2008-01-01

Goal-Striving and Affect in Bipolar I Disorder

Daniel Fulford
University of Miami, dfulford@psy.miami.edu

UNIVERSITY OF MIAMI

GOAL-STRIVING AND AFFECT IN BIPOLAR I DISORDER

By

Daniel Fulford

A THESIS

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Master of Science

Coral Gables, Florida

June 2008

UNIVERSITY OF MIAMI

A thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science

GOAL-STRIVING AND AFFECT IN BIPOLAR I DISORDER

Daniel Fulford

Approved:

_____	_____
Dr. Sheri L. Johnson	Dr. Terri A. Scandura
Professor of Psychology	Dean of the Graduate School
_____	_____
Dr. Charles S. Carver	Dr. Andrew L. Brickman
Professor of Psychology	Executive Director, Health Programs
	The Children's Trust

FULFORD, DANIEL (M.S., Psychology)
Goal-Striving and Affect in Bipolar I Disorder (June 2008)

Abstract of a thesis at the University of Miami.

Thesis supervised by Professor Sheri L. Johnson
No. of pages in text. (77)

Although most research on bipolar I disorder has focused on biological models, recent investigation has elucidated the importance of psychosocial predictors of the course of illness. Theories of the Behavioral Activation System's role in affect have helped unify biological and environmental explanations of the disorder. Along these lines, researchers have proposed that goal striving and attainment predict manic symptoms. In the current study, experience-sampling methodology was used to assess the relationship between fluctuations in goal striving and affect among 12 persons with bipolar I disorder and 12 without a history of mood disorder (control group). Participants completed measures of goal striving and affect three times each day for a period of three weeks. It was hypothesized that moving more quickly than expected toward a given goal would result in decreased subsequent effort toward that goal (coasting) for the control group, and increased subsequent effort (anti-coasting) for those with bipolar I disorder, with positive affect mediating the relationship in both cases. Results indicated that those in the bipolar I disorder group were significantly more likely to anti-coast than those in the control group. This finding, however, was explained primarily by gender, as men in the bipolar I disorder group showed no evidence of anti-coasting. In addition, there was no evidence of the mediating role of positive affect in these phenomena. Implications of the findings, limitations, and future directions are discussed.

DEDICATION

This thesis is dedicated to the life-long friends I have met in Miami.

ACKNOWLEDGEMENTS

Thank you to Dr. Sheri Johnson for convincing me that a thesis should be more than just a hoop through which to jump. Thank you to my committee members for their thoughtful feedback. Thank you to my team of research assistants for tackling the purely mundane. Thank you to the amazing people who told their story for science, without whom there would be no thesis. And finally, thank you to my family and friends for their constant support.

TABLE OF CONTENTS

Chapter 1: Introduction

Bipolar disorder poses unique challenges to psychologists in that the illness is difficult to identify and treat. The psychological and economic costs of the disorder exceed those of many physical and mental illnesses. Relapse, hospitalization, and suicide are especially problematic. Even with adequate pharmacological treatment over extended periods of time, a significant number of individuals with bipolar disorder still experience relapse (Gitlin, Swendsen, Heller, & Hammen, 1995). What is more, individuals with the disorder experience significantly more hours of absence from employment and larger disability payments than matched controls (Matza, de Lissovoy, Sasane, Pesa, & Mauskopf, 2004). After hospitalization for mania, almost one quarter of individuals remain unemployed for one year (Harrow, Goldberg, Grossman, & Meltzer, 1990). Most troubling, the lifetime rate of at least one suicide attempt is as high as 50% among those with bipolar disorder (Simpson & Jamison, 1999).

Beyond the direct effects of symptoms of bipolar disorder, psychological and medical comorbidity is common and predicts poorer outcome. In a large study of 865 individuals with bipolar disorder, approximately half (54.5%) experienced comorbidity with personality disorders (Serretti, Mandelli, Lattuada, Cusin, & Smeraldi, 2002). In an inpatient sample, 50% of individuals with bipolar disorder had current comorbidity with a substance use disorder (O'Croinin, Zibin, & Byrne, 1994), while data from the recent National Comorbidity Survey replication showed a lifetime comorbidity of 87% with an anxiety disorder (Merikangas et al., 2007). In addition, the medical burden of the disorder can be extreme (Kupfer, 2005). For example, total health care costs during the year after a diagnosis of bipolar disorder are more than four times that of the average individual

(Knoth, Chen, & Tafesse, 2004). These overwhelming medical costs affect caretakers immensely, with even greater financial strain experienced by family members of those with bipolar disorder than those with schizophrenia (Gianfrancesco, Wang, & Yu, 2005). Thus, the personal and societal burden of bipolar disorder has led researchers to look for answers regarding etiology to aid treatment development.

