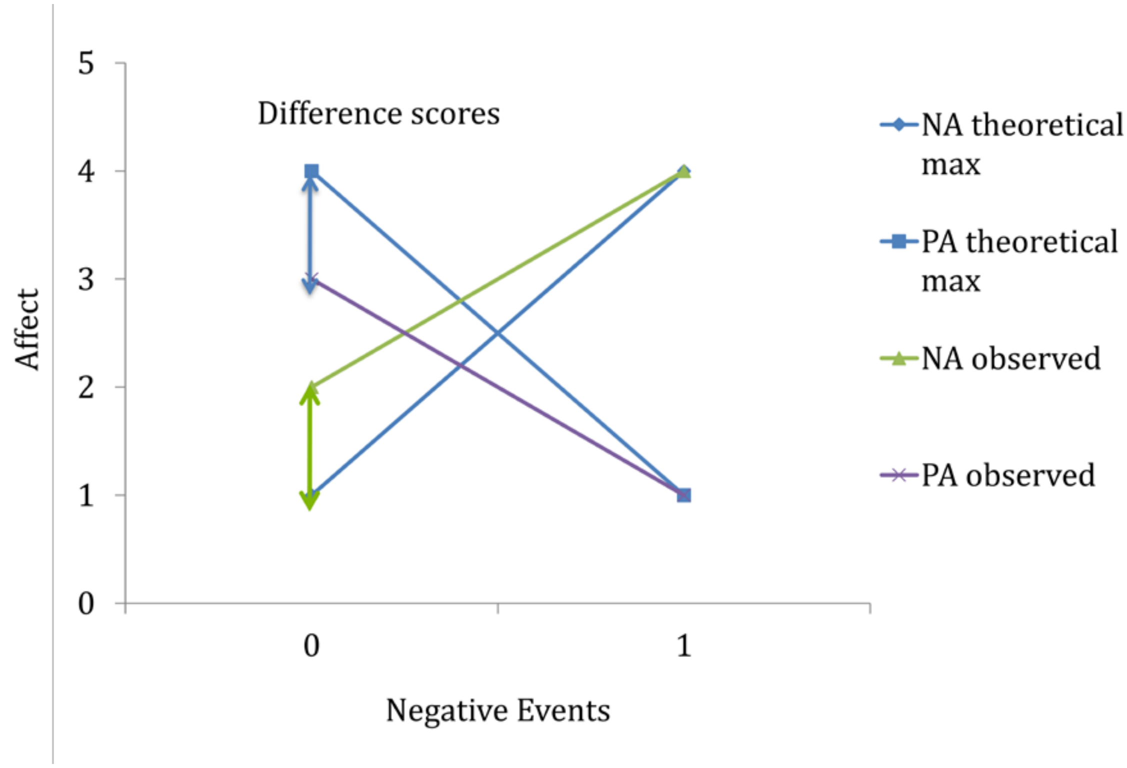


Figure 2.3 Complexity Variability PF: Maintenance of Emotional Complexity Model

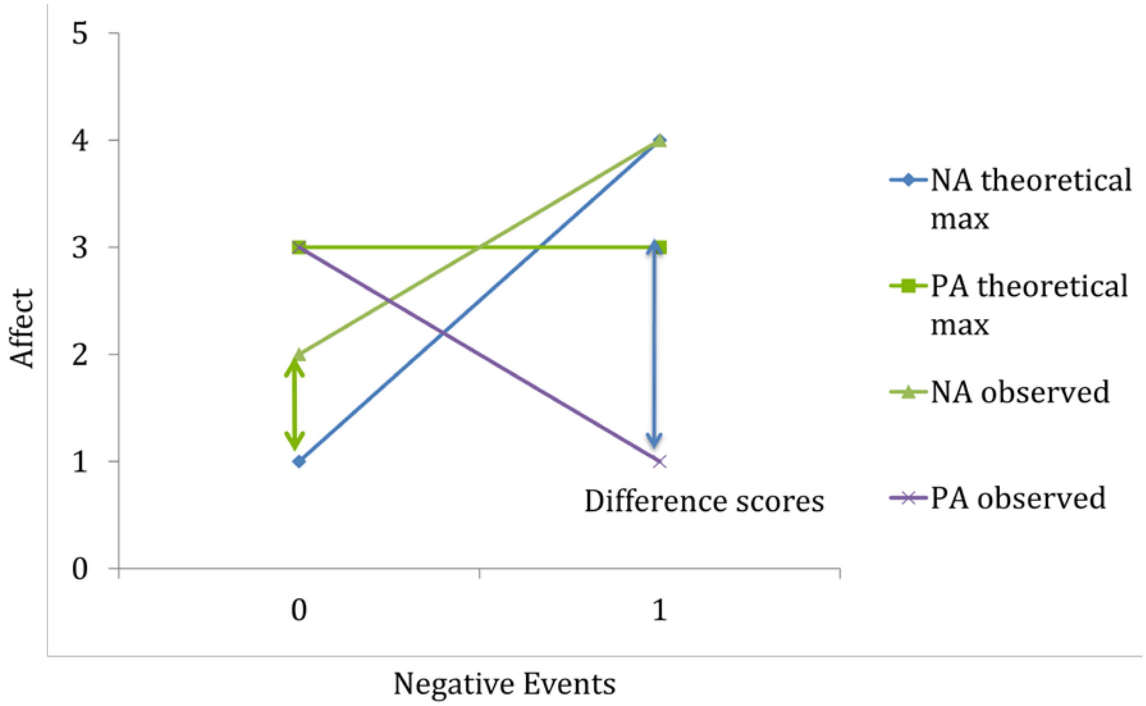
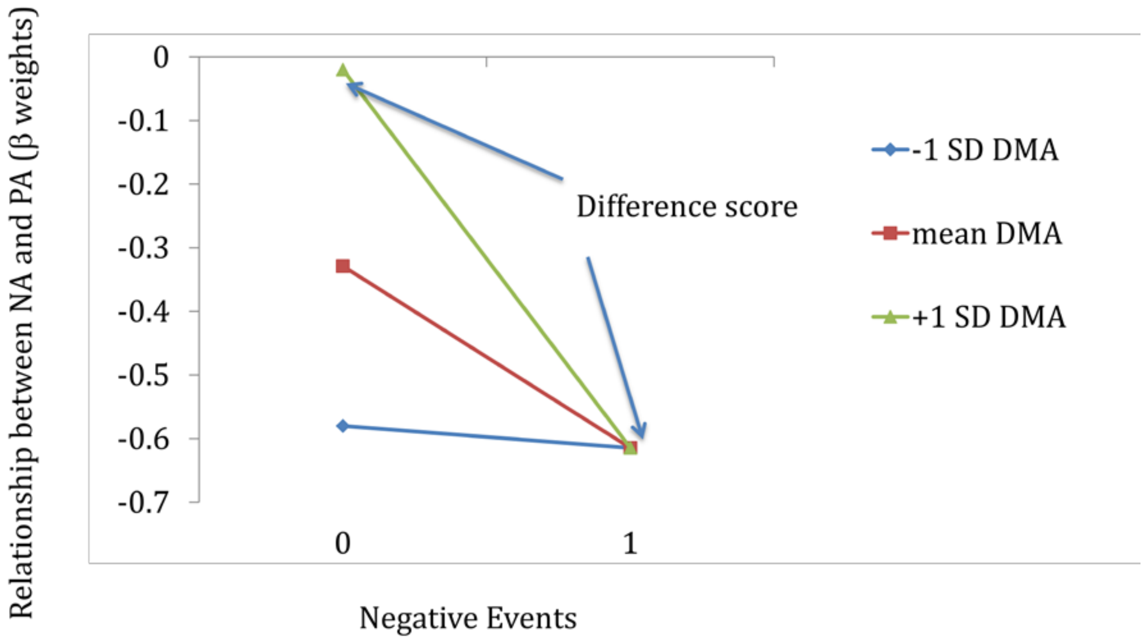


