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Extraversion and Ego-Resiliency: Predicting Electroencephalograph Measured Positive Emotion

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ABSTRACT - Defining features of extraversion, ego-resiliency, and ego-control (over- and under-control) were examined by testing their relations with positive emotion, measured over 8-min by EEG (PFC left dominant alpha activity). Data from 31 participants indicated that positive emotion increased over time. A time x extraversion interaction indicated that extraversion predicts positive emotion at the onset of the procedure, but not at the end, calling into question the notion that positive emotion lies at the core of extraversion. Alternatively, throughout the 8-min, positive emotionality was predicted from ego-resiliency, supporting the contention that ego-resiliency emerges from positive emotionality. The further study of ego-resiliency, ego-control, emotions, and their suggested relations with attention may shed new light on the prevention and treatment of psychological illness.

A great deal of progress has been made toward identifying personality characteristics that are most closely associated with emotion (Plutchik, 2003). Continuing interest in this area has been fueled, in part, by work in evolutionary psychology and behavioral genetics. These areas offer theories specifying that personality emerges from emotion through a polygenic temperamental core, which

interacts with the environment constraining the probability of developing a particular characteristic (Kagan, 2003). The associations among negative emotion and personality have historically been targeted for study; however, the importance of positive emotion for personality functioning has become increasingly evident. Recently, a positive emotion core has been attributed to both extraversion (Watson & Clark, 1997) and to resiliency (Friedrickson, 2001). Unfortunately, lingering discrepancies between conceptualizations of extraversion and resiliency raise concerns about this conclusion. Issues regarding the defining features of extraversion and resiliency, and their associations with positive emotion are the focus of this study.

Extraversion and Positive Emotionality

Carl Jung (1921) first identified extraversion-introversion as a domain of psychological importance, and since then the trait has garnered considerable attention. Over the years, differing theoretical and empirical approaches to defining extraversion have led to somewhat different conceptualizations of this trait (Watson & Clark, 1997). Inductive approaches have been driven by the lexical hypothesis, the notion that all important personality trait terms will become encoded in a culture's natural language (Goldberg, 1993). The resulting *Five Factor Personality Model* provides a lexical definition of extraversion that is widely accepted (McCrae & Costa, 2003). On the other hand, theories concerning the psychological processes that underlie extraverted and introverted behavior have received considerable empirical support (e.g., Eysenck & Eysenck, 1985).

Regardless of the approach used, all current definitions of extraversion emphasize the approach-related, social/interpersonal nature of the trait. Research also suggests that extraversion is marked by experiences of positive emotion. Robust correlations have been observed among extraversion and positive emotion in concurrent self-reports (Watson & Clark, 1997), and in reports of positive emotion measured at times when individuals are going about their daily routine (Eaton & Funder, 2001; Spain, Eaton, & Funder, 2000). Consequently, some have concluded that positive emotion is *the core* of extraversion (Tellegen, 1985; Watson & Clark, 1997).

Extraversion, Arousal, and Positive Emotion

The apparent movement toward emphasizing positive emotion as the defining feature of extraversion (Costa & McCrae, 1984; Watson & Clark, 1997) is not consistent with other conceptualizations of the trait. It may be particularly at odds with the notion that individual differences in *cortical arousal* serves as the

motivational core of the trait, such as in Eysenck's theory of personality (Eysenck & Eysenck, 1985). Eysenck proposed that individuals who tend to display extraverted behavior possess a high threshold for cortical arousal, a hypothesis that has been empirically supported by several studies examining overall cortical activity measured by EEG low-range alpha waves. Findings from these studies indicate that extraverts have been shown to display significantly less cortical arousal along the anterior reticular activating system (ARAS)/cortical pathway than do introverts (Gale, Edwards, Morris, Moore, & Forrester, 2001; Tran, Craig, & McIsaac, 2001). Due to a chronic state of under-arousal by the ARAS, it is reasoned that extraverts are motivated to seek change and stimulus-rich environments, a tendency reflected in personality characteristics such as being venturesome and carefree (Nicholson, Soane, Fenton-O'Creevy, & Willman, 2005). For introverts, the opposite is true; they are understood to possess a low threshold for cortical arousal (a chronic state of over-arousal by the ARAS), which motivates them to seek isolation from stimulus-rich environments and to avoid change (Gersten, 1989; Kagan, Snidman, & Arcus, 1998).

