DOES INDEPENDENCE OF AFFECTS IMPACT SOCIAL

FUNCTIONING AND MENTAL HEALTH?

By

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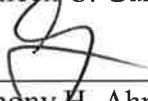
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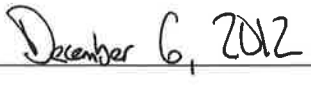
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ABSTRACT

Individuals differ in the degree to which their experience of positive and negative

emotion co-varies. That is, some people will have a stronger within-person inverse relationship

between positive affect (PA) and negative affect (NA), and some will display a weak or non-

existent relationship between the two, or affective independence. This study uses an ecological

momentary assessment approach with an undergraduate sample to explore both whether

individual differences in affective independence are concurrently related to other psychological

variables and whether affective independence can be used to prospectively predict mental health

outcomes. Results suggest that affective independence is related to sex and trait neuroticism but

is not predictive of depression or social support outcomes. Discussion focuses on fitting the sex

and neuroticism findings into the existing literature as well as exploring possible flaws in our

theory or study limitations which could have led to our null findings regarding our prospective

research questions.

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CHAPTER 1

INTRODUCTION

Instinctively, one might assume that positive and negative feelings are negatively correlated and that people feel either good or bad at any given point in time. In reality, however, emotions are not so simple. We frequently feel both happy but guilty, or sad but hopeful, or angry but sympathetic. Co-variation in positive and negative emotion is somewhat less studied than either polar end of the emotion spectrum, despite the fact that feelings are very often not exclusively positive or negative. However, in the 1950s, with the advent of more sophisticated statistical techniques, a small subset of researchers did begin to attempt to determine exactly how positive and negative affect are related (Russell & Carroll, 1999). At present, there is evidence for both the independence and the bipolarity of positive and negative emotions (Green, Goldman, & Salovey, 1993; Zautra, Potter, & Reich, 1997; Russell & Carroll, 1999; Diener & Emmons, 1985; Larsen, McGraw, & Cacioppo, 2001; Larsen, McGraw, Mellers, & Cacioppo, 2004). Furthermore, psychological and demographic differences may lead to individual differences in the relative independence of negative and positive affect (Williams & Aaker, 2002). Some people are more likely to experience emotion as bipolar opposites of one spectrum; positive affect will be low when negative affect is present. Others, in contrast, will be more likely to integrate emotions and experience a relative independence of negative and positive emotions (Williams & Aaker, 2002).

The independence of negative and positive emotions might have important implications for everyday life. If one is able to feel positive emotions even while sad, the experience of sadness might be less distressing. For example, Keltner and Bonanno (1997) found that the display of Duchenne laughter in widow(er)s during difficult interviews about their deceased

spouses was correlated with lower levels of negative emotion, especially anger, and greater

positive affect. In addition, those who displayed Duchenne laughter during the interviews

reported greater marital relationship adjustment with their deceased spouses as well as less

ambivalence in current significant relationships (Keltner & Bonanno, 1997). Therefore, being

able to laugh while venting to friends about a frustrating situation might help to protect one's

social support system (i.e., it might be easier to support someone who is able to infuse some

positive affect into support seeking). As an example of why it could also be important to

experience some negative feelings in the context of a positive situation, consider a scenario in

which a young woman receives a job offer in another city and decides to take it and move. It will

be beneficial to her relationships with her friends, should she want to maintain them after she

leaves, if she feels (and shows) her sadness about not being able to spend time with them

regularly anymore while enjoying her happiness about the new job. She will likely be

experienced by them as being a better, more caring, and more genuine friend.

Despite these potential implications, there has been little prospective research

investigating the impact of co-variation of negative and positive emotions on functioning, and in

particular social functioning. In the present study, an ecological momentary assessment (EMA)

design will be used to explore how independence of negative and positive emotion impacts social

functioning over time.

<u>Independence of Positive and Negative Affect</u>

Throughout much of the last century, research psychologists have focused primarily on

negative emotion, such as sadness, hopelessness, guilt, and anger. This negative approach to

psychology has been largely problem-focused and remedial, focusing on behavioral issues, their

etiology, and how to fix them, rather than the components of psychological health (Seligman,

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2000). In recent years, a movement focusing on positive emotions has emerged, gaining

momentum especially in the context of increased focus on prevention research by the American

Psychological Association (Seligman & Csikszentmihalyi, 2000). This school of thought,

positive psychology, is about positive emotions, traits, and experiences; in other words, the focus

is on the ingredients for a fulfilling life (Seligman & Csikszentmihalyi, 2000). What happens,

however, at the intersection of positive and negative emotion? Can they be experienced

simultaneously?

There currently exist two perspectives on this matter. The first is that positive and

negative affect are essentially bipolar opposites and vary inversely (Green, Goldman, & Salovey,

1993; Zautra, Potter, & Reich, 1997; Russell & Carroll, 1999). Green and colleagues (1993)

assert that positive and negative emotions are essentially two ends of a continuum and that the

possibility of experiencing both simultaneously is thus restricted. Indeed, many people believe

that someone who is unhappy is also necessarily sad (Zautra et al., 1997). Russell and Carroll

(1999) conducted a meta-analysis of the existing emotion data and found that a bipolar model

was the best fit. They concluded, borrowing from Lord Byron, that a human being is in fact a

"pendulum betwixt a smile and a tear" (p. 25).

By contrast, the second perspective is that positive and negative affect are independent

constructs (Diener & Emmons, 1985; Larsen, McGraw, & Cacioppo, 2001; Larsen, McGraw,

Mellers, & Cacioppo, 2004; Larson, 1987). Diener and Emmons (1985) initially found support

for this point of view in a series of five studies. The evidence they gathered indicated that the

strongest inverse relationship exists between the two when emotions are felt most intensely. That

is, at moments in time when people feel very strongly positive, they do not feel much negative

emotion, and vice versa. Over periods of weeks or more, however, Diener and Emmons (1985)

found that positive and negative emotion are in fact relatively independent. In addition, Larson (1987) conducted an experience sampling study using a sample of both adolescents and adults, paging them randomly at intervals of several hours to report on their current affective states using bipolar scales (which more often leads to finding support for the bipolarity hypothesis, rather than the independence hypothesis). He found that both adolescents and adults were quite intrapersonally consistent in the frequency of their reports of either positive or negative emotional states. More importantly, however, he found that there was almost no relationship between how often each individual reported positive and negative states (Larson, 1987). Taken together, these two sets of findings lend support to the theory of independence of affects over periods of hours, days, or weeks.

Furthermore, Larsen and colleagues (2001) conducted three studies to investigate whether people can feel happy or sad at the same time. In the first, they surveyed participants' emotional states both before and after viewing the film *Life is Beautiful* in a theater. Participants were surveyed after seeing this movie in particular because it is at times both comical and tragic. In the second, Larsen and colleagues (2001) measured college students' emotions on move-out day from their dormitories, and in the third, they assessed college seniors' emotions on graduation day. They found that in all three situations, many participants felt both happy and sad, to a much greater degree than they might in more typical, mundane circumstances (Larsen et al., 2001). In an extension of this work, Larsen and colleagues (2004) demonstrated that participants can experience "disappointing wins" and "relieving losses" even in response to simple laboratory games of chance, and, in addition, that they can actually experience simultaneous mixed emotions.

Some researchers have started to identify specific moderating variables in the experience of concurrent positive and negative emotion. One such variable is the differing tolerance for and acceptance of duality, which tends to vary by culture. Those accustomed to Eastern ideals have been found to generally be more tolerant of such duality than those raised in Western cultures (Williams & Aaker, 2002). Age has also been found to moderate the simultaneous experience of positive and negative emotion, with older people generally being more accepting of such duality than younger people (Ersner-Hershfield, Mikels, Sullivan, & Carstensen, 2008). Furthermore, there is evidence that in both college student and chronically ill populations, greater independence of affect is related to cognitive complexity (as measured by the Personal Need for Structure scale). Participants who were more complex reported greater independence and those who were cognitively simpler described more highly inversely correlated domains of affect (Reich, Zautra, & Potter, 2001).

Reich and colleagues (2001) further asserted that life stressors might weaken the independence of negative and positive emotion. Life stressors, they argued, tend to challenge our adaptive functioning and therefore increase the need for efficiency in information processing. When this occurs, cognitive functioning is necessarily simplified and ability to interpret daily experiences in a more nuanced way is limited. Put simply, life might seem more black-and-white when under strain, so life stress can therefore indirectly affect emotion independence domains as well. Zautra, Potter, and Reich (1997) found evidence supporting this theory in a sample of rheumatoid arthritis patients: during weeks of higher stress, the inverse correlation between the patients' positive and negative affect was significantly higher than during weeks of low stress.