Figure 2.4 Dynamic Variability PF: Dynamic Model of Affect



Chapter 3: Results

Convergent and Discriminant Validity

As hypothesized, people with higher scores of NA IIV and PA IIV had higher mean NA (r =.80, p < .01, r = .25, p < .01, respectively), higher neuroticism (r =.32, p < .01, r = .11, p < .01, respectively), lower mean PA (r =-.51, p < .01, r = -.34, p < .01, respectively), and lower perceived control (r = -.29, p < .01, r = -.12, p < .01, respectively) at wave 1, with similar correlations at wave 2 (Table 3.1).

People with higher scores of Congruent Variability and Complexity Variability PF had higher mean NA (r = .81, p < .01, r = .74, p < .01, respectively), higher neuroticism (r = .35, p < .01, r = .27, p < .01, respectively), lower mean PA (r = -.58, p < .01, r = -.30, p < .01, respectively), and lower perceived control (r = -.34, p < .01, r = -.27, p < .01, respectively) at wave 1, with similar correlations at wave 2 (Table 3.1).

People with higher scores of Dynamic Variability PF had lower mean NA (r = -.68, p < .01), lower neuroticism (r = -.24, p < .01), higher mean PA (r = .17, p < .01), and higher perceived control (r = .19, p < .01) at wave 1, with similar correlations at wave 2 (Table 3.1). There were no significant relationships between affective IIV or PF and HRV in the biomarker subset sample (N=296).

Separate multiple regression analyses were used to analyze the relationship between variability and personality to determine which personality factor may have more influence on affective IIV and PF (e.g., neuroticism may be more strongly related to affective IIV than extraversion), controlling for mean levels of affect to correct for the dependency of affective IIV and PF on mean levels of affect.

Hierarchical nonlinear regression analyses were used, with the mean level scores entered in the first step and personality variables entered in the second step. This would indicate which personality variable may be most effective in predicting individual differences in affective IIV and PF.

At Wave 1, lower extraversion predicted greater NA IIV (β = -.07, $p < .05$) and lower neuroticism predicted greater Dynamic Variability PF (β = -.09, $p < .05$), controlling for mean levels of affect (Table 3.2).

At Wave 2, higher agreeableness predicted greater NA IIV (β = .08, $p < .05$), and higher conscientiousness and lower perceived control predicted greater PA IIV (β = .10, $p < .01$, β = -.13, $p < .01$, respectively), controlling for mean levels of affect. For affective PF at wave 2, higher openness predicted lower Congruent Variability PF with negative events (β = -.09, $p < .01$), and higher neuroticism predicted lower Congruent Variability PF with positive events (β = -.09, $p < .05$), controlling for mean levels of affect. Lower neuroticism and lower extraversion predicted lower Complexity Variability PF (β = .09, $p < .01$, β = .08, $p < .05$, respectively), and higher openness and conscientiousness predicted lower Complexity Variability PF (β = -.11, $p < .01$, β = -.07, $p < .05$, respectively), controlling for mean levels of affect.

Predictive Validity

Concurrent Relationships Between Affective IIV, PF, and Health

Consistent with hypotheses, higher NA IIV was associated with higher psychological distress (Figure 3.1) at both waves ($\beta = .20$, $p<.01$, $\beta = .14$, $p<.01$, respectively), and higher physical ill-health (Figure 3.2) at both waves ($\beta = .21$,

p<.01, $\beta = .15$, p <0.05, respectively; Table 3.3). Similarly, higher PA IIV was associated with higher psychological distress at both waves ($\beta = .08$, p<.05, $\beta = .09$, p<.05, respectively), and was associated with higher physical ill-health at both waves ($\beta = .09$, p<.05, $\beta = .10$, p <0.05, respectively; Table 3.4). There were no significant interactions between affective IIV and chronic pain.

Higher scores of Congruent Variability PF and Complexity Variability PF were related to higher psychological distress at wave 1 ($\beta = .25$, p<.01, $\beta = .14$, p <.01, respectively; Tables 3.5 and 3.6) but not at wave 2. There were no significant relationships between Congruent Variability PF and physical ill-health at either wave. Higher Dynamic Variability PF was related to less psychological distress at wave 1 but not wave 2 ($\beta = -.11$, p<.01, $\beta = .09$, p = n.s., respectively; Table 3.7), and was related to less physical ill-health at wave 1 but not at wave 2 ($\beta = -.24$, p<.01, $\beta = .04$, p = n.s., respectively). There were no significant interactions between affective PF and chronic pain.

Longitudinal Relationships Between Affective IIV, PF, and Health

Higher NA IIV at wave 1 predicted higher psychological distress and physical ill-health 10 years later ($\beta = .13$, p<.01, $\beta = .16$, p < .05, respectively; Table 3.8). PA IIV at wave 1 was not significantly related to changes in psychological distress or physical ill-health ($\beta = .09$, p= n.s., $\beta = -.01$, p = n.s., respectively; Table 3.9).

For the affective PF models, neither Congruent Variability PF nor Complexity Variability PF were significantly related to psychological distress or physical ill-health 10 years later (Tables 3.10 and 3.11). Higher Dynamic Variability PF at Wave

1 was related to less psychological distress but not physical ill-health 10 years later ($\beta = -.54$, $p<.01$, $\beta = -.23$, $p = .06$, respectively; Table 3.12).