Etiology and Course of Bipolar Disorder

Most research on the etiology of bipolar disorder has focused on biological models. Several studies have attempted to identify specific genes associated with the disorder (e.g., Blackwood et al., 1996; Ewald, Flint, Kruse, & Mors, 2002; Morissette et al., 1999), although their findings are relatively inconclusive. Twin and adoption studies have provided more concrete evidence for the genetic bases of the disorder (for a thorough review, see Shih, Belmonte, & Zandi, 2004). Twin studies have found substantial evidence of a genetic contribution to this disorder, with findings from the most comprehensive study indicating a 67% concordance rate among monozygotic twins and a 20% rate among dizygotic twins (Kendler, Pedersen, Neale, & Mathe, 1995), yielding a heritability estimate of 79%. Adoption studies, albeit sparse, have shown concordance to be significantly higher between biological parents and their children with the disorder than between these same children and their adoptive parents (Mendlewicz & Rainer, 1977; Wender, Kety, Rosenthal, Schulsinger, Ortmann, & Lunde, 1986).

In terms of neurobiology, abnormalities in the serotonergic, dopaminergic, and noradrenergic systems of the brain have been found in patients with manic symptoms compared to normal controls (Gerner, Post, & Bunney, 1996; Li et al., 1999; Young & Joffe, 1997; Young, Warsh, Kish, Shannak, & Hornykiewcz, 1994). Drawing on

neurobiological literatures, lithium and other mood-stabilizing medications have been the mainstays of treatment for bipolar disorder (Geddes, Burgess, Hawton, Jamison, & Goodwin, 2004; Ketter, Winsberg, DeGolia, Dunai, Tate, & Strong, 1998). Although there is little doubt that the presence of bipolar disorder is heavily determined by genes and neurobiological factors, biological explanations do not account for all of the variance in the disorder. That is, environmental factors can have profound effects on the timing and severity of symptom expression.

Life events, social support, and family criticism have been shown to influence the course of the disorder. Even after controlling for adherence to medication, those who experience severe negative life events take more than three times as long to recover compared to those who do not (Johnson & Miller, 1997). Another predictor of the course of bipolar disorder is social support (Johnson, Winett, Meyer, Greenhouse, & Miller, 1999). Johnson and colleagues found that, at a 6-month follow-up, those with low social support took significantly longer to recover from episodes and displayed more symptoms than those with higher support. Low support from a complete social network (best friend, parent, and romantic partner) has also been found to predict depression over time among people with the bipolar disorder (Cohen, Hammen, Henry, Daley, 2004). Levels of expressed emotion, defined as overinvolvement, criticism and hostility toward the patient from caregivers, can have profound effects on the outcome of those with the disorder. That is, high expressed emotion among caregivers of those with the bipolar disorder has been found to predict higher relapse rates (Butzlaff & Hooley, 1998) and generally worse outcome (Miklowitz, Goldstein, Nuechterlein, Snyder, & Mintz, 1988; Miklowitz, Wisniewski, Miyahara, Otto, & Sachs, 2005; O'Connell, Mayo, Flatow, Cuthbertson, &

O'Brien, 1991) than low expressed emotion. Thus, psychosocial variables affect the outcome of the disorder.

Reward Sensitivity

One attempt at unifying the biological and environmental explanations of bipolar disorder has been the introduction of the behavioral activation (BAS) and inhibition (BIS) systems into theory (Hayden et al., 2008; Meyer, Johnson, & Carver, 1999; Meyer, Johnson, & Winters, 2001; Salavert et al., 2007). The BAS (Fowles, 1980), also known as the behavioral facilitation system (Depue & Iacono, 1989) or behavioral approach system (Gray, 1994), is a neurobiological system that, in response to cues of reward, activates emotions and behaviors related to approach. That is, high activation of the BAS results in positive affect and motivation for goal attainment (Gray, 1990). Stellar and Stellar (1985) have postulated that the BAS is associated with the dopaminergic pathways in the brain.