Clearly, there is a growing interest in the study of concurrent positive and negative emotion in contemporary emotion research. However, a review of the literature suggests a dearth

of *prospective* research on how independence of affects relates to outcomes over time. For example, an inability to experience any positive feelings while experiencing significant negative affect due to stressful life events might negatively impact social relationships. Impaired social functioning could lead to a further increase in depressive symptomatology. As such, this individual difference in affective independence could in fact be conceptualized as a vulnerability to poor outcomes. Longitudinal research is the best way to explore this possibility, yet there is no such published work to date, and it seems to be an important area to explore.

<u>Independence of Affect and Social Functioning</u>

As stated above, it is possible that social functioning is impacted by individual differences in the independence of positive and negative affect. Specifically, people who experience greater independence of affects, and thus have a higher capacity to experience mixed emotion, might also have better interpersonal relationships. A person's ability to experience mixed emotion indicates a more complex, nuanced way of interpreting the world around them (Reich et al., 2001). This greater cognitive ability may suggest higher levels of emotional maturity that will better equip one to navigate the complexities of close relationships. Furthermore, since sharing emotions with loved ones is a significant part of relationships, someone who is able to remain somewhat positive during hard times, retaining a sense of humor or hope for the future in the midst of a stressful or sad situation is likely easier for others to be around and support.

Kashdan, Volkmann, Breen, and Han (2007) studied this phenomenon in a sample of college women. They found that less socially anxious women reported more intimacy with their romantic partners when they were *more* willing to express negative emotions (Kashdan et al., 2007). This speaks to the importance of sharing any significant emotion with loved ones in close

relationships. However, Kashdan and colleagues (2007) found that more socially anxious women experienced a *deterioration* in their romantic relationships when they continuously expressed their negativity and actually felt closer to their partners when they *withheld* the expression of their chronically negative emotions. Thus, the data suggests that continued expression of *pervasive* negative emotionality may lead to a loss of social support (Kashdan et al., 2007). Therefore, those who have greater independence of affects and therefore the ability to feel some good even in light of major stress might be less likely to lose their support system during difficult life events; their attitudes might be less overwhelmingly negative and thus easier to tolerate.

If independence of positive and negative emotion is in fact protective against loss of social support, this effect will likely be even more pronounced during episodes of heightened stress. We have already seen that those who are enjoying a period of "smooth sailing" in their lives will be more likely to have greater independence of affects (Zautra et al., 1997). However, greater affective independence may be less relevant to their interpersonal relationships than it is to those who are experiencing greater life stress. It is the latter group, those who are not "sailing smoothly," for whom it will be particularly important to have the capacity to feel positive emotion even during times of distress. This ability will likely both benefit their moods and protect their social support systems, which are, for most, essential in navigating the troubled waters of life problems.

## Independence of Affect: Does Expression of Emotion Matter?

Another potential factor that could affect the relationship between affective independence and interpersonal functioning is expressive suppression, a form of emotion regulation involving

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the conscious inhibition of emotional expression. Expressive suppression is a frequently used method of regulating emotion, and in some instances, it is adaptive. One such example is when one is angered by a friend but suppresses the outward expression of anger until he or she can determine a way to resolve the problem (Butler, Egloff, Wilhelm, Smith, Erickson, & Gross, 2003). Another example is in the previously cited specific instance of severe social anxiety, in which Kashdan and colleagues (2007) found that more socially anxious women felt closer to their partners when they withheld the expression of their chronically negative emotions.

More generally, however, continuous or chronic suppression appears to have a number of adverse consequences (Gross & Levenson, 1997; Richards & Gross, 2000). The most relevant of these is that expressive suppression appears to have undesirable effects on social functioning. Butler and colleagues (2003) suggest that expressive suppression disrupts numerous aspects of social exchange, thus causing both the suppressor and the social partner stress. Indeed, they found in two studies of unacquainted female dyads discussing upsetting topics that suppression both hindered formation of new friendships and deterred growth in existing relationships (Butler et al., 2003).

Srivastava, Tamir, McGonigal, John, and Gross (2009) expanded upon this investigation of social consequences of emotional suppression by conducting a longitudinal study of students transitioning from high school to college. They found that suppression had implications in several areas of functioning: participants who tended to suppress more reported lower social support, less closeness to others, and lower levels of social satisfaction (Srivastava et al., 2009). The self-reports they obtained were corroborated by knowledgeable peers' reports, demonstrating that the effects of expression extend beyond the individual into his or her social network (Srivastava et al., 2009). Clearly, then, individual differences in the expression or

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suppression of emotion have significant consequences for the quality of one's interpersonal relationships.

Emotion expression is likely to be particularly helpful for those individuals who are able to experience simultaneous negative and positive emotion. They will obtain the benefit of sharing their negative emotions and receiving support, but they will also be expressing positive emotion in the context of their relationships. Therefore, it is expected that independence of negative and positive affect will predict positive social functioning more strongly in the context of high emotion expression. On the other hand, emotion expression might be particularly unhelpful in the context of relationships when there is strong dependence of negative and positive affect. When one is down and seeking support from friends or family, it might strain a relationship when one is very expressive, but is only voicing negative emotion. As such, there might be an interaction between independence of emotion and emotion expression in predicting social support, and a third variable of life stress might moderate this interaction.

<div align="center">Independence of Affect and Depression</div>

As previously suggested, it is possible that affective independence is related to the occurrence of depressive symptomatology over time. Clark and Watson (1991) propose that depression is defined by both the presence of distress (negative emotion) and anhedonia, the absence of positive emotion. Therefore, it follows that if one has greater independence of affects and thus the capacity to feel both good and bad, one will be less likely to experience depression. Furthermore, as depression has been conceptualized as largely interpersonal in nature (Pettit & Joiner, 2006), the ability to feel positive emotions even in the context of life stress may help to maintain social support and in turn, protect against depression symptoms. Thus, we believe that

individual differences in independence of affect may be related to differences in vulnerability to depressive symptomatology.

<div align="center">Assessment of Affective Independence: Ecological<br>Momentary Assessment Approach</div>

The proposed study will use ecological momentary assessment to explore independence of positive and negative emotion and how it affects interpersonal functioning in a sample of undergraduate students. Ecological momentary assessment, also called experience sampling, is the frequent, repeated collection of data in real-world settings (Shiffman & Stone, 1998). It differs from more traditional methods of data collection in that participants are repeatedly asked how they are feeling now or how they have felt for the last few minutes or hours, rather than days, weeks, months, or years. This is important because longer recall periods for previous cognitions, affective responses, and behaviors can easily become biased (Ptacek, Smith, Espe, & Raffety, 1994). There are a number of possible sources of retrospective bias, such as the greater likelihood of recalling experiences that are more personally relevant, that are more recent, that stand out as noteworthy, unique, or bizarre, or that are consistent with one's current mood (Gorin & Stone, 2001; Hufford, Shiffman, Paty, & Stone; 2001). Since EMA uses real-time data collection, it attenuates this problem of retrospective bias and offers a more accurate snapshot of participants' daily emotional, behavioral, and cognitive experiences (Trull & Ebner-Priemer, 2009).

Another way in which EMA differs from more traditional self-report methods is that participants are assessed in their natural environments rather than in the laboratory. This also has significant benefits. Because processes are sampled in the "real world," one can assume greater ecological and external validity of the assessments than if they are conducted in the laboratory

(Trull & Ebner-Priemer, 2009), where simple reactivity to the laboratory setting may influence participants' responses. Moreover, EMA research can track environmental characteristics like time of day or interpersonal difficulties that change over time and significantly impact mood, behavior, and cognitions (Trull & Ebner-Priemer, 2009).

Although diary methods have been used for years in psychology, the introduction of personal digital assistants or PDAs (also known as palmtop computers) in the 1990s and the gradual increase in their accessibility has led to growing interest in the application of EMA methodologies in research (Ebner-Priemer & Trull, 2009). These electronic devices often include a time-stamp of completion of the assessment, which ensures that the participant did not wait too long to fill it out, or, worse, simply back-fill all assessments before submitting them at the conclusion of the study period. Participant compliance is a potential point of concern, but compliance in EMA actually tends to be very good, and by limiting the frequency and overall number of assessment points, researchers can lower the burden on participants and thus both increase compliance and reduce reactivity (Ebner-Priemer & Trull, 2009).

In sum, there exists empirical support for both the methodological advantages of EMA and its increasing ease of implementation. However, a review of the literature indicates that little work has been done with applying this technique to the study of affective independence. One goal of this study is to add to the body of evidence in this growing area of interest.