Lastly, all affective IIV and PF variables were entered into a single regression model to determine which was the best predictor of health outcomes. For the concurrent analyses (Table 3.13), Dynamic Variability PF was the largest predictor of psychological distress at both waves ($\beta = -.16$, $p <.01$, $\beta = -.28$, $p <.01$, respectively). NA IIV was not a significant predictor of psychological distress at wave 1 but was at wave 2 ($\beta = .08$, p=.n.s., $\beta = .25$, $p <.05$, respectively). Dynamic Variability PF was the largest predictor of physical ill-health at wave 1 but was not significant at wave 2 ($\beta = -.24$, $p <.01$, $\beta = -.14$, p=.0.06, respectively). NA IIV was not a significant predictor of physical ill-health at wave 1 but was at wave 2 ($\beta = .12$, p=.n.s., $\beta = .15$, $p <.05$, respectively).

For the longitudinal analyses (Table 3.14), Dynamic Variability PF was the only significant predictor of psychological distress 10 years later ($\beta = -.18$, $p<.01$), and NA IIV was the only significant predictor of physical ill-health ($\beta = .18$, $p<.01$).

Tables for Chapter 3: Results

Table 3.1 Correlations Between Affective IIV and PF and Personality for Wave 1 and 2

	Neuroticism		Extraversion		Openness		Agreeableness		Conscienti-ousness		Perceived Control	
Wave	1	2	1	2	1	2	1	2	1	2	1	2
NA mean	.35**	.34**	-.08*	-.16**	-.05	-.06	.01	-.12**	-.06	-.18**	-.30**	-.31**
PA mean	-.35**	-.36**	.15**	.28**	.09*	.16**	.12**	.18**	.09*	.20**	.27**	.37**
NA IIV	.32**	.33**	-.11**	-.13**	-.06	-.09*	.03	-.05	-.08*	-.17**	-.29**	-.28**
PA IIV	.11**	.07	-.08*	-.11**	-.05	-.10**	-.05	-.01	-.03	-.01	-.12**	-.21**
Congruency Variability PF negative events	.35**	.26**	-.10**	-.14**	-.08*	-.14**	-.01	-.07	-.09*	-.17**	-.34**	-.26**
Congruency Variability PF positive events	-	.20**	-	-.24**	-	-.13**	-	-.14**	-	-.18**	-	-.32**
Complexity Variability PF	.27**	.27**	-.05	-.09*	-.03	-.13**	.03	-.08*	-.06	-.18**	-.27**	-.20**
Dynamic Variability PF	-.24**	-.21**	.04	.07*	.02	-.03	-.03	.05	.05	.08*	.19**	.21**

* $P < 0.05$, ** $P < 0.01$; NA = Negative Affect, PA = Positive Affect, IIV= Intra-Individual Variability, Congruency Variability PF = Emotional Congruency Model, Complexity Variability PF= Maintenance of Emotional Complexity Model, Dynamic Variability PF = Dynamic Model of Affect

Table 3.1 (continued). Correlations Between Affective IIV and PF and Personality for Wave 1 and 2

	Age	Gender	Self-Control Scale	HRV
Wave			2	2
NA mean	-.14**	.05	-.03	-.03
PA mean	.21**	-.03	.10	.06
NA IIV	-.15**	.09*	-.04	-.03
PA IIV	-.01	.05	.01	-.02
Congruency Variability PF negative events	-.13**	.04	.01	.01
Congruency Variability PF positive events	-.11**	.03	-.04	-.06
Complexity Variability PF	-.10**	.03	.01	.02
Dynamic Variability PF	.07*	-.02	-.01	.05

* P < 0.05 , ** P < 0.01; NA = Negative Affect, PA = Positive Affect, IIV= Intra-Individual Variability, Congruency Variability PF = Emotional Congruency Model, Complexity Variability PF= Maintenance of Emotional Complexity Model, Dynamic Variability PF = Dynamic Model of Affect

Table 3.2 Multilevel Regression Coefficients for Affective IIV and PF for Wave 1 and Wave 2

		Wave 1				Wave 2			
Dependent Variable			β	Partial	*t*		β	Partial	*t*
NA IIV		(R^2 = .64); *df* = 760				(R^2 = .50); *df* = 706			
	NA mean		.80	.80	36.48 **		.70	.70	25.91 **
	N		.03	.03	1.14		.10	.09	3.30**
	E		–.07	-.05	-2.34*		-.006	-.005	.18
	A		.05	.04	1.92		.08	.07	2.46*
	O		.02	.02	.79		-.02	-.02	.55
	C		–.03	-.03	1.43		-.04	-.04	1.45
	PC		–.03	-.02	1.08		-.02	-.01	.50
PA IIV		(R^2 = .11); *df* = 764				(R^2 = .16); *df* = 706			
	PA mean		–.34	-.34	9.90**		-.38	-.38	10.78 **
	N		–.02	-.01	.38		-.11	-.10	2.83**
	E		–.03	-.02	.65		-.007	-.005	.15
	A		.01	.008	.25		.07	.06	1.58
	O		.006	.005	.15		-.06	-.05	1.37
	C		.002	.002	.05		.10	.09	2.66**
	PC		–.03	-.03	.82		-.13	-.10	3.01**
Congruency Variability PF negative events		(R^2 = .65); *df* = 758				(R^2 = .41); *df* = 704			
	NA mean		.74	.56	25.68 **		.57	.47	15.99 **
	PA mean		–.10	-.07	3.31**		-.11	-.08	2.99**
	N		.04	.03	1.28		.04	.03	1.07
	E		.005	.003	.20		.03	.02	.82
	A		–.003	-.002	.11		.05	.05	1.58
	O		–.002	-.002	.07		-.09	-.07	2.44**
	C		–.03	-.02	1.05		-.04	.04	1.24
	PC		–.08	-.06	2.94**		.01	.01	.30

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered. NA IIV = Negative Affect Intra-Individual Variability, PA IIV = Positive Affect Intra-Individual Variability, Congruency Variability PF = Emotional Congruency Model, Complexity Variability PF= Maintenance of Emotional Complexity Model, Dynamic Variability PF = Dynamic Model of Affect, NA = Negative Affect, PA = Positive Affect, N = neuroticism, E = extraversion, A = agreeableness, O = openness, C = conscientiousness, PC = perceived control

Table 3.2 (continued). Multilevel Regression Coefficients for Affective IIV and PF for Wave 1 and Wave 2

		Wave 1				Wave 2			
Dependent Variable			β	Partial	*t*		β	Partial	*t*
Congruency Variability PF positive events		–				(R^2 = .52); *df* = 704			
	NA mean		–	–	–		.03	.03	1.00
	PA mean		–	–	–		-.70	-.57	21.76 **
	N		–	–	–		-.09	-.08	3.16*
	E		–	–	–		-.03	-.02	.91
	A		–	–	–		.01	.01	.33
	O		–	–	–		.01	.01	.15
	C		–	–	–		-.02	-.02	.72
	PC		–	–	–		-.05	-.04	1.40
Complexity Variability PF		(R^2 = .59); *df* = 758				(R^2 = .39); *df* = 704			
	NA mean		.93	.70	30.15 **		.66	.54	17.81 **
	PA mean		.31	.23	9.99**		.09	.08	2.55**
	N		.03	.02	.80		.09	.08	2.58**
	E		–.01	-.007	.31		.08	.06	2.02*
	A		–.02	-.01	.54		.01	.01	.33
	O		.02	.02	.69		-.11	-.09	3.10**
	C		–.02	-.02	.67		-.07	-.07	2.22*
	PC		–.07	-.06	2.48*		.05	.04	1.29