On the other hand, the BIS (Gray, 1972) is associated with the septohippocampal system in the brain and activates aversive motivation. This system is believed to promote feelings of anxiety in response to cues of punishment, novelty, and nonreward, which may result in heightened arousal, ceasing ongoing behavior, and heightened sensitivity to novel stimuli (Gray, 1978). Gray (1987) believed the BAS and BIS are relatively orthogonal systems in that, in a given individual, sensitivity of one system is unrelated to the sensitivity of the other. Other researchers, though, believe activation of one system may affect activation of the other (see Pizzagalli, Sherwood, Henriques, & Davidson, 2005). A person with high BAS sensitivity should have heightened positive affect and display approach behaviors in response to cues of reward, while one with high BIS

sensitivity should have anxiety and display avoidant behaviors in response to cues of punishment (Carver & White, 1994). Relevant to high BAS, one pattern of approach behavior involves working towards the attainment of life goals.

Goal Striving and Attainment

Goals have been broadly defined as internal representations of desired outcomes (Austin & Vancouver, 1996). These outcomes range from simple biological needs to more abstract desires, such as being a happy person. Although they are strong motivators of human behavior, these internal representations are thought to be often largely outside of awareness (Shah, 2003; Trehub, 1991). In terms of self-regulation, goals have been described as a means to decrease discrepancies that may exist between current and desired states (Carver & Scheier, 1998; Miller, Galanter, & Pribram, 1960). A classic metaphor for goal-directed behavior is that of a thermostat. The thermostat receives external information about temperature. If the external temperature does not match the desired state (the temperature the thermostat is set on), then the thermostat sends information to increase either cool or warm air to match the desired state—this process is referred to as a feedback loop. Goals can also be seen as ways to obtain desired states: "not simply end points to be attained but paths to be negotiated" (Carver, Lawrence, & Scheier, 1996).

Carver & Scheier (1998) expanded upon the idea of the self-regulatory feedback loop by introducing their idea of *effectiveness of movement* toward goals as another feedback loop. In their theory, emotions are thought to serve vital functions in human behavior (Averill et al., 1994; Carver, 2003). The feedback loop of *effectiveness of movement* toward goals is related to affect, as one's rate of progress toward a given goal

is compared to a reference rate (Carver & Scheier, 1998). This reference rate can be seen as the goal itself for this loop as it is where the person desires to be, or the standard to which they compare their present state. If progress toward a given goal is lower than that expected by the reference rate, or if there is no progress at all, negative affect arises. If progress exceeds that expected by the reference, positive affect arises. When one's rate of progress matches the criterion (i.e., no discrepancy exists), then there is no affect. Thus, negative feelings serve as internal indicators to motivate one to work more towards a given goal, while positive feelings tell one they are doing better than they need to, and thus can decrease effort. The feedback loop thus serves to decrease discrepancies between desired and actual states.

The effects of rate of movement towards a given goal have been supported by preliminary evidence. In one study, Hsee and Abelson (1991) examined participants' preference for velocity toward an increase in class standing from the 30^{th} to 70^{th} percentile over time. In this hypothetical situation, participants were asked to indicate if they would be more satisfied if their class standing had risen over the past six weeks versus over the past three weeks. As predicted, participants said they would be more satisfied if their standing improved more quickly (over three weeks). Conversely, if the hypothetical outcome was negative (a decrease in salary), participants preferred a slow decrease to a quick one. These findings show that it is the velocity toward a given goal, rather than the goal itself, that has the most impact on one's affect. Although supportive of the proposed feedback loop's role in affect, this study's paradigm was completely hypothetical.