In any case, in the course of daily living, individuals choose and shape their environments in ways that are congruent with their personality, thereby promoting positive emotion (Aspinwall & Taylor, 1997; Bandura, 2001; Emmons, Diener, & Larsen, 1986). Eysenck's theory suggests that, in the course of daily living, individuals who are more extraverted tend to seek more stimulating environments, situations that provide novel or exciting experiences. Individuals who are more introverted tend to choose environments where external stimulation is consistently low. As long as individuals choose to remain in a personality-congruent environment, they should typically experience positive emotion; when presented with a personality-incongruent situation, positive emotion should decline. In summary, instead of leading to the conclusion that positive emotion lies at the core of extraversion, this literature suggests that positive emotion might covary with the degree of *cortical arousal* that situations provide.

Psychological Resiliency and Positive Emotionality

Alternatively, we propose that positive emotion may lie at the core of psychological *resiliency*. Before proceeding, it is important to differentiate between psychological and social forms of resilience. From a social-psychological perspective, resilience involves an individual's awareness and utilization of social resources that society provides. Doubtless, some individuals are resilient, at least in part, because they seek and utilize support from government programs and local community resources (Maton, Schellenbach, Leadbeater, & Solarz, 2004). Similarly,

resiliency can come from material-social-emotional support provided by a family unit or very close friends who function as part of the family unit (Epps & Jackson, 2000; Ladd, 1999; Dishion & Patterson, 2006). Studies of resiliency in these domains typically measure important social outcomes (e.g., avoidance of deviant peer groups; abstaining from drug use; nonparticipation in criminal activity; delaying childbearing until an appropriate age; see Dishion & Patterson, 2006). These social-psychological forms are contrasted with another domain of resilience, one that focuses on psychological processes that resides within a person (i.e., personality processes; Block, 2002). From this perspective, the presence/absence of psychological disorder becomes the primary outcome of interest.

To clarify the distinction between social and psychological forms of resilience, the term *ego-resiliency* was adopted for the psychological form (J. Block, 1950 & J.H. Block, 1951, cited in Garmezy, 1996). Ego-resiliency is defined as a set of personality characteristics and psychological control processes (cognitive and affective) that allow an individual to remain free from the harmful effects of negative emotion (anxiety in particular) (Block, 2002). Ego-resiliency reflects individual differences in the ability to remain *flexible* and *adaptive* despite an ever-changing set of environmental circumstances. Fundamental for flexible adaptation is *ego-control.* At one extreme, an individual can be *over-controlled* (behavioral expression is highly constrained, and behavioral impulses are rigidly controlled). At the other extreme, the individual can be *under-controlled* (behavioral expression is less constrained, possibly even uncontrolled). Neither extremes of the ego-control construct are associated with ego-resiliency; a resilient individual can appropriately use either ego-control strategy to meet environmental demands (Eisenberg, Fabes, Guthrie, & Reiser, 2000).

Research has established that, when unchallenged by the environment, most individuals typically experience mild positive emotion, a phenomenon known as the *positive offset* (Cacioppo & Gardner, 1999). This homeostatic level of mild positive emotion is understood to provide the fuel that motivates approach toward the world, unmotivated exploration, and the need to make use of information gleaned from the environment (Block, 2002). Similarly, Fredrickson's (2001; 2006) *Broaden-and-Build* theory asserts that individual differences in positive offset (typical level of positive emotion) play a pivotal role in resiliency, with greater levels of positive offset protecting individuals from psychological distress following a negative life event. When challenged by circumstances that elicit negative emotion, Fredrickson and colleagues have shown that positive emotion can *undo* lingering negative emotions to bring individuals back to their homeostatic, positive offset (Fredrickson, Mancusco, Branigan, & Tugade, 2000; Tugrade, Fredrickson, & Feldman-Barrett,

2004). Positive emotions may, in fact, even fuel upward spirals toward ever-increasing degrees of positive emotion, resiliency, and general psychological well-being over time (Fredrickson & Losada, 2005). From this line of research, Fredrickson (2006) has concluded that positive emotion likely provides the core for psychological resiliency.