Overview and Hypotheses

In the present study, college student participants will complete self-report measures of social functioning, personality, life events, and depression, and then carry a PDA device for one week. The device will beep four times per day to prompt them to complete momentary assessments of stress and mood. Of particular interest will be the degree of co-variation in

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participants' positive and negative emotion and, in those who demonstrate affective independence, reports of experiencing both positive and negative affect at any given time point. Four months after initial data collection, participants will complete an online Time 2 assessment, which will again include self-report measures of social functioning, life events, and depression. Our hypotheses are as follows:

1. Greater independence of affects will both a) be related to greater perceived social support and less depression at initial evaluation and b) be predictive of greater perceived social support and less depression at the follow-up evaluation.

2. The relationship between independence of affects, operationalized by calculating an empirical Bayes regression coefficient for each person representing their intrapersonal relationship between PA and NA over the course of the week, and perceived social support will be more strongly positive for those experiencing more negative life events.

3. In the context of life stress, greater independence of affects, controlling for individuals' average positive affect and average negative affect, will predict lower incidence of depressive symptomatology at follow-up.

4. Emotion expression will benefit social relationships and depression outcomes more in the context of affective independence and less in the context of high co-variation of positive and negative affect. A third variable of life stress will moderate this interaction.

5. Emotion suppression will harm social relationships and increase depressive symptomatology more in the context of affective independence and less in the context of high co-variation of positive and negative affect. A third variable of life stress will moderate this interaction.

CHAPTER 2

METHOD

Participants

Participants were 145 undergraduate students (105 (72%) female and 40 (28%) male).

Participants were recruited from psychology courses at American University, as well as the

"Today@AU" daily university-wide email announcement. They ranged in age from 18 to 29

years old ($M = 19.25$, $SD = 1.54$; age of 7 participants unknown). Seventy-five percent of

initially recruited participants were white, 10% were "other" (mixed race), 7% were Asian, 3%

were African-American, 1% were Native Hawaiian or Pacific Islander, and 4% was unknown.

Six percent of the sample self-reported as Hispanic or Latino, 89% reported self-identifying as

not Hispanic or Latino, and 5% of the sample was unknown.

Of these initial 145 participants, 17 completed fewer than half of the daily assessments

and were not included in the follow-up portion of the study as we were concerned that they were

perhaps not taking the study seriously. As such, 128 participants were invited to complete the

Time 2 assessment, and of these, 102 fully completed all relevant measures of the follow-up

portion of the study and were included in the final sample used for analyses. See Table 1 for

demographic characteristics of the final sample.

All participants were treated in accordance with the APA's guidelines for the ethical

treatment of human subjects.

Table 1. Demographic Characteristics of the Final Sample

| | |
|---|---|
| Age | 19.33 (1.58) |
| Sex | |
| Male | 20 (20%) |
| Female | 82 (80%) |
| Year | |
| Freshman | 37 (36%) |
| Sophomore | 32 (31%) |
| Junior | 23 (23%) |
| Senior | 10 (10%) |
| Race | |
| White | 82 (80%) |
| Black or African-American | 4 (4%) |
| Asian | 2 (2%) |
| Native Hawaiian or Pacific Islander | 1 (1%) |
| Other | 13 (13%) |
| Hispanic | |
| Yes | 6 (6%) |
| No | 95 (93%) |
| Unkown | 1 (1%) |

## Measures and Procedure

After participants were recruited from Psychology courses and through the Today@AU email announcement, they were scheduled for an initial one-hour laboratory visit. Upon arrival to the laboratory, research assistants obtained their consent to participate in the study. The participants then completed a battery of questionnaires assessing several constructs as follows.

Depression

The Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977) is a widely used 20-item self-report questionnaire that is designed to measure depressive symptomatology in the general population. It measures components of depression such as depressed mood, feelings of guilt, worthlessness, helplessness, and hopelessness, sleep disturbance, loss of appetite, and psychomotor retardation. Participants rate how often they have experienced each symptom over the course of the past week on a 4-point Likert-type scale, from 0 (rarely) to 3 (most of the time), and possible scores range from zero to 60. Internal consistency as measured by the Spearman-Brown split-halves method is high (co-efficient alpha of .85) in the general population and even higher (co-efficient alpha of .90) in a patient population (Radloff, 1977). These findings are in line with expectations, since heterogeneity of symptoms should be much higher in the general population than a clinical population. Radloff (1977) found test-retest correlations to be moderate, all except for one falling between .45 and .70, which is also expected considering the scale is designed to capture experience over a short period of time, and symptoms could change between test administrations. In our sample, internal consistency was high (Cronbach's alpha of .89). Regarding validity, the CES-D discriminates well between psychiatric and non-clinical samples and moderately well between patient groups of differing severity levels (Radloff, 1977).

Life Stress

The Life Experiences Survey (LES; Sarason, Johnson, & Siegal, 1978). The LES is a 59-item self-report questionnaire assessing the number of life-changing events one has experienced in the past three months, as well as the impact they have had. Each of the items represents a life event, such as "death of a close family member" or "new job," and the last ten items apply

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specifically to college students, such as "changing a major" or "joining a fraternity/sorority." The participant checks off each event he or she has experienced within the past three months, indicates whether the impact has been positive or negative, and then rates the perceived strength of the impact at the time the event occurred on a 7-point scale, where -3 is extremely negative and 3 is extremely positive. The sum of the ratings declared positive by the participant is the positive change score, the sum of the scores declared negative by the participant is the negative change score, and the sum of these two values is the total change score. When using the LES to assess life events, one can use either the checklist score (that is, the sum of the positive or negative events checked off by the participant) or the total change score (that is, the sum of the *rating scores* of the positive or negative events). There is some concern that using the subjective weighting approach increases the risk of confounding of mental health variables. Turner and Wheaton (1997) assert that using the weighted score from a checklist measure, which in this case is the total change score, does not increase real or artificial correlations with outcomes. Using the checklist score implies that all endorsed events have an equal potential for impact on the respondent, which is almost surely untrue. Therefore, for the reported analyses in the present study, we used the total change score, but it is noteworthy that no results changed when using the checklist score.

Studies have shown that the positive change score and negative change score are uncorrelated (Sarason, Johnson, & Siegal, 1978). Evidence that negative change scores are correlated with state and trait anxiety and depression provides support for validity of the LES. Test-retest reliability scores obtained in two studies over a 5-6 week interval were moderate, with correlations for the positive change score being .19 and .53 ($p < .001$), correlations for the negative change score being .56 ($p < .001$) and .88($p < .001$), and correlations for the total

change score being .63($p < .001$)  and .64 ($p < .001$) (Sarason, Johnson, & Siegal, 1978). These moderate correlations could be explained, however, by real change in life events experienced between the original test and the retest.

Social Support

The Social Provisions Scale (SPS; Cutrona & Russell, 1987) is a 24-item self-report questionnaire that evaluates attachment, social integration, opportunity for nurturance, reassurance of worth, reliable alliance, and guidance in current relationships with family members, friends, co-workers, community members, etc. Participants rate how much they agree with each item on a 4-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). Scores for each subscale are obtained by summing the score on each item within that subscale, and total scores are obtained by summing all of the item scores. A higher score indicates greater perceived social support. Cutrona, Russell, and Rose (1984) found in a sample of 100 elderly adults that SPS scores correlate with both measures of social networks like number of relationships and frequency of contact as well as satisfaction with social relationships, providing support for its validity. In the same study, all internal consistency figures were above .70 and test-retest reliability coefficients ranged from .37 to .66 (Cutrona et al., 1984). In our sample, internal consistency reliability was high (Cronbach's alpha of .91).

Neuroticism

The Neuroticism scale of the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992b) is a 12-item self-report measure of one's tendency to experience negative emotionality. It includes items assessing anxiety, hostility, depression, self-consciousness, impulsiveness, and vulnerability. Participants indicate the degree to which they agree with each item on a 5-point

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Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The NEO-FFI has

consistently demonstrated adequate reliability across a number of studies (Costa & McCrae,

1992b). In our sample, internal consistency reliability was high (Cronbach's alpha of .87). We

felt that neuroticism was an important variable to include in our study, as it is in any study of

stress and emotion regulation, because it relates uniquely to negative emotionality (Gunthert,

Cohen, & Armeli, 1999). By measuring it, we were able to parse out the unique effects of

depression and neuroticism on our various outcome variables.

As this project was part of a larger study, participants also completed the Differentiation

of Positive Emotion Scale (DOPES ; Kirby, Tugade, Morrow, Ahrens, & Smith, in press), the

Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), the

Friendship Compassionate and Self-Image Goals Scale (Crocker & Canevello, 2008), the Beliefs

about Mood Regulation questionnaire (Hutchison & Gunthert, manuscript submitted for

publication), the Generalized Expectancy for Negative Mood Regulation (NMR) Scale

(Catanzaro & Mearns, 1990), the Affective Control Scale (ACS; Williams, Chambless, &

Ahrens, 1997), and the Five-Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins,

Krietemeyer, & Toney, 2006). However, these scales were not used in the analyses for this study.