In a more experimental paradigm, Lawrence, Carver, and Scheier (1995) provided feedback to participants regarding their rate of progress toward a desired goal in vivo. Researchers told participants that they wanted to assess how people used intuition to sense the meaning of foreign words (nonsense words). After each block of words, participants were given feedback regarding their performance. Mood was assessed before and after the task blocks. A total of 5 different patterns of feedback were randomly assigned to the participants, ranging from beginning with 1 number "correct" to 9 numbers "correct." Each trial lasted 6 blocks and ended with the same feedback, indicating 5 "correct" numbers in that block. If a participant started with only 1 number "correct" in the first block, they were gradually given more positive feedback as the study went on. Conversely, if a participant started with 9 numbers "correct" in the first block, they were gradually given worse feedback as the study went on. Results showed that for those who started with the least positive feedback (only 1 number "correct") but were gradually given better feedback, affect increased the most. But, for those who started with the most positive feedback (9 numbers "correct"), affect *decreased* more than any other group. This finding provides further support for the theory that movement towards a given goal is a strong predictor of one's affect—positive affect arises when you are moving quickly towards a desired outcome, while negative affect arises when you are moving away from a desired outcome.

Coasting

The phenomenon of easing back effort towards a given goal in response to positive affect has been referred to as coasting (Carver, 2003). The easing back is done automatically and unconsciously, and is specific to the goal in which one is doing better

than expected. With this easing back comes openness to a shift in focus towards other goals. This phenomenon has been supported by the finding that moving quickly towards a given goal results in a broadening of attention (Fredrickson & Branigan, 2005). Shifting focus is not an imperative consequence of doing better than one need to. Rather, the positive affect associated with effectiveness of movement towards a given goal opens up the possibility of this shifting (Vallacher & Kaufman, 1996).

But why would one discontinue a behavior that makes them feel good? In essence, humans do enough to "get by," thus freeing up resources for other goals. If we are doing better than expected on a given goal, we can divert this excess effort toward another goal that is receiving little or no effort. Thus, the primary purpose of coasting is that it diverts attention to other domains, allowing the distribution of resources among multiple goals. There is a need to test the proposed model of coasting and I provided one such test in the current study.

Reward Responsivity in Bipolar Disorder

Over the past several decades, a range of theorists have suggested that reward responsivity relates to mania (Hayden et al., 2008; Meyer, Beevers, Johnson, & Simmons, 2007; Meyer, Johnson, & Carver, 1999; Meyer, Johnson, & Winters, 2001; Salavert et al., 2007). It has been suggested that essential features of mania, such as heightened mood, increased self-esteem, increased goal-directed behavior, and less sleep, are the result of high BAS activity (Depue & Iacono, 1989). Others have noted how dysregulation of dopamine-secreting neurons projecting from the ventral tegmental area to the nucleus accumbens are implicated in both the BAS (Bozarth, 1991) and bipolar I disorder (Depue & Zald, 1993; Hestenes, 1992; Swerdlow & Koob, 1987; Winters,

Johnson, & Cuellar, under review). It has also been suggested that cognitions regarding reward in those with bipolar disorder predict the course of mania (Leahy, 1999, 2000). Thus, heightened activation of the BAS and manic symptoms seem to be significantly intertwined.

Recent research in bipolar disorder has examined the relationship between goal attainment and manic symptoms. Using the goal attainment scale of the Life Events and Difficulties Schedule (LEDS; Leenstra, Ormel, & Giel, 1995) among a sample of people with bipolar disorder, Johnson and colleagues (2000) found that life events involving goal attainment predicted manic symptoms over time. This phenomenon has also been replicated in a more recent study (Johnson et al., in press), as well as in a recent analog sample (Alloy et al., 2006). In addition, increased achievement striving has been found to predict manic symptoms over time (Lozano & Johnson, 2001). These findings provide evidence that goal striving and attainment are closely tied to mania among those with bipolar disorder.

Coasting and Bipolar Disorder

One cardinal symptom of mania is expansive mood (American Psychiatric Association, 1994). Within a coasting framework, this elevation of affect may be a result of a failure to coast in those with bipolar disorder. Instead of easing back effort when feeling good, those with bipolar disorder may continue pursuing goals with substantial effort and intensity (what I term “anti-coasting”). The speed of goal pursuit may amplify positive moods, intensifying the initial positive affect of a small success.