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered. NA IIV = Negative Affect Intra-Individual Variability, PA IIV = Positive Affect Intra-Individual Variability, Congruency Variability PF = Emotional Congruency Model, Complexity Variability PF= Maintenance of Emotional Complexity Model, Dynamic Variability PF = Dynamic Model of Affect, NA = Negative Affect, PA = Positive Affect, N = neuroticism, E = extraversion, A = agreeableness, O = openness, C = conscientiousness, PC = perceived control

Table 3.2 (continued). Multilevel Regression Coefficients for Affective IIV and PF for Wave 1 and Wave 2

		Wave 1				Wave 2			
Dependent Variable			β	Partial	*t*		β	Partial	*t*
Dynamic Variability PF		(R^2 = .58); *df* = 746				(R^2 = .76); *df* = 699			
	NA mean		–.96	-.74	30.91 **		-1.02	-.84	44.20 **
	PA mean		–.46	-.35	14.58 **		-.36	-.29	15.49 **
	N		–.09	-.07	2.80*		-.02	-.02	1.10
	E		.03	.02	.82		.03	.02	1.30
	A		.03	.02	1.03		.02	.01	.82
	O		–.02	-.02	.77		-.09	-.07	3.75
	C		.03	.03	1.10		-.05	-.04	2.32
	PC		–.01	-.01	.50		.03	.03	1.46

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered. NA IIV = Negative Affect Intra-Individual Variability, PA IIV = Positive Affect Intra-Individual Variability, Congruency Variability PF = Emotional Congruency Model, Complexity Variability PF= Maintenance of Emotional Complexity Model, Dynamic Variability PF = Dynamic Model of Affect, NA = Negative Affect, PA = Positive Affect, N = neuroticism, E = extraversion, A = agreeableness, O = openness, C = conscientiousness, PC = perceived control

Table 3.3 Relationships between NA IIV and Concurrent Health Outcomes

Wave 1					Wave 2				
	B(SE)	β	Partial	t		B(SE)	β	Partial	t
Physical ill-health (R^2 = .19), df = 762					Physical ill-health (R^2 = .24), df = 693				
NA mean	.74(.12)	.22	.22	6.21**		.78(.12)	.25	.25	6.75**
Negative Events mean	-.29(.11)	-.10	-.09	2.65**		-.27(.12)	-.09	-.08	2.18*
NA IIV	1.00(.27)	.21	.13	3.65**		.72(.29)	.13	.09	2.44*
Psychological distress (R^2 = .23), df = 762					Psychological distress (R^2 = .19), df = 693				
NA mean	1.37(.10)	.45	.45	14.12**		1.19 (.10)	.41	.41	11.94**
Negative Events mean	-.17(.09)	-.07	-.06	1.85		-.13(.11)	-.05	-.04	1.21
NA IIV	.86(.23)	.20	.12	3.77**		.73(.25)	.14	.10	2.86**

* P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.4 Relationships between PA IIV and Concurrent Health Outcomes

Wave 1					Wave 2				
	B(SE)	β	Partial	*t*		B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .15), *df* = 762					Physical ill-health (R^2 =.21), *df* = 693				
PA mean	-.16(.05)	-.13	-.13	3.45**		-.26(.05)	-.20	-.20	5.26**
Negative Events mean	-.13(.11)	-.05	-.04	1.21		-.05(.11)	-.02	-.02	.42
PA IIV	.20(.08)	.09	.09	2.42*		.23(.09)	.10	.09	2.52*
Psychological distress (R^2 = .16), *df* = 762					Psychological distress (R^2 = .18), *df* = 693				
PA mean	-.42(.04)	-.36	-.36	10.82**		-.48(.04)	-.40	-.40	11.50**
Negative Events mean	.01(.09)	.00	.00	.01		.11(.10)	.04	.04	1.11
PA IIV	.16(.07)	.08	.08	2.31*		.18(.08)	.09	.09	2.29*

* P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.5 Relationships between Emotional Complexity Model (Congruency Variability PF) and Concurrent Health Outcomes

Wave 1					Wave 2				
	B(SE)	β	Partial	*t*		B(SE)	β	Partial	*t*
Physical ill-health (R^2 =.18), *df* = 759					Physical ill-health (R^2 = .24), *df* = 690				
NA mean	.84(.16)	.25	.18	5.34**		.72(.14)	.23	.18	5.02
PA mean	.05(.06)	.04	.03	.84		-.09(.06)	-.07	-.06	1.52
Negative Events mean	-.28(.11)	-.10	-.09	2.60*		-.27(.12)	-.09	-.08	2.24*
Congruency Variability PF	.20(.12)	.11	.06	1.73		.01(.09)	.01	.01	.08
Psychological distress (R^2 = .26), *df* = 759					Psychological distress (R^2 = .23), *df* = 690				
NA mean	1.16(.13)	.38	.29	8.94**		.87(.12)	.29	.24	7.10**
PA mean	-.13(.05)	-.11	-.09	2.67**		-.28(.05)	-.23	-.19	5.61**
Negative Events mean	-.20(.09)	-.08	-.07	2.18*		-.14(.10)	-.05	-.04	1.35
Congruency Variability PF	.42(.09)	.25	-14	4.45**		-.04(.08)	-.02	-.02	.49

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.6 Relationships between Maintenance of Emotional Complexity Model (Complexity Variability PF) and Concurrent Health Outcomes

Wave 1					Wave 2				
	B(SE)	β	Partial	*t*		B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .18), *df* = 759					Physical ill-health (R^2 = .24), *df* = 690				
NA mean	.84(.16)	.25	.19	5.34**		.72(.14)	.23	.18	5.02**
PA mean	.05(.06)	.04	.03	.85		-.09(.06)	-.07	-.06	1.52
Negative Events mean	-.28(.11)	-.10	-.09	2.60**		-.27(.12)	-.09	-.08	2.24*
Complexity Variability PF	.16(.14)	.06	.04	1.08		.04(.11)	.02	.01	.36
Psychological distress (R^2 = .25), *df* = 759					Psychological distress (R^2 = .23), *df* = 690				
NA mean	1.16(.13)	.38	.29	8.94**		.87(.12)	.29	.24	7.10**
PA mean	-.13(.05)	-.11	-.09	2.67**		-.28(.05)	-.23	-.19	5.61**
Negative Events mean	-.20(.09)	-.07	-.07	2.18*		-.14(.10)	-.05	-.05	1.35
Complexity Variability PF	.31(.12)	.14	.08	2.61**		-.13(.09)	-.07	-.06	1.70