After participants completed the battery of self-reports, they received PDAs to carry with

them for the following week. The PDAs were programmed using the Purdue Momentary

Assessment Tool (PMAT; Weiss, Beal, Lucy, & MacDermid, 2004) to probe participants 4 times

a day for 7 days, resulting in up to 28 assessments per participant. The PDAs were set to "beep"

participants at 11:15 a.m., 2:05 p.m., 6:40 p.m., and 9:52 p.m. Times between classes and in the

evening were oversampled to minimize classroom disruption. These times were not random

because the limitations of PMAT are such that the signal pattern cannot be set to randomly

oversample passing periods between classes; it can either be entirely random (with constraints set only on the daily frequency of beeps, the time span during which the daily beeps occur, and minimum spacing between each beep) or fixed to occur at the same exact time each day. Because it was important for the PDAs not to beep students unexpectedly during classes, it was decided that the fixed signal pattern should be used.

As further protection against classroom (or other) disruption, the PMAT program offers an "I'm busy" button which can be used to ensure that the PDA does not signal during a time when the participant cannot be disrupted. If there is a scheduled assessment during the window when the participant tells the PDA that she is busy, that assessment is skipped rather than being postponed to the end of the busy period. The "busy" feature was explained to each participant at enrollment in the study. In the instance that a participant did not have the PDA with her at the time of an assessment, the invitation to complete it remained on the screen for 90 minutes. If the student did not return to the PDA and complete the assessment within 90 minutes of being beeped, the PDA re-set and that assessment was considered "skipped" by the PMAT program. Therefore, all assessments were completed within, at the very longest, 90 minutes.

The PDA asked participants a series of questions about their experiences and their emotion-related behaviors. Specifically, participants were asked to rate on a 1 to 5 scale to what degree they have felt happy, anxious, content, sad, proud, angry, and grateful since last being "beeped." Similar mood items have been used in other daily emotion studies (Wenze, Gunthert, & Forand, 2007; Forand, Gunthert, German, & Wenze, 2010). Participants were also asked how they responded to each of these emotions: whether they tried to change the situation, expressed the emotion to another person, expressed the emotion creatively or physically in private, tried to distract themselves, tried to feel it more, tried to feel it less, or did nothing and just let it be.

Emotion expression was defined as the proportion of times that the participants expressed an emotion to another person out of the total times that they reported feeling an emotion. Suppression was defined as the proportion of the number of times that they reported that they tried to feel an emotion less out of the total times that they reported feeling an emotion. Composite expression and suppression scores were created for the positive feelings, the negative feelings, and an overall index including all of the emotions queried in the momentary assessments.

The independence of positive and negative emotion was estimated by each participant's unique within-person relationship between positive affect and negative affect. That is, for each participant, all of the positive mood items (happy, content, proud, or grateful) and all of the negative mood items (anxious, sad, or angry) were summed at each time point. The momentary observations of the emotions representing PA and NA were evaluated for scale reliability, to ensure that they were reliably measuring the same construct. Because we had up to 30 momentary observations of PA or NA for each participant, each unique value of PA or NA cannot be considered independent from the other momentary emotion observations for the same participant. However, item independence is one of the assumptions of using Cronbach's alpha. Therefore, to address this problem, we obtained alphas for PA and NA for each individual assessment point, and we then averaged the thirty alpha values to estimate scale reliability for the sample. We ultimately obtained Cronbach's alphas of .74 for PA and .57 for NA. The reliability for PA is acceptable, but that of NA is somewhat low, as .6 is generally considered the cut-off point for adequate reliability. An intercorrelation matrix reveals, however, that all of the NA items are significantly correlated with each other at the $\alpha = .01$ level ($r = .29$ for sadness-anxiety,

*r* = .26 for anger-anxiety, and *r* = .45 for anger-sadness). The overall mean levels of PA and NA

for the final sample were, in that order, 2.59 (*SD* = .46) and 1.81 (*SD* = .40).

At the conclusion of the one-week EMA phase, participants returned to the laboratory,

where research staff uploaded their momentary data. The number of assessments completed by

those participants included in the final sample used for the main analyses ranged from 8 to 30 (at

times the Palm could not be returned after exactly 7 days due to scheduling conflicts and would

continue to beep the participant on the 8th day of their participation). The mean number

completed was 23.70 (*SD* = 3.38). On average, participants responded to 84.86% of their "beeps"

(*SD* = 11.55). Only 41 participants used the "busy" button, and of those 41, they used it a mean

of 1.61 times per person (*SD* = .83). On the other hand, almost every participant (92 of 102)

skipped at least one assessment, and of those who did, they skipped a mean of 3.76 times (*SD* =

3.00). If participants had completed 14 or more of the assessments, research staff notified them

that they would receive follow-up questionnaires via email in four months. If they had completed

fewer than 14 assessments, the study ended at that time. Either way, participants received one

research credit for their participation (to be used either towards the research participation

requirement in certain psychology courses or as extra credit in those with no such obligation) as

well as their monetary compensation, $1 for every completed momentary assessment.

The participants who completed at least half of the assessments were contacted four

months after the completion of the EMA phase of the study via e-mail, with follow-up

questionnaires evaluating the outcome measures of depressive symptomatology and social

support. These questionnaires included the Center for Epidemiological Studies-Depression Scale

(CES-D; Radloff, 1977), the Life Experiences Survey (LES; Sarason, Johnson, & Siegal, 1978),

and the Social Provisions Scale (SPS; Cutrona & Russell, 1987). In addition, the Pittsburgh

Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) was included in the follow-up assessment as this project is part of a larger study, but again was not used for our analyses. The incentive to complete these questionnaires was entry into a lottery to win one of four $50 prizes, for which odds of winning were about 1/27.

CHAPTER 3

RESULTS

All analyses were conducted using SPSS Statistics 17.0 and HLM 6. The means and standard deviations of total scores on all Time 1 and Time 2 variables of interest are listed in Table 2. Independence of positive and negative affect was measured by estimating each person's within-person relationship between momentary positive and negative affect. Each person had up to 30 observations, so we used hierarchical linear modeling (HLM; Bryk & Raudenbush, 1992) to generate a unique regression equation for each person, where we entered momentary positive affect as a group-mean-centered predictor variable and momentary negative affect as the outcome variable at Level 1 and no variables at Level 2. We saved each person's empirical Bayes slope estimate, so that the slope became a variable that could be used to predict future functioning. The empirical Bayes estimates are the maximum likelihood estimation of within-person relationships between positive and negative affect generated by our model described above. They combine within and between-person variance and attempt to minimize bias by weighting estimates in the direction of the more reliable observations. Individuals had a stronger negative within-person slope when increases in positive affect were associated with more drastic decreases in negative affect and when decreases in positive affect were related to more drastic increases in negative affect. A table of intercorrelations between Time 1, Time 2, and momentary variables of interest (i.e., mean PA and NA as well as PA-NA slopes) is presented in Table 3.

Table 2. Mean Scores on Variables of Interest at Time 1 and Time 2

| | Initial Sample | Follow-Up Qualifier | | Full Completer | |
|---|---|---|---|---|---|
| | | Yes | No | Yes | No |
| T1 CES-D | 16.34 (9.90) | 16.16 (9.92) | 17.71 (1.00) | 16.06 (9.88) | 17.00 (10.05) |
| T1 SPS | 82.74 (9.41) | 83.02 (9.40) | 80.66 (9.50) | 82.96 (9.51) | 82.21 (9.23) |
| T1 LES-N Total Change | 7.05 (5.48) | 6.81 (5.18) | 8.75 (7.31) | 6.74 (5.07) | 7.86 (6.46) |
| T1 NEO-FFI N | 33.79 (9.13) | 33.73 (9.12) | 34.18 (9.43) | 33.30 (9.02) | 34.93 (9.37) |
| T2 CES-D | | | | 35.29 (9.72) | |
| T2 SPS | | | | 80.94 (10.42) | |
| T2 LES-N Total Change | | | | 4.41 (5.02) | |

Note. T1 = initial assessment; T2 = 4-month follow-up; CES-D = Center for Epidemiological Studies-Depression Scale; SPS = Social Provisions Scale; LES-N = Life Experiences Survey – Negative Events; NEO-FFFI N = NEO-Five Factor Inventory Neuroticism.

Table 3. Intercorrelations Between Time 1 and Momentary Variables of Interest

| | T1 CES-D | T1 SPS | T1 LES-N | T1 NEO-FFI N | Mean PA | Mean NA | PA-NA Slope |
|---|---|---|---|---|---|---|---|
| T1 CES-D | | | | | | | |
| T1 SPS | -.46** | | | | | | |
| T1 LES-N | .45** | -.21* | | | | | |
| T1 NEO-FFI N | .65** | -.37** | .31** | | | | |
| Mean PA | -.28** | .27** | -.10 | -.21* | | | |
| Mean NA | .50** | -.34** | .11 | .58** | -.04 | | |
| PA-NA Slope | -.22* | -.04 | .04 | -.35** | -.05 | -.53** | |

Note. T1 = initial assessment; CES-D = Center for Epidemiological Studies-Depression Scale; SPS = Social Provisions Scale; LES-N = Life Experiences Survey – Negative Events; NEO-FFI N = NEO-FFI Neuroticism; Mean PA = mean momentary positive affect; Mean NA = mean momentary negative affect; PA-NA Slope = Within-person empirical Bayes slope estimate using momentary PA to predict momentary NA. *$p<.05$, **$p<.01$.