The Present Study

This study will examine relations among extraversion, ego-resiliency, ego-control (over-control and under-control), and positive emotion. Extraversion will be measured by the NEO-FFI (Costa & McCrae, 1992), a measure that is theoretically neutral with regard to our hypotheses; it operationalizes extraversion empirically. Ego-resiliency and ego-control will be prototype-scored from the California Q-sort (Block, 1978), a procedure that reduces demand characteristics by allowing us to keep our participants blind to the specific personality characteristics of interest.

Positive emotion will be measured as prefrontal cortex (PFC) asymmetry (scored left-dominant) in scalp-recorded EEG (brain electrical activity) in the alpha range, an increasingly important and reliable psychophysiological measure of positive emotion (Davidson, 2000; 2004). This measure of emotion is advantageous because participants can remain unaware of the specific purpose of the EEG measurements, thereby reducing method variance, a potential confound in personality-emotion research when both the predictor and the criterion are measured using the same method (e.g., self-report) (Campbell & Fiske, 1959; Lengua, West, & Sandler, 1998).

At the beginning of the 8-min resting protocol used in this study the participants will have just completed the EEG prep procedure, which by its nature imposes a sequence of stimulus-rich events. The current study will focus on predicted emotionality at the beginning and end of the resting protocol. Virtually all conceptions of extraversion lead to the prediction that extraversion will covary with the degree of positive emotion measured at the onset of the resting protocol. What is more important, however, is the degree of change in positive emotion as participants habituate to the EEG and the surrounding laboratory environment. Based on Eysenck's theory of personality an interaction effect is expected for positive emotion over the 8-min resting protocol. For those who are more extraverted, greater levels of *initial* positive emotion experienced, due to the novel experience of EEG prep, are expected to decline during the course of the protocol; this is because the quiet, resting environment is a personality incongruent situation for extraverts. For those individuals tending to be more introverted, positive emotions should increase during the resting protocol, because the quiet, stimulus-minimized environment is a

personality congruent situation for introverts. Correlation coefficients are used in this study as a measure of effect size to illustrate the impact of this interaction effect on personality-emotion correlates over time.

In contrast to extraversion, theories of psychological resiliency predict a consistent relationship among ego-resiliency scores and positive emotion measurements across time (Block, 2002; Fredrickson, 2001; 2006); these two variables are hypothesized to remain positively associated throughout the resting protocol. In terms of ego-control, under-control will predict positive emotion at the onset of the study, because under-control broadens approach (Block, 2002; Fredrickson, 2001; Isen, 2000) and approach has been found to be related to positive emotion (Davidson, 2000; 2004). Over-control is expected to be negatively correlated with positive emotion at the onset of the resting protocol, as over-controlled individuals tend to deny or delay pleasure as a means of coping, even when pleasure would come at little personal cost (Block, 2002). Block's theory further suggests that ego-control (under-control and over-control) functions, at least in part, as a coping mechanism; therefore, once habituated to the environment, ego-control processes will likely cease to promote (i.e. covary with) positive emotion.

Method

Participants

Thirty-one undergraduate students at a comprehensive university, recruited from announcements made in various lower and upper division psychology classes, volunteered to participate. All announcements included a list of study criteria, and volunteers were prescreened to ensure they met the inclusion criteria for this study (right-handed; not previously or currently diagnosed with a brain injury or psychological disorder; not currently consuming mood-altering substances, e.g., antidepressant medication). The average age of the participants was 21-years-old (*SD* = .66). The sample consisted primarily of women, 93%; eighty-two percent of the participants self-identified as Euro-American, and 18% reported an ethnicity other than Euro-American (Puerto-Rican or African-American). Students received extra credit in psychology courses for their participation. Some minor attrition occurred due to the use of multiple sessions; one student withdrew and one session was lost to an equipment set-up problem. A final sample of 29 participants was used in data analysis.