Several studies have examined responses to success among those with bipolar disorder and those with vulnerability to bipolar disorder. In one study, undergraduate

students scoring high on measures of hypomanic vulnerability completed a button-pressing task and were rewarded for fast performance. Current hypomanic symptoms significantly predicted expectancies of success and greater positive affect after reward. Also, lifetime vulnerability to hypomania predicted higher goal-setting for future tasks after reward (Johnson, Ruggero, & Carver, 2005). Johnson & Ruggero (2003) replicated these findings in a sample of people with bipolar I disorder—after an initial success, those with the disorder chose to work on more difficult future goals than control participants. Thus, the existing evidence suggests that, after positive feedback about goal attainment, those with vulnerability to bipolar disorder do not ease back on goal-striving behavior. Rather, expectancies of success and goal-setting for future tasks actually *increase* after this feedback. Although these findings provide preliminary support for the idea that successful goal attainment leads to increases in goal-directed behavior, no researchers have examined this phenomenon in a naturalistic design. That is, coasting in response to real life successes among people with bipolar disorder has not yet been examined.

Findings from the present study may help elucidate the concept of coasting in both those with no history of mood disorder and in those diagnosed with bipolar disorder. The hypotheses for the current study were as follows: When moving toward a given goal more quickly than expected, those without history of mood disorder will plan to ease back effort on that goal, or "coast." Conversely, if moving toward a given goal more quickly than expected, those diagnosed with bipolar disorder will plan to *increase* effort on that goal, or "anti-coast." In terms of affect, for those without a history of mood disorder, positive affect will mediate the relationship between velocity towards goal

attainment and subsequent coasting. The effects of velocity and positive affect on subsequent effort will be the opposite for those with a diagnosis of bipolar I disorder. That is, positive affect will predict anti-coasting. The idea is that those with bipolar I disorder interpret positive affect as a signal to continue working hard toward goals, rather than as a signal to decrease effort.

One of the major outcomes to be assessed will be how moving closer than expected toward a given goal (on the GASS, comparing item 3 of one time point to item 4 from the previous time point) will affect how much effort they plan on putting toward that same goal for the next several time points (item 5 on the GASS). When coasting is at work, there should be a significant correlation between overshooting a goal at one time point and planning less effort towards that goal on subsequent time points. Conversely, a significant correlation between overshooting a goal at one time point and planning *more* effort towards that goal on subsequent time points will signify evidence of anti-coasting. The number of time points (lags) in which these changes in effort planned occurs will be tested using time series analysis.

Chapter 2: Method

Participants

Participants for the current study were recruited from the greater Miami-Dade, Florida area using public flyers, print, and internet advertisements. Announcements about the research were made in local clinics and bipolar support groups. Those recruited were compensated for their participation in the study. Two groups were recruited: 12 participants diagnosed with bipolar I disorder and 12 participants without any history of mood disorder. As the current study is a single-case experimental design using time series analysis, each participant served as a sample and each additional participant a replication. The number of participants selected is consistent with psychotherapy research studies using the single-case experimental design (see West & Hepworth, 1991).

Participant selection for the bipolar I disorder group included the following: bipolar I disorder diagnosed by the Structured Clinical Interview for DSM–IV (SCID; First, Spitzer, Gibbon, & Williams, 1996); current remission from an episode of depression, as indicated by a Modified Hamilton Rating Scale for Depression (MHRSD) score below 10; current remission from an episode of mania, as indicated by a Bech–Rafaelsen Mania Rating Scale (BRMS) score below 7; and age between 18 and 70, inclusive. Exclusion criteria included meeting SCID criteria for substance abuse or dependence within the past six months and/or meeting SCID lifetime criteria for psychosis outside of mood episodes. In addition, exclusion criteria included central nervous system diseases other than bipolar disorder, or the inability to complete self-report measures independently because of mental retardation or language barriers.