We first conducted some preliminary analyses to determine whether there were any significant group differences on demographic variables or main variables of interest. There were no significant differences between participants who qualified and did not qualify for the follow-up in terms of age or sex. To explore differences based on race between participants who qualified or did not, we combined participants who identified as anything except "white" and compared them to those who identified as "white" because we had so few minority participants that expected cell sizes were too small (<5) for a valid chi-square analysis. In fact, even after doing this, there were only three non-white participants who did not qualify for the follow-up, so the formal analysis was not valid. Therefore, we conducted a Fisher's exact test and found that $p$ =1 (two-sided), so there were no differences in qualification for the follow-up based on race. When we attempted to explore differences in qualification status based on whether or not the participant identifies as Hispanic, we encountered the same problem of expected cell sizes being too small for a valid chi-square analysis. We again performed a Fisher's exact test and found that $p = .60$ (two-sided), so there were no differences in qualification for the follow-up based on Hispanic status.

When separated into completer (i.e., those who both qualified for the follow-up phase of the study and completed it) and non-completer (i.e., those who either did not qualify for the follow-up phase or did not complete it) categories, there were also no significant differences between the groups on age or race (when comparing "white" participants to those who identified as anything except white, as described above). Expected cell sizes were again too small for a valid chi-square analysis exploring completion differences based on Hispanic status, but a Fisher's exact test suggested that there were no significant differences ($p = .70$, two-sided). The

sex distribution of those who completed the follow-up as compared to those who did not complete it (i.e., either did not qualify for it or qualified but did not complete it) did differ significantly (sex: $\chi^2$ (1, $N = 145$) = 10.96, $p = .001$). Females were more likely to complete the follow-up than males.

Furthermore, there were no significant differences based on qualification status or completion status on any variables of interest from the Time 1 and Time 2 survey assessments, such as initial scores on measures of depression, social support, negative life events (measured, as stated above, by the total change rather than the checklist score on the LES), or neuroticism. Total (rather than mean) scores were used for all variables of interest in both preliminary and subsequent analyses.

Regarding the daily assessment data, there was a significant difference in the mean number of daily assessments completed by those qualified for and completed the Time 2 follow-up survey as compared to those who either qualified for but did not complete the survey or did not qualify for the follow-up ($t(132) = -5.03$, $p < .001$). Members of the final sample completed a mean of 23.70 (SD = 3.38) daily assessments and those who did not qualify for or respond to the follow-up survey completed a mean of 19.66 (SD = 5.45). Number of assessments completed by those included in the final sample did not differ by sex, year in school, race, or Hispanic status. There were no significant differences on average levels of PA or NA between members of the final sample as compared to those who did not qualify for or respond to the Time 2 follow-up survey. Average PA and NA in the final sample also did not differ by sex, year in school, race, or Hispanic status.

Individuals' within-person slopes for affective independence in the final sample ranged from -0.82 to 0.15 ($M = -0.33$, $SD = 0.20$). There were no significant differences in affective

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independence based on race or Hispanic status. Interestingly, there was a significant difference in affective independence based on sex ($t(100) = 2.18$, $p = .03$), with women ($M = -.35$, $SD = .19$) displaying a stronger inverse relationship between PA and NA than men ($M = -.25$, $SD = .20$). A one-way ANOVA also revealed a significant difference in affective independence based on year in school ($F(3, 98) = 2.78$, $p < .05$). Specifically, seniors appeared to have a stronger inverse relationship between PA and NA ($M = -0.50$, $SD = 0.22$) than freshmen ($M = -.32$, $SD = .20$), sophomores ($M = -.32$, $SD = .19$), or juniors ($M = -.30$, $SD = .18$).

There were no significant differences on overall emotion expression based on completer status in the initial sample or based on year in school, race, or Hispanic status in the final sample. However, there was a significant difference in overall emotion expression based on sex ($t(100) = -2.20$, $p < .05$), with women expressing emotions to others a greater proportion of the time ($M = .25$, $SD = .13$) than men ($M = .18$, $SD = .10$). Finally, there were no significant differences on overall emotion suppression in the initial sample based on completer status or in the final sample based on sex, year in school, race, or Hispanic status.

## Hypothesis 1

To address Hypothesis 1a, we estimated the relationships between initial social support and independence of PA and NA as well as depression and independence of PA and NA. In a two level HLM model, we used grand-mean centered Time 1 social support or depression (Level 2) to predict the within-person relationship between group-mean centered PA and the outcome variable NA (Level 1). See Table 4 for unstandardized beta values, $t$-ratios, and $p$-values for each predictor. Neither social support nor depression was related to affective independence. We did check to see whether any of the specific social support subscales moderated the PA-NA

relationship, and there were no significant effects. Further, Time 1 negative life events had no effect on the PA-NA relationship.

Table 4. Unstandardized Beta Coefficients, T-ratios, and P-values for Level 2 HLM Moderators of Overall Slope Relationship Between PA and NA

| Level 2 Moderator | $b$ | $t$-ratio | $p$-value |
|---|---|---|---|
| Depression | -0.00 | -1.26 | .21 |
| Social Support | -0.00 | -0.89 | .37 |
| Attachment Subscale | -0.01 | -0.78 | .44 |
| Social Integration Subscale | -0.02 | -1.42 | .16 |
| Reassurance of Worth Subscale | -0.02 | -1.52 | .13 |
| Reliable Alliance Subscale | -0.01 | -0.29 | .77 |
| Guidance Subscale | 0.00 | 0.02 | .99 |
| Opportunity for Nurturance Subscale | -0.00 | -0.30 | .76 |
| Time 1 Life Events | 0.01 | 1.04 | .30 |

Note. All of the above are separate regression models.*p<.05.

To prospectively predict perceived social support and depression as a function of affective independence, we used least squares regression equations, where Time 1 social support (or depression) was first used to predict Time 2 social support (or depression). In the second block of the equation, we controlled for average PA and average NA over the course of the week. In the third block of the equation, we used the within-person slope for the relationship between PA and NA (independence of affect) to predict change in social support (or depression) over the 4-month time frame. Standardized beta values, $t$-ratios, and $p$-values for the affective independence slope term for all of the models mentioned above are presented in Table 5. We found that individuals' within-person slopes did not prospectively predict social support ($\beta =$

0.03, $t(97) = 0.36$, $p = .72$) or depression ($\beta = 0.05$, $t(97) = 0.54$, $p = .59$) outcomes. The slopes

also failed to significantly predict outcomes on any of the social support subscales.

Table 5. Standardized Beta Coefficients, T-ratios, and P-values for Affective Independence
Slope Terms

| Time 2 Outcome Variable | $\beta$ | $t$-ratio | $p$-value |
|---|---|---|---|
| Social Support | 0.03 | 0.36 | .72 |
| Attachment Subscale | 0.03 | 0.33 | .74 |
| Social Integration Subscale | 0.04 | 0.41 | .69 |
| Reassurance of Worth Subscale | -0.06 | -0.58 | .57 |
| Reliable Alliance Subscale | -0.01 | -0.08 | .93 |
| Guidance Subscale | -0.03 | -0.32 | .75 |
| Opportunity for Nurturance Subscale | 0.05 | 0.48 | .63 |
| Depression | 0.05 | 0.54 | .59 |

Note. All of the above are separate regression models.

## Hypotheses 2 and 3

To address Hypotheses 2 and 3, we created an interaction term between life stress (as

measured by the total change score on the LES at Time 1) and independence of affect. We had

hypothesized that the relationship between independence of affect and social support would be

stronger in the context of greater life stress (Hypothesis 2) and that greater independence of

affects in the context of life stress would predict lower depressive symptomatology at follow-up

(Hypothesis 3). We therefore entered the interaction term as a fourth block in the regression

model (while also adding life stress as a main effect in the model). We found that the interaction

between life stress and affective independence did not significantly predict either change in

social support ($\beta = -0.05$, $t(90) = -0.61$, $p = .54$) or change in depression ($\beta = 0.06$, $t(90) = 0.66$, $p$

$= .51$) over the 4-month follow-up time frame. Furthermore, the interaction between life stress

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and affective independence also did not significantly predict change in any of the social support

subscales. See Table 6 for standardized beta values, *t*-ratios, and *p*-values for the interaction term

for all of the models described above.