- P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.7 Relationships between Dynamic Model of Affect (Dynamic Variability PF) and Concurrent Health Outcomes

Wave 1					Wave 2				
Dependent Variable	B(SE)	β	Partial	*t*		B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .20), *df* = 747					Physical ill-health (R^2 = .24), *df* = 685				
NA mean	.87(.16)	.26	.19	5.46**		.72(.15)	.22	.18	4.98**
PA mean	.05(.06)	.04	.03	.85		-.10(.06)	-.08	-.06	1.68
Negative Events mean	-.29(.11)	-.10	-.09	2.55*		-.28(.12)	-.09	-.08	2.23*
Dynamic Variability PF	-.65(.15)	-.24	-.15	4.33**		.08(.17)	.04	.02	.49
Psychological distress (R^2 = .26), *df* = 747					Psychological distress (R^2 = .23), *df* = 685				
NA mean	1.17(.13)	.39	.30	9.28**		.88(.12)	.30	.24	7.20**
PA mean	-.14(.05)	-.12	-.09	2.84**		-.28(.05)	-.23	-.19	5.53**
Negative Events mean	-.23(.09)	-.08	-.08	2.55*		-.12(.10)	-.04	-.04	1.12
Dynamic Variability PF	-.27(.11)	-.11	-.07	2.23*		.19(.15)	.09	.04	1.27

* P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.8 Relationship Between NA IIV at Wave 1 with Health Outcomes 10 Years Later (Wave 2)

	B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .40), *df* = 761				
NA mean	.82(.13)	.23	.23	6.51**
Negative Event mean	-.21(.12)	-.07	.06	1.79
Physical ill-health at wave 1	.63(.03)	.59	.57	20.31**
NA IIV	.84(.24)	.16	.10	3.50**
Psychological distress (R^2 = .23), *df* = 761				
NA mean	.98(.11)	.31	.31	9.24**
Negative Event mean	-.19(.10)	-.07	-.07	1.97
Psychological distress at wave 1	.40(.04)	.39	.35	10.95**
NA IIV	.46(.23)	.10	.06	1.98*

* P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.9 Relationship Between PA IIV at Wave 1 with Health Outcomes 10 Years Later (Wave 2)

	B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .38), *df* = 761				
PA mean	-.18(.05)	-.13	-.13	3.73**
Negative Events mean	-.05(.12)	-.02	-.01	.39
Physical ill-health at wave 1	.65(.03)	.60	.60	21.09**
PA IIV	.08(.07)	.04	.04	1.18
Psychological distress (R^2 = .14), *df* = 761				
PA mean	-.35(.04)	-.29	-.29	8.60**
Negative Events mean	-.12(.10)	-.05	-.04	1.24
Psychological distress at wave 1	.19(.03)	.20	.20	5.90**
PA IIV	.14(.07)	.07	.07	1.92

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.10 Relationship Between Emotional Congruency Model (Congruency Variability PF) at Wave 1 with Health Outcomes 10 Years Later (Wave 2)

Dependent Variable	B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .39), *df* = 758				
NA mean	.92(.17)	.26	.20	5.49**
PA mean	.05(.06)	.03	.03	.72
Negative Events mean	-.21(.12)	-.07	-.06	1.75
Physical ill-health at wave 1	.63(.03)	.59	.57	19.97**
Congruency Variability PF	.07(.10)	.03	.02	.66
Psychological distress (R^2 = .24), *df* = 770				
NA mean	.64(.14)	.21	.16	4.60**
PA mean	-.20(.05)	-.17	-.13	3.74**
Negative Events mean	-.24(.10)	-.09	-.08	2.42*
Psychological distress at wave 1	.39(.04)	.38	.34	10.54**
Congruency Variability PF	.-11(.10)	-.07	-.04	1.15

* P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.11 Relationship Between Maintenance of Emotional Complexity Model (Complexity Variability PF) at Wave 1 with Health Outcomes 10 Years Later (Wave 2)

	B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .46), *df* = 681				
NA mean	.96(.17)	.27	.21	5.62**
PA mean	.05(.06)	.04	.03	.82
Negative Events mean	-.26(.12)	-.09	-.08	2.20*
Physical ill-health at wave 1	.61(.03)	.58	.56	18.85**
Complexity Variability PF	.14(.13)	.05	.03	1.08
Psychological distress (R^2 = .27), *df* = 681				
NA mean	.73(.15)	.22	.17	4.83**
PA mean	-.21(.06)	-.17	-.13	3.72**
Negative Events mean	-.24(.10)	-.09	-.08	2.24*
Psychological distress at wave 1	.41(.04)	.40	.35	10.72**
Complexity Variability PF	-.13(.13)	-.05	-.03	1.00

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.12 Relationship Between Dynamic Model of Affect (Dynamic Variability PF) at Wave 1 with Health Outcomes 10 Years Later (Wave 2)

	B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .39), *df* = 759				
NA mean	.95(.17)	.26	.20	5.60**
PA mean	.04(.06)	.03	.02	.68
Negative Events mean	-.21(.12)	-.07	-.06	1.71
Physical ill-health at wave 1	.63(.03)	.58	.57	19.72**
Dynamic Variability PF	-.23(.13)	-.08	-.05	1.72
Psychological distress (R^2 = .27), *df* = 746				
NA mean	.68(.14)	-.21	.16	4.73**
PA mean	-.20(.05)	-.17	-.13	3.72**
Negative Events mean	-.21(.10)	-.08	-.07	2.07*
Psychological distress at wave 1	.43(.04)	.40	.35	11.08**
Dynamic Variability PF	-.54(.12)	-.21	-.14	4.31**

* P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.13 Affective IIV and PF as Concurrent Predictors of Health

Wave 1					Wave 2				
	B(SE)	β	Partial	*t*		B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .10), *df* = 751					Physical ill-health (R^2 = .10), *df* = 763				
NA mean	.86(.16)	.25	.19	5.33**		.80(.14)	.24	.20	5.70**
PA mean	.05(.06)	.04	.03	.74		-.09(.06)	-.06	-.05	1.54
Negative Event mean	-.31(.11)	-.10	-.10	2.73**		-.31(.12)	-.10	-.09	2.57**
NA IIV	.59(.33)	.12	.06	1.77		.88(.40)	.15	.08	2.20*
PA IIV	.08(.09)	.04	.03	.93		.14(.09)	.06	.05	1.49
Congruency Variability PF	.23(.18)	.12	.04	1.28		-.27(.13)	-.14	-.07	2.10*
Complexity Variability PF	-.01(.22)	-.01	-.01	.06		-.05(.15)	-.02	-.01	.32
Dynamic Variability PF	-.66(.16)	-.24	-.14	4.10**		.35(.20)	.14	.06	1.73