Procedures

Initial assessment. Those interested in the study contacted our team and were then asked to come to the University to complete written informed consent procedures. Interested participants then completed the diagnostic interview with a graduate student researcher trained and supervised by the thesis chair. Then, measures of current depression and mania, ambition, reward sensitivity, and background information (see below) were administered. Next, participants were asked to provide the researcher with three goals that they would be striving toward in the coming weeks (see Appendix A for script). The researcher helped participants choose tangible goals that met the following criteria: 1) goals that the participant was confident they would put adequate effort toward; 2) goals that could be accomplished during the length of the study; and 3) goals that required more than minimal effort to be accomplished. Examples of such goals varied across individuals (see below). The purpose of these criteria was to ensure that the goals the participants would be working toward would require enough time and effort to be significantly important to them. Additionally, to examine goal-striving behaviors as naturalistically as possible, participants were encouraged to identify goals for which they were already striving.

Experience sampling. Participants were then given a small questionnaire booklet enclosed inside a fanny pack. The three goals that the participants selected were written on the inside cover of the booklet. Participants were instructed on how to answer the questions and tested on the information to make sure they understood the procedures completely. Measures of affect and goal-striving were assessed three times each day for a period of three weeks (see measures below), resulting in approximately 63 indices of goal

striving and affect for each participant. Expecting an 80% completion rate, this number of time points was selected per recommendations that time series data should have at least 50 observations in the input data (Ostrom, 1990). The pack also included a signaling device that notified each participant to complete the measures at one time in the morning, one time mid-day, and one time at night. The affect measure was presented first. Then, six questions pertaining to each of the three goals were presented in sequential order. Researchers called each participant twice each week to check their progress and make sure there were no problems completing the questionnaires.

Measures

Diagnosis and Symptom Severity

Structured Clinical Interview for the DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996). Diagnoses were assessed using the depression, mania, substance abuse and dependence, and psychosis disorders modules of the SCID. The interrater reliability of the SCID for diagnosing bipolar I disorder is high (k = .84; Williams et al., 1992) and it is a diagnostic measure widely used in research (Spitzer, Williams, Gibbon, & First, 1992).

Modified Hamilton Rating Scale for Depression (MHRSD; Miller, Bishop, Norman, & Maddever, 1985). This 17-item clinician-administered scale assesses current depressive symptoms. The MHRSD is a modified version of the original HRSD and correlates highly with it (r = .84). In addition, high interrater reliability has been observed, with an intraclass correlation of .93. Validity for the measure has also been supported in that the scale consistently identifies bipolar depression in concert with SCID diagnoses of current depression (Johnson, Meyer, Winett, & Small, 2000; Miller,

Uebelacker, Keitner, Ryan, & Solomon, 2004). The scale was used to assess the severity of current depression among the participants.

Bech-Rafaelson Mania Scale (BRMS; Bech, Bolwig, Kramp, & Rafaelsen, 1979). Severity of current mania was assessed using the BRMS. Within our team, standardized probes and anchors have been developed to rate each of the 11 items on a scale of 0 (not present) to 4 (severe). The BRMS is widely used to assess manic symptoms and has demonstrated high interrater reliability on our team (interclass correlation = .92; Johnson, Winett, Meyer, Greenhouse, & Miller, 1999). The BRMS has been shown repeatedly across 20 years of research to demonstrate high sensitivity to small changes in symptoms (Bech, 2002). In a factor analysis, the BRMS and MHRSD represented one mania factor and one depression factor, respectively (Johnson & Miller, 1997).

Baseline Measures

Demographics. All participants completed a form concerning personal background information. Age, gender, ethnicity, marital status, language, and medication status were obtained. This information was used to assess potential confound variables

BIS/BAS Scale (Carver & White, 1994). The Behavioral Inhibition/Behavioral Activation (BIS/BAS) scale is a 24-item self-report questionnaire that measures sensitivity to reward and punishment. Response scales range from 1 (very false for me) to 4 (very true for me). Seven items compose the BIS scale, while the BAS scale is composed of the remaining 13. Factor analyses yielded three separate subscales for the BAS: 1) reward responsiveness (5 items); 2) drive (4 items); 3) and fun-seeking (4 items). Internal consistency has been reported as high, with alpha levels ranging from .66 for fun seeking to .76 for drive. Over a period of eight weeks, test-retest correlations

ranged from .59 for reward responsiveness to .69 for fun seeking (Carver & White, 1994).