Materials and Apparatus

Electroencephalogram recording and quantification. A standard EEG prep protocol was used, and electrodes were placed according to the 10-20 electrode

system using a Lycra stretchable cap and ear lobe referents (Electro-Cap International, Eaton, OH). EEG responses were measured using a Mindset MS-1000 (Nolan Computer Systems, L.L.C., Conifer, CO) 16 channel topographic neuromapping instrument. EEG was sampled at 256 samples per sec at 16-bit resolution, amplified with a 91dB gain, and a low pass filter with an attenuation of 48 dB per decade above 100 Hz was applied. Artifact was rejected by visual inspection, and subsequently as second time by MindMeld software (Nolan Computer Systems). Artifact-free 30-sec epochs of EEG were spectral analyzed using a Fast Fourier Transformation with a Hanning window (50% overlap). For more than 25 years, the measurement of EEG prefrontal asymmetry has become an increasingly important measure of emotional valence, with left dominance being associated with positive emotion, and left dominance being associated with negative emotions (Davidson, 2004). The convergent validity of prefrontal asymmetry for measuring emotional valence has been demonstrated most frequently using self-reports (Davidson, 2000). More recently experimental research has shown that startle magnitude following the offset of a negative picture has been associated with predicted EEG measurements of frontal hemispheric asymmetry (Jackson, Mueller, Dolski, Dalton, Nitschke, Urry, et al., 2003). This frontal hemispheric asymmetry observed in adults appears to develop early in infancy (clearly found in 10-month old infants; Fox & Davidson, 1988). Furthermore it appears to be affected, in theoretically consistent ways, by the quality of the infant-mother relationship as evidenced by EEG prefrontal asymmetry is measured in infants of depressed and non-depressed mothers (infants as young as 3-6 months old; Diego, Field, Jones, & Hernandez-Reif, 2006). As in previous research, the EEG analysis for this study concentrated on alpha activity, from 8 to 13 Hz in the PFC, the wave form and cortical regions important for measuring emotional valence (Davidson, 2000).

California Q-sort (CQ; Block, 1961; 1978; as adapted by Bem & Funder, 1978). The CQ is a set of 100 cards, with a personality phrase printed on each card. Participants are asked to place each of the 100 cards into a nine-step, symmetric, normal forced-choice distribution ranging from "*not at all characteristic"* (category 1) to "*highly characteristic*" (category 9) of the person being described. The result is 100 scores that extensively reflect an individual's personality. The CQ can be scored for higher-order personality characteristics by prototype matching (Block, 1978), and prototypes for ego-resiliency and ego-control (over control and under control), previously compiled by Block and his colleagues (ego-control α=.95; ego-resiliency α=.97; Funder & Block, 1989), were used to score the CQ for these higher-order personality characteristics. The validity of this procedure for scoring the CQ has

been established for a variety of measurement methods (e.g., self-report, informant-report, and clinician-report; Letzring, Block, & Funder, 2005).

NEO-FFI (NEO-FFI; Costa & McCrae, 1992). The NEO-FFI is a 60-item short measure of the 5 factors of personality based on the widely-used, longer version of the NEO-PI. Respondents answer to a set of personality phrases, marking their response on a 0 – 4 scale with 0 = *"strongly disagree,"* 4 = *"strongly agree*." Only the extraversion factor scale was germane to this research, and $\alpha = .71$ was the reliability for this scale.

Design and Procedure

In this study, serving as predictor variables are the extraversion factor scores from the NEO-FFI and, ego-resiliency, over-control, and under-control scores from the CQ. The dependent variable is PFC alpha asymmetry, scored in the direction of left sided dominance, a psychophysiological measure of positive emotion (Davidson, 2000; 2004).

Participants were recruited via announcements in several psychology classes to participate in a study concerning "*Personality, Social Context, and Human Emotion*." In the first session of this study, participants were administered informed consent and they completed a battery of questionnaires including a basic demographic questionnaire, the NEO-FFI, and the CQ. At the conclusion of the questionnaire session, the participant was asked to schedule an EEG session.