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.13 (continued). Affective IIV and PF as Concurrent Predictors of Health

Wave 1					Wave 2				
	B(SE)	β	Partial	*t*		B(SE)	β	Partial	*t*
Psychological distress (R^2 = .27), *df* = 751					Psychological distress (R^2 = .22), *df* = 763				
NA mean	1.17(.13)	.39	.30	9.30**		.82(.11)	.28	.23	7.15**
PA mean	-.14(.05)	-.12	-.09	2.88**		-.26(.05)	-.22	-.18	5.63**
Negative Event mean	-.24(.09)	-.09	-.09	-2.70**		-.11(.10)	-.04	-.04	1.11
NA IIV	.33(.26)	.08	.04	1.26		1.27(.33)	.25	.13	3.95**
PA IIV	.03(.07)	.02	.01	.41		.02(.08)	.01	.01	.33
Congruency Variability PF	.51(.14)	.31	.12	3.69**		-.23(.11)	-.14	-.07	2.29*
Complexity Variability PF	-.17(.17)	-.08	-.03	1.03		-.35(.12)	-.16	-.09	2.90**
Dynamic Variability PF	-.39(.12)	-.16	-.10	3.02**		.59(.17)	.28	.11	3.56**

* P < 0.05, ** P < 0.01; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Table 3.14 Affective IIV and PF as Predictors of Health 10 Years Later

	B(SE)	β	Partial	*t*
Physical ill-health (R^2 = .40), *df* = 751				
NA mean	.98(.17)	.27	.20	5.82**
PA mean	.05(.06)	.03	.03	.73
Negative Event mean				
Physical ill-health at wave 1	.63(.03)	.58	.57	19.93**
NA IIV	.94(.28)	.18	.09	3.29**
PA IIV	-.02(.07)	-.009	-.008	.29
Congruency Variability PF	-.006(.15)	-.003	-.001	.04
Complexity Variability PF	-.10(.19)	-.04	-.02	.52
Dynamic Variability PF	-.22(.14)	-.08	-.04	1.56
Psychological distress (R^2 = .27), *df* = 750				
NA mean	.68(.14)	.22	.16	4.79**
PA mean	-.20(.05)	-.16	-.12	3.61**
Negative Event mean	-.19(.10)	-.07	-.07	1.91
Psychological distress at wave 1	.43(.04)	.40	.35	11.02**
NA IIV	.53(.28)	.12	.06	1.90
PA IIV	.03(.07)	.01	.01	.44
Congruency Variability PF	-.04(.15)	-.02	-.01	.28
Complexity Variability PF	-.13(.18)	-.06	-.02	.74
Dynamic Variability PF	-.46(.13)	-.18	-.11	3.41**

* $P < 0.05$, ** $P < 0.01$; R^2 values are from the final equation. Other parameters are from the step in which the predictor was first entered.

Figure 3.1 Relationships Between Affective IIV, PF, and Psychological Distress at Waves 1 and 2, and 10 Years Later

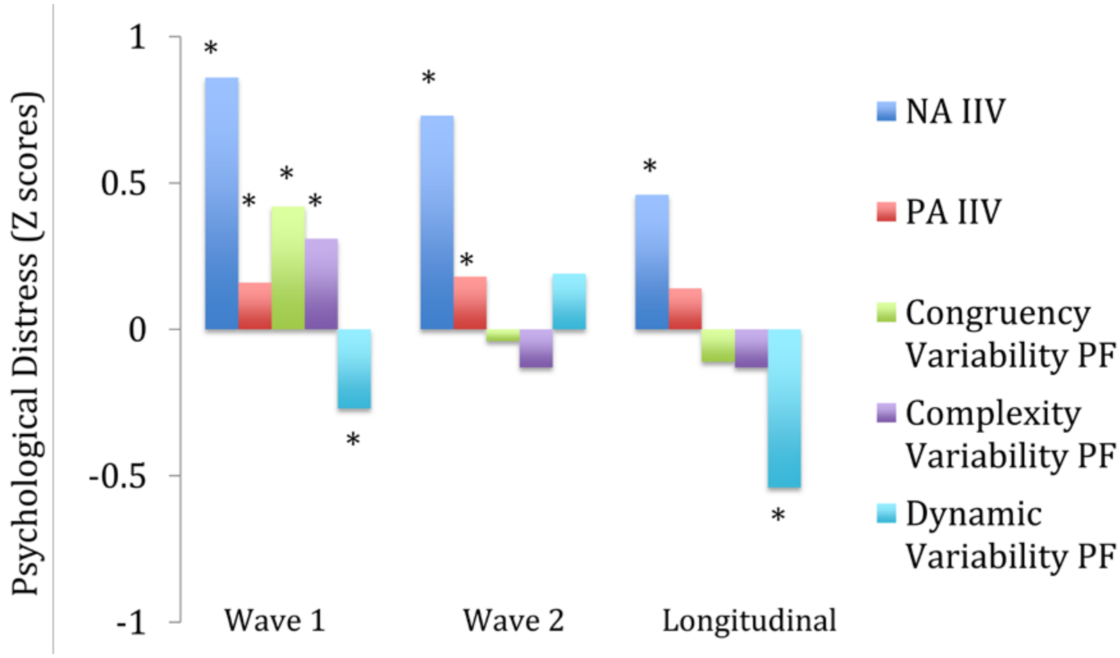
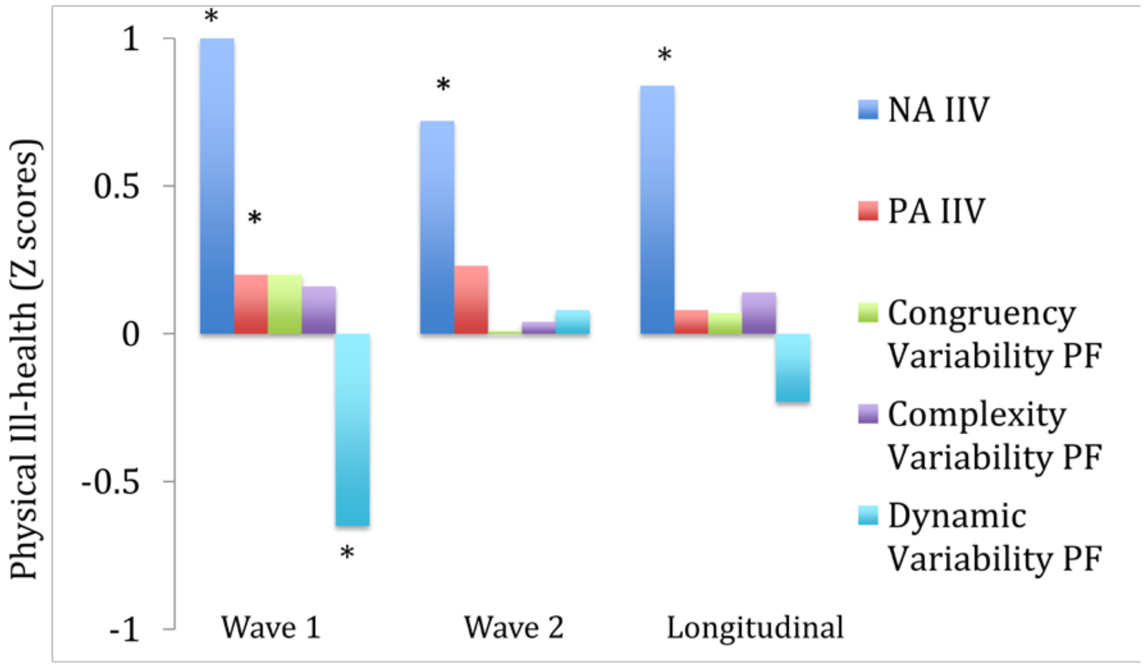