Table 6. Standardized Beta Coefficients, T-ratios, and P-values for Affective Independence and
Life Events Interaction Terms

| Time 2 Outcome Variable | $\beta$ | *t*-ratio | *p*-value |
|---|---|---|---|
| Social Support | -0.05 | -0.61 | .54 |
| Attachment Subscale | -0.01 | -0.15 | .88 |
| Social Integration Subscale | 0.02 | 0.25 | .80 |
| Reassurance of Worth Subscale | -0.06 | -0.68 | .50 |
| Reliable Alliance Subscale | -0.04 | -0.47 | .64 |
| Guidance Subscale | -0.03 | -0.36 | .72 |
| Opportunity for Nurturance Subscale | -0.06 | -0.67 | .50 |
| Depression | 0.06 | 0.66 | .51 |

Note. All of the above are separate regression models.

## Hypothesis 4

We used the same approaches as above for Hypothesis 4, which was that emotion

expression would moderate the relationship between independence of affect and social support

(and depression) and that a third variable of life stress would moderate this interaction. That is, to

predict follow-up social support, social support subscale, or depression scores, we entered Time

1 social support (or social support subscale or depression) scores in the first block of the

regression model. In the second block, we controlled for average PA and NA. We then entered

emotion expression (using either expression of PA, expression of NA, or overall emotion

expression) and independence of affects in the third block of the regression model and the

interaction of expression (again using either expression of PA or NA or overall expression) and

affective independence in the fourth. The interaction did not significantly predict any of our outcome variables (see Table 7 for standardized beta values, $t$-ratios, and $p$-values for the interaction terms of all the models mentioned above).

To test whether life stress further moderated this interaction, we added life stress as well as the two-way interactions of affective independence and life stress, affective independence and emotion expression, and life stress and emotion expression as main effects in the third block. We then entered the three-way interaction between emotion expression, independence of affects, and life stress in the fourth block. We found that the three-way interaction of affective independence, expression of negative affect, and life stress only significantly predicted scores on the Reliable Alliance subscale of the SPS ($\beta = 0.27$, $t(85) = 2.48$, $p = 0.02$). See Figure 1 for a graphical representation of this finding. None of the three-way interactions predicted overall social support or depression scores or any of the other subscale scores. Standardized beta values, $t$-ratios, and $p$-values for the three-way interaction terms of all models are presented in Table 8.

<u>Hypothesis 5</u>

Hypothesis 5 was that emotion suppression would moderate the relationship between independence of affect and social support (and depression) and that a third variable of life stress would moderate this interaction, so our analysis approach paralleled the one described above. That is, to predict follow-up social support, social support subscale, or depression scores, we entered Time 1 social support (or social support subscale or depression) scores in the first block of the regression model. In the second block, we controlled for average PA and NA. We then entered emotion suppression (using either suppression of PA, suppression of NA, or overall emotion suppression) and independence of affects in the third block of the regression model and the interaction of suppression (again using either suppression of PA or NA or overall

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suppression) and affective independence in the fourth. The interaction did not significantly

predict any of our outcome variables (see Table 9 for standardized beta values, *t*-ratios, and *p*-

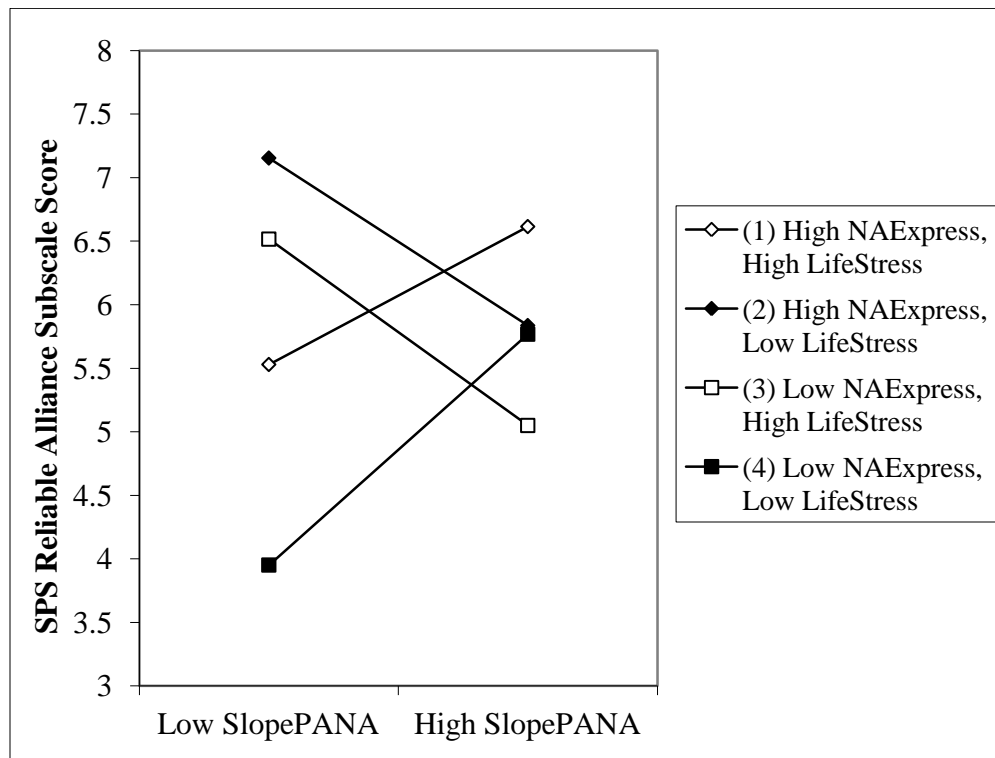values for the interaction terms of all the models described above).



Figure 1. Three-way Interaction of Affective Independence ("SlopePANA"), Expression of Negative Affect ("NAExpress"), and Life Stress Prospectively Predicting Follow-up SPS Reliable Alliance Subscale Scores

Table 7. Standardized Beta Coefficients, T-ratios, and P-values for Emotion Expression and Affective Independence Interaction Terms

| Predictor Term | Time 2 Outcome Variable | $\beta$ | $t$-ratio | $p$-value |
|---|---|---|---|---|
| Expression of PA x Aff. Independence | Social Support | -0.08 | -1.05 | .30 |
| | Attachment Subscale | -0.02 | -0.28 | .78 |
| | Social Integration Subscale | -0.01 | -0.09 | .93 |
| | Reassurance of Worth Subscale | -0.11 | -1.37 | .17 |
| | Reliable Alliance Subscale | -0.06 | -0.63 | .53 |
| | Guidance Subscale | -0.09 | -1.06 | .29 |
| | Opportunity for Nurturance Subscale | -0.06 | -0.69 | .49 |
| | Depression | 0.09 | 1.09 | .28 |
| Expression of NA x Aff. Independence | Social Support | -0.06 | -0.73 | .47 |
| | Attachment Subscale | -0.02 | -0.21 | .84 |
| | Social Integration Subscale | -0.11 | -1.14 | .26 |
| | Reassurance of Worth Subscale | -0.004 | -0.04 | .97 |
| | Reliable Alliance Subscale | -0.03 | -0.30 | .77 |
| | Guidance Subscale | 0.01 | 0.12 | .90 |
| | Opportunity for Nurturance Subscale | -0.09 | -0.97 | .34 |
| | Depression | -0.01 | -0.08 | .94 |
| Overall Expression x Aff. Independence | Social Support | -0.05 | -0.69 | .49 |
| | Attachment Subscale | 0.01 | 0.12 | .91 |
| | Social Integration Subscale | -0.04 | -0.43 | .67 |
| | Reassurance of Worth Subscale | -0.03 | -0.36 | .72 |
| | Reliable Alliance Subscale | -0.01 | -0.05 | .96 |
| | Guidance Subscale | -0.05 | -0.54 | .59 |
| | Opportunity for Nurturance Subscale | -0.09 | -1.04 | .30 |
| | Depression | 0.04 | 0.41 | .69 |

Note. All of the above are separate regression models.