The BIS/BAS Scale has also demonstrated adequate reliability and validity in a sample of 59 people diagnosed with bipolar I disorder. Internal consistency estimates as measured by *a* were .78 for BIS and .84 for BAS. Some scales appear related to current symptoms, and others appear more stable. For example, among those at-risk for bipolar spectrum symptoms as indicated by the General Behavior Inventory (GBI; Depue, Krauss, Spoont, & Arbisi, 1989), all subscales of the BAS scale were significantly correlated with lifetime mania (Meyer, Johnson, & Carver, 1999). In a longitudinal study of those with bipolar disorder, BAS Reward-Responsiveness scores did not fluctuate with manic symptoms, suggesting that mania measured by the scale is not state-dependent. In addition, Reward Responsiveness was the only scale significantly associated with manic symptom intensification over time, consistent with theory implicating this construct in mania (Meyer, Johnson, & Winters, 2001). Alpha reliability coefficients for the current study were as follows: drive = .71, fun = .78, reward = .77, BAS total = .75, and BIS = .73.

The Willingly Approached Set of Statistically Unlikely Pursuits (WASSUP; Johnson & Carver, 2006). The WASSUP is a scale designed to assess unrealistic ambitions. The questionnaire consists of seven subscales: financial success (e.g., "You will run a Fortune 500 company"), popular fame (e.g., "Celebrities will want to be your friends"), idealized relations with family (e.g., "Your children will see you as the perfect parent") and friends (e.g., "everyone you know will love you"), having a positive impact on world well-being (e.g., "you will create world peace"), political influence (e.g., "you

will be important in political circles"), and one with items reflecting self-actualization ("you will self-actualize or reach Nirvana") and creativity ("you will create a great work of art, music, or poetry"). Psychometric analyses of the WASSUP have shown subscales to have strong internal consistency and the scale to have factor analytic support (Johnson & Carver, 2006). In three separate samples, scales relevant to overly ambitious extrinsic goals have been correlated with mania risk (Johnson & Carver, 2006; Gruber, Johnson, Oveis, & Keltner, 2008). In addition, these scales have been found to differentiate those with diagnosed bipolar disorder from those with depression or no mood disorder (Eisner, Johnson, & Carver, 2008). In the current study, the alpha reliability coefficient for each subscale was as follows: popular fame = .97, friends = .69, world well-being = .91, political influence = .56, family = .92, money = .76, and create = .70.

The Mood and Anxiety Symptom Questionnaire – Short Version (MASQ-Short; Watson & Clark, 1991). The MASQ was administered to examine the effects of current symptoms of anxiety and depression. The original scale consists of 90 items, but a shortened, 62-item scale was used for the current study. This version yields four subscales (with reliabilities in the current study): General Distress – Anxiety (GDA), α = .87; Anxious Arousal (AA), α = .94; General Distress – Depression (GDD), α = .95; and Anhedonic Depression (AD), α = .86. Symptoms are assessed using a 5-point scale for each item, and higher scores on each subscale indicate greater distress.

The MASQ is highly correlated with other measures of anxiety and depression, and its subscales have excellent internal consistency (Watson, Weber, Assenheimer, Clark, Strauss, & McCormick, 1995). Importantly, the MASQ differentiates anxiety and depression well, and factor analyses support its structure (Watson et al., 1995).

Experience Sampling Measures

Experience sampling refers to methodology designed to capture psychological phenomena (mood, cognition, behavior) within the context of daily life (Conner Christensen, Feldman Barrett, Bliss-Moreau, Lebo, & Kaschub, 2003). This technique allows the researcher to study phenomena that occur outside of the laboratory walls, as well as examine these phenomena close in time to when they actually happen. Experience sampling designs are implemented in varying lengths (from one day to a month) and with several data collection measures (paper-and-pencil, personal computers, etc.). Initial plans were to use Palm Pilots to gather the data, but this plan proved to be unfeasible, as the first three participants experienced too much difficulty using the equipment and data for these participants were lost. So, the two measures, the SPANA and GASS, were completed by all 24 participants in a paper-and-pencil booklet. The time and date at which the measures were completed were recorded in the booklet.