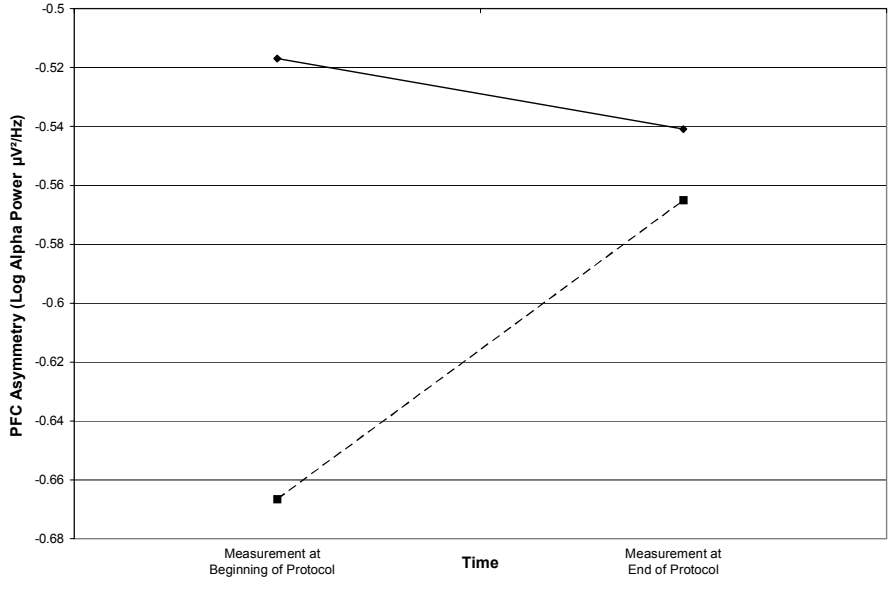
Upon arrival for the EEG session, the participant was asked to sit down in a comfortable straight-back chair in a space free of noise and visual distractions. Next, a trained researcher prepared the participant for EEG recordings using a standard cap and prep protocol (Electro-Cap International, Eaton, OH). After EEG prep, the participant was asked to sit quietly and as still as possible in the chair; the room was darkened (ambient very low-level lighting was provided). A resting, alternating eyes open and eyes closed EEG procedure was used to provide a minimally stimulating environment shown to be critical methodology for this line of research (Gale et al, 2001). Eight-minutes of resting EEG were obtained. At the conclusion of the procedure the participant was debriefed.

Results

To test the hypotheses related to extraversion and changes in positive emotion across time, a repeated measures ANOVA was used. Two critical time periods of EEG alpha power were isolated for these analyses: *Time 1,* at the beginning of the resting protocol (the first 30-sec epoch) and *Time 2*, the ending of the resting protocol (the 30-sec epoch concluding at 7-min 30-sec). In this ANOVA, Time (PFC

asymmetry at Time 1 and Time 2) was entered as a repeated measure and extraversion was entered as the covariate. Positive emotion significantly increased over time F (1, 26) = 8.73, p = .007, *eta* = .50; and, extraversion was found to be a significant covariate F (1, 26) = 4.40, p = .046, *eta* = .38. More importantly, a two-way Time x Extraversion interaction effect on positive emotion was statistically significant and large, F (1, 26) = 7.71, p = .010, *eta* = .48. For the purpose of illustration, Figure 1 depicts this significant interaction effect, with a median split applied to the extraversion scores creating ad hoc high and low extraversion groups (i.e. extraverts and introverts).

Figure 1
Interaction Effect for Extraversion and Positive Emotion Over Time



Note: Extraversion categories (high/low) created by a median split; —— Extraversion (high extraversion; ---- Introversion (low extraversion); Interaction effect is significant with the categorical between-groups extraversion variable (p = .033).

Next, correlational analyses were conducted for the personality variables and positive emotion (PFC alpha asymmetry), and these results are displayed in Table 1. The difference between the correlations for extraversion at Time 1 and Time 2 is significant, t (26) = 2.26, p = .032. In fact, post hoc it was determined that the correlation among extraversion and positive emotion had significantly attenuated to r = .15, *ns* as early as the 30-sec epoch just prior to the 2-minute mark (the second earliest epoch that our protocol will allow us to analyze; eliminating potential eyes-open, eyes-closed confounds; Gale et al., 2001). Furthermore, it is important to note that the extraversion and ego-resiliency scores produced a small, non-significant correlation, r = .28, *ns*.

Table 1
Correlations Among Predictor and Criterion Variables

Positive Emotion	Extraversion r (p)	Resilience r (p)	Under-control r (p)	Over-control r (p)
At 30-sec	**.47** (.012)	**.56** (.002)	**.39** (.041)	**-.34** (.075)
At 7-min 30-sec	**.04** (*ns*)	**.57** (.001)	**.11** (*ns*)	**-.01** (*ns*)

Note: Positive emotion is measured as PFC asymmetry scored in the direction of left PFC activity; zero-order correlations are bolded, exact p-values are found in the parentheses; p<.05 are statistically significant correlations; p<.10 are correlations that approach significance (a.k.a., statistical trend)

Discussion

The aim of this study was to evaluate the assertion that positive emotionality serves as the core of both extraversion and psychological resiliency. If extraversion possesses a positive emotional core, as some Five Factor trait theories assert, extraversion would be expected to be correlated with positive emotion *across time* and over *situations*. Alternatively, Eysenck's theory of extraversion places arousal at the core of extraversion, which leads to different predictions for the stability of positive emotion across time and over situations. This study found significant support for Eysneck's theory of extraversion (see interaction effect displayed in Figure 1), showing that extraversion was associated with systematic, predictable changes in emotion (PFC alpha asymmetry) across time.