Figure 3.2 Relationships Between Affective IIV, PF, and Physical Ill-health at Waves 1 and 2, and 10 Years Later



Chapter 4: Discussion

The current study proposed to examine affective IIV and PF side-by-side in order to establish these as distinct constructs with distinct features and outcomes. Additionally, the current study wanted to assess which theory of affective PF is most adaptive. It was found that affective IIV and PF were correlated, and interestingly, affective IIV was differentially correlated with affective PF depending on how it was operationalized. Higher NA IIV and PA IIV were associated with higher Congruent Variability PF and Complexity Variability PF indicating these constructs were similar. However, higher NA IIV and PA IIV were associated with lower affective PF when it was operationalized as Dynamic Variability PF, indicating these constructs may have different properties. This suggests that affective PF may be more complex than mere congruency of emotion with the situation, but may indicate that a more appropriate way to describe affective PF is that the relationship between positive and negative emotions changes depending on the situation. In this data set, higher affective PF as operationalized by Congruent Variability PF and Complexity Variability PF was highly correlated with higher NA and lower PA and may reflect the amount of NA and PA experienced in general rather than changing levels of NA or PA depending on the situation. Affective PF as defined by Dynamic Variability PF had a much lower correlation with PA than did Congruent Variability PF and Complexity Variability PF. This suggests the definition of affective PF, as operationalized by Dynamic Variability PF, may capture the patterned response predicted by affective PF the most accurately.

Affective IIV and PF also differentially correlated with personality factors. Although there were a number of significant correlations between affective IIV and PF and personality factors, not all were significant across both waves. In order to be conservative in identifying potential relationships, only those that replicated across both waves ought to be considered as robust findings. Higher NA IIV, Congruent Variability PF, and Complexity Variability PF were related to higher neuroticism and lower perceived control, consistent with previous studies suggesting NA IIV represents emotional lability (Bolger & Zuckerman, 1995). In contrast, higher Dynamic Variability PF was related to lower neuroticism and higher perceived control, which suggests higher self-regulatory control (Bonanno & Burton, 2013). This suggests that when affect is assessed in conjunction with the situational demands, a different pattern may emerge than when simply measuring change in emotion. Those with higher Dynamic Variability PF also reported greater perceived control, suggesting that changes in emotion reflect intentional responses rather than emotional lability.

It is interesting to note that self-control as measured by HRV and the self-control scale in the Biomarker subsample were not related to any of the personality factors in this study. Although some research has found a relationship between HRV and neuroticism, agreeableness, and affect (Wang, Lü, & Qin, 2013), these findings have not been consistent and other studies have found no significant relationships (Silvia, Jackson & Sopko, 2014). Other research has found no relationship between HRV, neuroticism, and NA, but rather an interaction between neuroticism and HRV where higher HRV mitigates the detrimental effects of neuroticism on physical and psychological distress (Ode, Hilmert, Zielke, et al. 2010). Thus the relationship between HRV and affective IIV and PF may be more complex and may be moderated by other personality factors such as neuroticism.

When the relationships between affective IIV and PF and personality were assessed in multiple regressions controlling for mean levels of affect, the relationships between affective IIV and PF and neuroticism and perceived control were not consistent across both waves. This may be in part due to the high correlations between mean levels of NA and PA and affective IIV and PF. In this sample, people generally reported low NA and high PA. This restriction in range of affect limits the ability to statistically assess the effects of affective IIV and PF over and above the effects of mean NA and PA. The relationships between neuroticism, perceived control and affective IIV and PF may be more apparent in a sample with more range in affect. Nonreplicability across waves may also be due to the low within-wave stability in affective IIV and PF in wave 2.

There were also distinct outcomes for affective IIV and affective PF. NA IIV was related to higher psychological distress as well as physical ill-health at both waves, as well as change over 10 years, consistent with previous research (Eid & Diener, 1999; Kuppens, Van Mechelen, Nezlek, Dossche, & Timmermans, 2007; Ram, Gerstrof, Lindenberger, & Smith, 2011). PA IIV was also related to higher psychological distress and ill-health at both waves, but did not predict psychological distress or ill-health 10 years later, consistent with previous studies (Gruber, Kogan, Quoidbach, & Mauss, 2013).

Congruent Variability PF and Complexity Variability PF were related to higher psychological distress at wave 1 but these findings did not replicate at wave 2 or when assessing longitudinal effects. Congruent Variability PF and Complexity Variability PF were not related to physical ill-health at any time point. Because these variables had particularly low within-wave stability estimates in wave 2, it is unclear whether the results in wave 1 are spurious or if the variables were not adequately captured in wave 2, leading to a Type II error. Assessing these variables in another study with higher within-wave stability would clarify these findings.

Dynamic Variability PF was related to lower psychological distress and lower physical ill-health at wave 1 and 10 years later but not at wave 2. However, when all of the affective IIV and PF were used as predictors of health, Dynamic Variability PF was one of the best predictors of psychological distress at both waves and at 10 years, even better than NA IIV. Operationalizing affective PF according to this theory appears to be consistent with previous research of affect regulation. Affect regulation flexibility moderated the relationship between cumulative life stress and positive psychological adjustment (Westphal et al., 2010), and the ability to both suppress and enhance expression of affect predicted less distress 2 years later (Bonanno et al., 2004). Further assessment of affective PF as operationalized by Dynamic Variability PF in other populations would increase understanding of this trait as a distinct construct separate from IIV.