Table 8. Standardized Beta Coefficients, T-ratios, and P-values for Emotion Expression, Affective Independence, and Life Stress Three-way Interaction Terms

| Predictor Term | Time 2 Outcome Variable | $\beta$ | $t$-ratio | $p$-value |
|---|---|---|---|---|
| Expression of PA x Aff. Independence x Life Stress | Social Support | -0.07 | -0.82 | .41 |
| | Attachment Subscale | -0.08 | -0.96 | .34 |
| | Social Integration Subscale | 0.02 | 0.16 | .87 |
| | Reassurance of Worth Subscale | -0.09 | -1.01 | .32 |
| | Reliable Alliance Subscale | -0.08 | -0.83 | .41 |
| | Guidance Subscale | -0.02 | -0.22 | .83 |
| | Opportunity for Nurturance Subscale | 0.02 | 0.23 | .82 |
| | Depression | 0.06 | 0.72 | .47 |
| Expression of NA x Aff. Independence x Life Stress | Social Support | 0.10 | 1.08 | .29 |
| | Attachment Subscale | 0.12 | 1.31 | .19 |
| | Social Integration Subscale | 0.10 | 0.87 | .39 |
| | Reassurance of Worth Subscale | 0.04 | 0.40 | .69 |
| | Reliable Alliance Subscale | 0.27 | 2.48 | .02* |
| | Guidance Subscale | 0.08 | 0.75 | .46 |
| | Opportunity for Nurturance Subscale | -0.01 | -0.10 | .92 |
| | Depression | 0.10 | 0.96 | .34 |
| Overall Expression x Aff. Independence x Life Stress | Social Support | 0.03 | 0.29 | .77 |
| | Attachment Subscale | 0.03 | 0.30 | .77 |
| | Social Integration Subscale | 0.06 | 0.52 | .60 |
| | Reassurance of Worth Subscale | -0.02 | -0.22 | .83 |
| | Reliable Alliance Subscale | 0.11 | 1.03 | .30 |
| | Guidance Subscale | 0.05 | 0.50 | .62 |
| | Opportunity for Nurturance Subscale | 0.02 | 0.18 | .86 |
| | Depression | 0.09 | 0.94 | .35 |

Note. All of the above are separate regression models.*$p<.05$.

Table 9. Standardized Beta Coefficients, T-ratios, and P-values for Emotion Suppression and Affective Independence Interaction Terms

| Predictor Term | Time 2 Outcome Variable | $\beta$ | $t$-ratio | $p$-value |
|---|---|---|---|---|
| Suppression of PA x Aff. Independence | Social Support | -0.09 | -1.10 | .28 |
| | Attachment Subscale | -0.10 | -1.27 | .21 |
| | Social Integration Subscale | 0.11 | 1.17 | .25 |
| | Reassurance of Worth Subscale | -0.02 | -0.26 | .80 |
| | Reliable Alliance Subscale | -0.13 | -1.43 | .16 |
| | Guidance Subscale | -0.12 | -1.45 | .15 |
| | Opportunity for Nurturance Subscale | -0.07 | -0.75 | .45 |
| | Depression | -0.02 | -0.23 | .82 |
| Suppression of NA x Aff. Independence | Social Support | -0.07 | -0.90 | .37 |
| | Attachment Subscale | 0.01 | 0.10 | .92 |
| | Social Integration Subscale | -0.09 | -0.99 | .32 |
| | Reassurance of Worth Subscale | -0.06 | -0.68 | .50 |
| | Reliable Alliance Subscale | -0.10 | -1.18 | .24 |
| | Guidance Subscale | -0.04 | -0.44 | .66 |
| | Opportunity for Nurturance Subscale | -0.08 | -0.91 | .37 |
| | Depression | 0.10 | 1.20 | .24 |
| Overall Suppression x Aff. Independence | Social Support | -0.09 | -1.20 | .23 |
| | Attachment Subscale | -0.02 | -0.29 | .77 |
| | Social Integration Subscale | -0.08 | -0.91 | .37 |
| | Reassurance of Worth Subscale | -0.05 | -0.61 | .55 |
| | Reliable Alliance Subscale | -0.12 | -1.31 | .19 |
| | Guidance Subscale | -0.06 | -0.72 | .48 |
| | Opportunity for Nurturance Subscale | -0.10 | -1.24 | .22 |
| | Depression | 0.10 | 1.12 | .27 |

Note. All of the above are separate regression models.

Finally, to test whether life stress further moderated this interaction, we added life stress as well as the two-way interactions of affective independence and life stress, affective independence and emotion suppression, and life stress and emotion suppression as main effects in the third block. We then entered the three-way interaction between emotion suppression, independence of affects, and life stress in the fourth block. Again, the three-way interactions did not significantly predict any of our outcome variables. Standardized beta values, $t$-ratios, and $p$-values for the three-way interaction terms of all models can be found in Table 10.

## Exploratory Analyses

Because we found in our preliminary analyses that there was a significant difference in affective independence based on sex, we wanted to explore whether sex was related to independence of PA and NA. Therefore, we created a multi-level model in HLM where we entered sex at Level 2 to predict the within-person relationship between PA and NA and found that sex indeed moderated the relationship between PA and NA ($B = -0.18$, $t(100) = -2.46$, $p = 0.02$), with women displaying a higher level of affective independence than men. Also, because neuroticism is related to negative emotionality (just as depression is), we entered neuroticism at Level 2 and independence of PA and NA at Level 1 and found that there was a significant relationship between the two, such that those high in neuroticism had a stronger negative relationship between PA and NA ($B = -0.01$, $t(100) = -2.62$, $p = 0.01$). It is noteworthy to add that, as the above findings might suggest, the women in our sample were slightly higher in neuroticism than men ($M = 2.84$, $SD = .70$ for women; $M = 2.50$, $SD = .91$ for men). However, the difference between the sexes on this variable was not significant ($t(101) = -1.82$, $p = .07$) and the relationship between neuroticism and affective independence held when sex was added to the model ($B = -0.01$, $t(99) = -2.25$, $p = 0.03$).

Table 10. Standardized Beta Coefficients, T-ratios, and P-values for Emotion Suppression, Affective Independence, and Life Stress Three-way Interaction Terms

| Predictor Term | Time 2 Outcome Variable | $\beta$ | $t$-ratio | $p$-value |
|---|---|---|---|---|
| Suppression of PA x Aff. Independence x Life Stress | Social Support | -0.28 | -1.14 | .26 |
| | Attachment Subscale | -0.29 | -1.23 | .22 |
| | Social Integration Subscale | -0.32 | -1.14 | .26 |
| | Reassurance of Worth Subscale | -0.22 | -0.89 | .38 |
| | Reliable Alliance Subscale | -0.36 | -1.30 | .20 |
| | Guidance Subscale | -0.28 | -1.12 | .27 |
| | Opportunity for Nurturance Subscale | 0.04 | 0.14 | .89 |
| | Depression | 0.20 | 0.78 | .44 |
| Suppression of NA x Aff. Independence x Life Stress | Social Support | 0.09 | 1.02 | .31 |
| | Attachment Subscale | 0.10 | 1.20 | .23 |
| | Social Integration Subscale | 0.03 | 0.33 | .74 |
| | Reassurance of Worth Subscale | -0.02 | -0.28 | .78 |
| | Reliable Alliance Subscale | 0.05 | 0.53 | .60 |
| | Guidance Subscale | 0.17 | 2.00 | .05 |
| | Opportunity for Nurturance Subscale | 0.07 | 0.84 | .40 |
| | Depression | -0.03 | -0.37 | .72 |
| Overall Suppression x Aff. Independence x Life Stress | Social Support | 0.06 | 0.77 | .44 |
| | Attachment Subscale | 0.07 | 0.81 | .42 |
| | Social Integration Subscale | 0.05 | 0.53 | .60 |
| | Reassurance of Worth Subscale | -0.02 | -0.20 | .85 |
| | Reliable Alliance Subscale | 0.03 | 0.27 | .79 |
| | Guidance Subscale | 0.15 | 1.77 | .08 |
| | Opportunity for Nurturance Subscale | 0.06 | 0.63 | .53 |
| | Depression | -0.05 | -0.52 | .60 |

Note. All of the above are separate regression models.

CHAPTER 4

DISCUSSION

In this study, we investigated how affective independence is related to a number of social

support and depression outcomes. We found no evidence for a relationship between affective

independence and social support or depression. Further, the relationship between affective

independence and subsequent perceived social support did not emerge in the context of high life

stress. Similarly, depression was not prospectively predicted by affective independence or the

interaction of affective independence and life stress. Emotion expression did not moderate the

relationships between affective independence and social support or depression outcomes (and

life stress generally did not further moderate this interaction). Finally, we found that emotion

suppression did not moderate the relationships between affective independence and social

support or depression outcomes (and life stress did not further moderate this interaction).

We did find, however, that greater independence of affects was significantly related to

sex, with women having a stronger inverse relationship between PA and NA (and thus being

lower in affective independence) than men. This finding contributes to the literature on sex

differences in emotion regulation. Diener and colleagues have found that females tend to be

higher in emotional intensity than males (Diener, Sandvik, & Larsen, 1985; Fujita, Diener, &

Sandvik, 1991). Combining these results with Diener and Emmons' (1985) finding that there is a

stronger inverse relationship between positive and negative affect when emotions are felt more

intensely, it follows logically that women would be lower in affective independence than men.