The current findings coincide with findings from EEG studies of *arousal* (whole-head alpha activity; Gale, 1983; Gale et al., 2001). For example, participants who were similarly exposed to a resting protocol showed extraversion related arousal early in the protocol (at 20-sec) but not later in the protocol (at 3-min) (Tran et al.,

2001). It appears that, when an individual is resting, the effects of extraversion on positive emotion and arousal appear to be very short lived. Therefore, it is not surprising that some researchers have found null results for extraversion predicting arousal when resting EEG measurements are aggregated across long periods of time (e.g., 8-min; Schmidtke & Heller, 2004), and that mixed results are reported in meta-analysis (Lucas & Baird, 2004). Even in a study using a different protocol, involving habituation to an acoustic startle response, a similar effect was found for extraversion (LaRowe, Patrick, Curtin, & Kline, 2006).

Although extraversion may not consistently predict positive emotion across time when the environment is unchanging, extraversion may predict positive emotion across situations outside of the laboratory. In daily life, individuals can generally choose the situations they enter. In other words, human agency, the ability to alter one's social environment in a variety of ways (Bandura, 2001), may sufficiently explain how extraversion might be related to positive emotion over situations (Lischetzke & Eid, 2006). Extraversion has been found to be associated with choosing to enter situations where others will be present, and those who are more extraverted tend to experience positive outcomes resulting from their engagement with others (Blankstein, Flett, Koledin, Bortolotto, 1989; Eaton & Funder, 2003; Emmons et al., 1986; Furnham, Crump, & Whelan 1997). Furthermore, individuals who are more extraverted tend to show a diurnal pattern of experiencing evening positive mood (Larsen, 1985). That is, they tend to report greater levels of positive emotion as their day goes on, presumably as a result of their lifestyle. Moreover, when individuals behave in ways consistent with extraversion, they too report experiencing greater levels of positive emotion (Fleeson, Malanos, Achille, 2002). In fact, high activity levels alone can produce positive emotion (Mutrie & Faulkner, 2004), regardless of individuals' level of extraversion.

This collection of research results also implies that factor analyses of lexical trait terms alone will not lead psychologists to any greater understanding of the psychological core or defining features of extraversion, or any other psychological characteristic. To answer that kind of question, theoretically driven research is required (Block, 1995; 2001). In sum, findings from psychophysiological and experience sampling studies both challenge the assertion that positive emotion lies at the core of extraversion. Rather, it appears that the positive emotion extraverts experience may be the result of their venturesomeness; extraverts experience positive emotion by consistently choosing active social environments, likely driven by their need for stimulation.

Alternatively, the results of this study support the notion that positive emotion may lie at the core of ego-resiliency. Positive emotionality at the onset and at the

conclusion of the resting EEG procedure was consistently and strongly predicted from ego-resiliency scores. Extraversion may be modestly related to resiliency, as has been documented in previous research (Letzring et al., 2005). This association among extraversion and ego-resiliency may be the product of the positive social environments that those with greater levels of extraversion create around themselves. Over time, engaging in social activities afford extraverts with greater opportunities to acquire reliable social resources. These circumstances could then, in turn, bolster *social forms of resiliency* (e.g., the ability to acquire immediate material and social support in a crisis) (Eisenberg et al., 2000). This proposition highlights the necessity of logically and empirically separating the psychological and social forms of resilience in future research.