Many studies focus on concurrent relationships between variables, yet this study design allowed the examination of both concurrent relationships and longitudinal effects of affective IIV and PF on health outcomes. Only one prospective study has been done examining the effects of affective PF on later distress (Bonanno et al., 2004). As studies that only examine concurrent results are not able to exclude the possibility of another factor driving the relationship between findings, examining the temporal relationship of Dynamic Variability PF and psychological distress strengthens the finding of this relationship and provides further evidence of this construct as a distinct trait. These findings also add to the body of research on the stability of affective IIV, indicating that this is a stable personality trait not only over a couple of months (Eid & Diener, 1999; Rocke, Li, & Smith, 2009) but also over a 10 year span.

Limitations

There were a limited number of days assessed at each wave, which limited reliability analysis. Ideally, one would use Latent State-trait analysis to examine the reliability of these constructs (Eid & Diener, 1999). However, this would require a minimum of at least 12 days and would be more effective with more data points. Future studies should examine how many data points are necessary to achieve reliability when examining affective IIV and PF. Currently there is a large range in the number of time points assessed when studying affective IIV, from 5 time points to upwards of 50, with a majority of studies assessing 5-14 timepoints (Eid & Diener, 1999; Kuppens, Van Mechelen, Nezlek, Dossche, & Timmermans, 2007; Ram, Gerstrof, Lindenberger, & Smith, 2011). Establishing the minimum number of time points necessary will help future studies ensure reliable measurement of affective IIV and PF as these constructs are further examined.

This study assessed affect and negative events once daily. However, affect may vary widely over the course of the day, as may the experience of negative events, and daily assessment (versus throughout the day) may mask moment to moment changes. Examining the pattern of affective response with negative events within the course of a day would be useful in order to determine if the pattern of affective PF is similar to the results found with daily assessment.

Low within-wave stability of affective IIV and PF in wave 2 limited interpretation of the results. Due to this low stability, it is unclear if the lack of replicability in the results is due to no significant results or due to inability to capture the IIV and PF at that wave. One strength of this study design was the ability to compare findings across 2 waves and assess replicability of the findings. Findings that were robust across waves may be interpreted with more confidence.

The MIDUS data set has low diversity in both race and education level. This limits the generalization of these findings to other populations. Future work should be done with greater ethnically diverse groups to determine whether these results translate to the broader population.

Future Directions

It appears that affective IIV and PF are different constructs and more needs to be done to characterize these traits. However, how they are operationalized is important. Dynamic Variability PF may capture affective PF better than Congruent Variability PF or Complexity Variability PF and should be replicated in other samples.

The ability to theoretically and operationally define affective IIV and PF will allow for more precision and clarity in research on within-person variability. With regard to affective PF in particular, important questions remain. First, is affective PF a stable individual difference? Affective IIV has been shown to vary across the lifespan (Rocke, Li, & Smith, 2009) and it would be interesting to determine if affective PF likewise varies and what life changes may contribute to changes in affective PF. Affective NA IIV was lower in older adults, consistent with previous findings (Rocke, Li, & Smith, 2009), whereas Dynamic Variability PF was only marginally related to age. This study assessed whether chronic pain affected IIV and PF in the effects on health outcomes, and found no significant differences. However, it would be useful to determine if there are differences in other populations, such as those with current psychological distress. Second, is there an overarching quality of PF that crosses domains? Although evidence from IIV suggests that variable people are variable across domains, it is possible that people who have PF in one domain (e.g., affect) may not be as flexible in other domains (e.g., interpersonal interactions, or coping skills).

Conclusion

Within-person variability has multiple manifestations with different implications for psychological and physical health. Affective IIV is total within-person variability that is typically assessed absent consideration of changes in situation. In general, more variability in affect is associated with poorer psychological and physiological outcomes. Affective PF is within-person variability comprising a patterned, predictable response. Affective PF can be operationalized by constructing a theory of situational fit predicting contextually appropriate responses and a difference score based on the theory of fit. In general, affective PF has been related to better psychological outcomes. When situational context is included in the calculation of emotional within person variability, one may see patterned responses rather than emotional lability. These patterned changes in emotional response represent increased emotional control and are related to better psychological and physical outcomes.

Therefore, whether affective within-person variability is found to be adaptive or maladaptive depends on how it is defined. Total affective variability appears maladaptive. However, affective variability conforming to patterned responses to different situations, specifically when the relationship of NA and PA changes depending on the situation, appears adaptive.

The substantial literature on IIV in domains in addition to affect will be enhanced by future studies that distinguish between variability that is not patterned across situations and variability that is patterned across situations. Future studies should also draw on theoretical models to predict who benefits from variability, in which situations, and at what points in the life span. Such work will increase our ability to understand the dynamic processes of personality and their effects on psychological and physiological well-being.

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VITA

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EDUCATION

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2009	B.S., Psychology University of Kentucky Lexington, KY *Honors Thesis*: The relationship of goal conflict and fatigue in women with fibromyalgia (Advisor: Suzanne Segerstrom, Ph.D.)
2004	M.S., Organismal & Integrative Biology University of Kentucky Lexington, KY *Thesis Title:* The regulation of insulin-like growth factor binding proteins (IGFBPs) in two teleosts, channel catfish (*Ictalurus punctatus*) and rainbow trout (*Oncorhychus mykiss*)
2001	B.S., Biology University of Kentucky Lexington, KY *Honors Thesis*: The development of a non-radioactive Western Blot for channel catfish (*Ictalurus punctatus*). (Advisor: Brian Shepherd, Ph.D.)

PROFESSIONAL POSITIONS

07/14-Present	Assessment Coordinator, Jesse G. Harris Psychological Services Center
08/10-Present	Student Therapist, Jesse G. Harris Psychological Services Center
05/11-08/13	Bluegrass Health Psychology
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06/10-08/11	University of Kentucky Counseling and Testing Center
2010-2013	Research Assistant University of Kentucky, Department of Psychology Lexington, KY
2004-2009	Research Assistant University of Kentucky, Department of Anesthesiology Lexington, KY
2001-2002	Research Assistant University of Kentucky, Department of Biology Lexington, KY

AWARDS AND HONORS

2011-2012	Daniel Reedy Achievement Award (renewal), $3000
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2009-2010	Kentucky Non-Service Fellowship, University of Kentucky, $15,000
2006, 2007, 2009	Outstanding poster presentation, Neuroscience Day, Bluegrass Chapter of the Society of Neuroscience, $100
2002-2003	Integrative Neurophysiology and Psychology Fellowship, University of Kentucky, $18,000
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ABSTRACTS AND PRESENTATIONS

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24. Hardy, J.K., Sephton, S., Segerstrom, S.C. [Presenter]. Cognitive flexibility in older adults flattens cortisol slopes. APS, San Antonio, TX, March 9-12, 2011.

25. Hardy, J.K., Segerstrom, S.C., Evans, D. [Oral Presentation]. Physical Activity and Distress: Effects on Antibody Response, Executive Function, and Cognitive Fatigue. Brain, Behavior and Immunity, Chicago, IL, Dec. 2-4, 2011.

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