Relatedly, McRae et al. (2008) found in an fMRI study of gender differences in emotion

regulation that after viewing negatively valenced pictures and instruction to down-regulate their

subsequent negative emotions, men demonstrated significantly less activity in the pre-frontal

brain regions when actively trying to use cognitive regulation strategies and less activity in the ventral striata (an area which is related to both processing of positive stimuli and self-report of positive affect) when down-regulating negative emotion. The authors noted that initial amygdala activity in men and woman was comparable, as was self-report of NA, indicating that the sexes were equally emotionally reactive to the stimuli (McRae et al., 2008). McRae and colleagues interpreted these findings as suggesting that cognitive regulation may be more automatic for men and require less effort (explaining the lesser activity in the pre-frontal regions) and that women are more likely than men to use positive emotion to reappraise negative emotional stimuli and down-regulate negative affect (explaining the ventral striata finding). In other words, the women are effectively boosting their PA to lower their NA. This result is again consistent with our finding that women have a stronger inverse relationship between positive and negative emotion. As none of the above authors touched on affective independence explicitly, however, our finding builds upon and adds uniquely to the literature on sex differences in emotion regulation.

We also found that greater independence of affects was significantly related to neuroticism at initial evaluation, with those participants who were higher in neuroticism demonstrating a stronger inverse relationship between PA and NA (and therefore being lower in affective independence). This finding contributes to the literature on neuroticism and emotionality. Neuroticism is, by definition, associated with high negative emotionality (McCrae & Costa, 1987), and it has also been found to negatively correlate with positive emotion in daily life (David, Green, Martin, & Suls, 1997). Thus, neuroticism has been linked to strong emotionality, but this study is the first to demonstrate that negative and positive emotion are more closely linked in real time for those high in neuroticism. For these individuals, bad moods are less often offset by simultaneous positive emotion.

Again considering Diener and Emmons' (1985) finding that the strongest inverse relationship exists between PA and NA when emotions are felt intensely, it may be that those who are higher in neuroticism have a tendency to not only experience more negative affect but also *stronger* negative emotions and therefore have stronger within-person inverse relationships between PA and NA. Moreover, both Reich and colleagues (2001) and Zautra et al. (1997) have reported findings that co-variation of PA and NA decreases during times of life stress, perhaps due to cognitive resources being more limited during those periods. Although stress was not related to affective independence in our sample (maybe due to our method of measuring life stress, which we will address below), it is possible that neuroticism predisposes people to experience greater life stress, which in turn is related to decreased affective independence.

Finally, we also found that affective independence, expression of negative affect, and life stress interacted to prospectively predict the experience of a reliable alliance in social relationships. Those who were low in affective independence, low in expression of NA, and low in life stress had the lowest reliable alliance scores, whereas those who were low in affective independence, high in expression of NA, and low in life stress had the highest. Because the same finding did not hold true for overall social support and because this result does not make much theoretical sense, we are reluctant to interpret it as being meaningful. Certainly we keep in mind the large number of analyses we conducted and see it as likely that this finding stems from Type I error.

There are several possible explanations for our finding of null results in our core analyses. With null results, we consider two main interpretations: first, that our theory was incorrect; and second, that our design failed to capture real effects. In terms of theory, one might wonder whether emotion does in fact exist along a bipolar spectrum, as suggested by Green and

colleagues (1993), Zautra et al. (1997), and Russell and Carroll (1999). However, there was plenty of variability in our sample to suggest that some people experience greater independence of PA and NA than others.

It is a greater possibility that affective independence is simply not systematically related to depression or social support. Specifically, it is plausible that one's internal emotional experience might not necessarily translate into any particular social behaviors that would be likely cause a loss of social support and, in turn, an increase in depression. Alternatively, it may be that people tend to choose friends who have emotional styles like their own. That is, they may consider themselves more compatible with those who share similar emotional styles and "sort through" friends until they find ones whom they feel are a good fit or match. If this were the case, high independence of affects would be expected, because it had been sought out, and it therefore would seem less likely to cause interpersonal difficulties and, in turn, depression.

It may also be that affective independence is moderated by other factors that we failed to measure. For example, since neuroticism, a tendency to experience negative affect, is related to co-variation in PA and NA, maybe extraversion, which predisposes one to experience positive affect (Costa & McCrae, 1992a), is too. Additionally, as mentioned above, Reich et al. (2001) have found evidence to suggest that the inverse relationship between PA and NA strengthens during times of life stress. They explained this as being due to cognitive resources being depleted and thinking becoming more black-and-white. As such, it may be that cognitive factors like mental flexibility or $g$ might be associated with affective independence.

On the other hand, it is possible that our null results were due to Type II error, that is, not capturing a real effect when a real effect exists. Because our sample was a non-clinical, presumably healthy, and well-adjusted group of college students, it could be possible that there

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would not be enough variability in depression or social support to find a relationship between affective independence and social support or affective independence and depression. This does not, however, seem to be the case in our sample, as there was reasonable variability on those variables.

In addition, our measure of life stress, the LES (Sarason et al., 1978), is a self-report checklist measure that requires participants to indicate which events have occurred for them within a certain time frame. Such self-report measures are easy to administer and economical, but there are some serious methodological problems associated with their use. For example, recall bias, intracategory variability (i.e., the possibility that a number of different events could be reported under one category due to differences in interpretation), and subsequent problems with reliability and validity are some often-cited concerns (see Dohrenwend, 2006, for a comprehensive review). We chose to use the LES because of its ease of administration and because the "gold standard" interview measures of life stress such as the Bedford College Life Events and Difficulties Schedule (LEDS; Brown & Harris, 1978) or the UCLA Life Stress Interview (Hammen, Adrian, Gordon, Burge, Jaenicke, & Hiroto, 1987) are extremely labor- and resource-intensive, but it may not have adequately captured our participants' levels of life stress.

Furthermore, our daily measure was not a previously developed standardized measure but rather items that we wrote to assess specifically what we wanted to study. We only queried seven total emotions (four PA and three NA), and our barely adequate scale reliability estimate for NA (.57) suggests that we might not have included a sufficient number of NA items in particular to capture well the NA construct. A greater number of NA items may have been warranted. Moreover, we asked participants "to what extent" they had been feeling each of above-mentioned seven emotions, and Stone, Greenberg, Kennedy-Moore, and Newman (1991) have

found that people in fact interpret "extent" differently. Some take it to mean frequency, some understand it as duration, some intensity, or some even effort. As such, it is possible that our daily measure lacked construct validity and was not actually measuring what we were intending to assess.

Finally, our method of measuring co-variation of positive and negative emotion is but one way of assessing this construct. It is important to acknowledge this, because the way in which a construct is measured can affect findings. We chose to observe emotional experience in everyday life because of its high external validity, but another way we could have measured affective independence would have been through some sort of experimental manipulation. For example, we could have used either short stories or video clips that, based on their content, could be expected to produce either a purely positive or purely negative mood. We then could have queried participants on the degree to which they were currently feeling each of several positive and negative emotions. Using this sort of methodological approach would have allowed us to standardize our participants' emotional experiences, guaranteeing that they were all reacting to the same stimuli and allowing us to assess for co-variation in that more tightly controlled context. It is possible that if we had used a different measurement method of affective independence, we might have found support for our hypotheses.

Despite several methodological strengths, such as our prospective design and our use of multilevel modeling to make both ipsative and normative comparisons, our study design is subject to some general limitations. Our sample was largely comprised of female, Caucasian, middle-class college students and therefore the results may not generalize to a more racially or socioeconomically diverse population. The restricted age range is especially relevant considering that Diener and colleagues (1985) found that emotional intensity, which may be related to

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affective independence, decreases over the span of adulthood for both sexes. Ersner-Hershfield and his associates (2008) have also found that age moderates the simultaneous experience of positive and negative emotion, with older people generally being more accepting of such duality (and thus presumably higher in affective independence) than younger people. Had the age range of our participants been greater, we might have seen more of a range in affective independence and found support for some of our hypotheses. In addition, we relied on self-report to assess both emotional experience and outcomes, which can artificially inflate correlations due to common method variance (i.e., a respondent's tendency to always select "always" or "never"); however, given that we did not actually find support for our hypotheses, this is perhaps less relevant to our results. Finally, the momentary emotion questions asked participants about the degree to which they had felt a certain emotion since *last beeped* rather than the degree to which they were *currently* feeling that certain emotion. As such, our design does not fully eliminate the possibility of retrospective recall bias confounding our results.

In conclusion, in the present sample it did not appear that dependence of positive and negative affect had an adverse effect on social support or depression. However, even though we did not find support for our original hypotheses, this study does uniquely contribute to the literature on emotion regulation in daily life in two important ways. One is that we found that sex moderates within-person co-variation of the experience of positive and negative emotion in daily functioning. The other is that we found that trait neuroticism is also related to independence of affects in daily experience. Both of these findings could have meaningful implications for social functioning in everyday life as well as therapeutic interventions in a clinical setting.

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