Under- and over-control appeared to have served as a coping mechanisms at the onset of the procedure, with under-control producing a positive and significant association with positive emotion, as was predicted by Block's (2002) affect processing theory, as well as Fredrickson's (2001; 2006) Broaden-and-Build theory. Future research should ensure that an adequate number of EEG sites are sampled with equal distribution around the scalp to allow for proper time-related comparisons between positive and negative emotion processes. EEG measurements could also be taken simultaneously with self-reports of emotion, and other psychophysiological measures (e.g., electrodermal response, heart rate) to further understanding of emotion response coherence. Finally, the limited range of ego-resiliency scores observed in a college student sample may have attenuated the observed correlations among ego-resiliency and EEG asymmetry. In future research, the use of a broader and larger sample of participants, those that are more representative of the population would likely increase the variability of ego-resiliency scores. These suggested improvements in methodology could aid in furthering our understanding of emotion control processes related with ego-resiliency by allowing psychologists to study discrete, basic emotions (e.g., anxiety, happiness) in a more generalizable sample of participants.

Although Block (2002) and Fredrickson (2001; 2006) have proposed similar theories concerning resiliency, there are several points of divergence. These dissimilarities concerning the psychological nature of resiliency are important and warrant future research. Two areas that seem to be particularly crucial are the study of emotional control and the study of attention. Regarding the first of these two, emotional control, Fredrickson's theory suggests that positive emotion facilitates the broadening of thought-action repertoires and acts as an undoing effect on negative emotion. Block's theory indicates that the *flexible* use of ego-control reduces anxiety and promotes healthy *adaptation* to changing environmental circumstances. One

approach to examining these issues might be to operationalize emotion regulation in terms of *affective chronometry*—the timing and duration of emotional reactions to experimentally elicited events (Davidson, 1998), with emotion reactions measured in small units of time (i.e., milliseconds). These measurement parameters for emotion provide researchers with the opportunity to identify the precise cognitive and emotion mechanisms involved in ego-control, and therein, resolve some issues that differ among theories of resilience.

Regardless of the precise mechanism for control (broadening or flexible adaptation), it appears that ego-resiliency and emotion regulation are probably also closely related to *attention,* the second area where we suggest future research. Determining the role that attention plays in the formation and functioning of ego-resiliency may be difficult, given that attention is a not a unitary system. Cognitive psychologists long ago identified a myriad of attention-related processes (e.g. selective, sustained, dual, etc.), any of which impact the individual's ability to process social information. More recently, researchers have identified distinct neurocognitive networks that may underlie the processes involved in attention (i.e. anterior executive, posterior orienting, and vigilance networks; see Parasuraman, 2000; Pashler, 1998; Posner & Petersen, 1990). To begin work in this area, psychologists must define which attention processes and which attention systems are likely to be involved in ego-resiliency. It is likely that individual differences in arousal (i.e. the vigilance system), inhibition (i.e. anterior executive system), or orienting (i.e. posterior orienting system), or some combination therein underlie this personality trait.

Temperament and behavioral genetics researchers have long been interested in both attention and emotion regulation. It has been argued that the co-development of attention control and emotion-regulation during infancy may reflect the degree to which infants (aided by caregivers) learn to distract themselves from distressing stimuli (and presumably thoughts) (Wilson & Gottman, 1996). Specifically, Block's (2002) theory suggests that the development and functioning of attention (i.e. vigilance and selective attention) might be critical to ego-resiliency. Failure of attention systems might be related to a lack of resiliency; behaviors indicative of several psychological disorders could result from attention deficits (Block, 2002). Several researchers have associated maladaptive psychosocial behaviors exhibited by children diagnosed with Attention Deficit/Hyperactivity Disorder with maladaptive development of inhibitory processes (Barkley, 1997; Quay, 1997), orienting processes (Collings & Kwasman, 2006; Voeller & Heilman, 1988), and vigilance deficits (Collings & Kwasman, 2006; Schaughency & Hynd, 1989). This would suggest a direct linkage between maladaptive behaviors and any or all of the three

attention systems. The study of ego-resiliency, ego-control, emotion, and attention may shed new light on the prevention and treatment of psychological illness.

Although several theorists have suggested that attention plays a vital role in personality processes, emotion regulation, and ego-resiliency, very little research has directly addressed this issue outside of developmental paradigms (see Rothbart & Posner, 2006). The complexity of human attention presents several opportunities for future research into the relationship between ego-resiliency and emotion regulation processes. It is clear from the current findings, however, that individual differences in ego-resiliency and ego-control processes should be important considerations for future emotion and attention studies.

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