Scale of Positive And Negative Affect (SPANA). The SPANA is a self-report inventory for rating positive and negative affect. This measure was developed specifically for the current study. Nine adjectives describing positive (5 words) and negative (4 words) affect were chosen, with two separate dimensions for positive affect (one dimension for high energy positive affect, and one for low energy positive affect). Participants indicated the degree to which they felt a certain adjective accurately described their mood state at the time. The scale is scored from 1 “not at all” to 9 “extremely—the most I’ve ever felt” (see Appendix B). Alpha reliability coefficients in the current study were .94 and .83 for the positive and negative affect subscales, respectively.

Goal Attainment and Striving Scale (GASS). The GASS (see Appendix C) is a measure designed for the current study to assess four dimensions of goal striving and attainment. Ratings cover the importance of the goal, the amount of effort the participant put toward a given goal since the last assessment, how much closer they came to achieving the goal since the last assessment, how much closer they expect to get to that goal by the next assessment point, and how much effort they expect to put toward the goal in the near future. These five goal-oriented questions were asked at all time points for each of the three goals identified by the participant in the initial assessment.

Goal velocity was calculated by comparing expected goal progress at one time point (item 4 on the GASS) to actual progress made on that goal by the next time point (item 3 on the GASS). Positive values indicated more progress made than expected (increased velocity), while negative values indicated less progress made than expected (decreased velocity). Thus, the comparison of expected goal progress to actual goal progress was referred to as "goal velocity." The effort plan variable ("How much effort do you plan on putting towards this goal by the next assessment?") was used in all analyses for two primary reasons: 1) to assess the effects of goal progress on subsequent goal effort planned *at that time point*, and 2) levels of effort planned were significantly positively correlated with the actual effort placed ("How much effort have you put towards this goal since the last assessment?") by the next time point. Average correlations between effort planned at one time point and effort exerted by the next time point were .61 and .67 for the bipolar I disorder and control groups, respectively. Only one participant's average correlation between effort planned and effort actually exerted was non-significant ($r = .14$).

Data Analyses

Examinations of the data and subsequent cleaning were carried out prior to any preliminary analyses. The causes and pattern of missing data were examined and appropriate data imputation techniques were implemented (see below). All univariate distributions were reviewed for normalcy. Data distributions were inspected and variables were transformed—or outliers removed—when appropriate. Potential confounds were analyzed to determine the need to control for them in later analyses. That is, variables that differentiated the bipolar I disorder group from the control group, and that also related to key outcomes, were considered as covariates in data analysis. Alpha was set to .05 for all analyses.

Time Series Analysis

Time series hypotheses were tested using time series analysis functions of the Statistical Package for the Social Sciences – Trends, version 15.0 (SPSS Inc., 2006) software. The analysis of time series data employs a statistical technique similar to simple linear regression. The cardinal difference between the two techniques is that time series regression equations model the effects of observations on each other over time. When phenomena are observed close together in time, observations (and their respective error terms) are likely to be highly correlated with each other. This phenomenon is known as serial dependency. Because these observations can be highly correlated, using all of them in estimating the parameters may result in inflated estimates of effect sizes. The primary hypotheses of the current study were tested with Autoregressive Integrated Moving Average (ARIMA) modeling (Box & Jenkins, 1976; McDowall, McCleary, Meidinger, & Hay, 1980).

Using SPSS Trends, initial models were used to examine how many lags were relevant before implementing ARIMA modeling. More specifically, correlations were calculated to examine the relationship between goal velocity, effort planned, and affect within each participant at various lags. Three relationships were modeled for each person: velocity on each goal (i.e., making more or less progress than expected on a given goal) as a predictor of subsequent effort planned for that goal (the velocity-effort relationship); the combined velocity of all three goals as a predictor of positive affect; and positive affect as a predictor of subsequent effort for each goal. For each of these analyses, the relationship between variables cross-sectionally at lags 0, 1, and 2 was examined. Consistent with a priori theory, variables were rarely correlated significantly with each other beyond lag 2.

In general, velocity towards a goal at one time point should conceptually have the most pronounced effect on subsequent effort planned for that goal at the same time point, as effects of velocity should be most salient to the participant when planning effort at that time. Additionally, positive affect should have the strongest effect on effort planned, and be most affected by goal velocity, at the same time point. Indeed, analyses using SPSS trends indicated that the most consistently strong patterns of effects were demonstrated at lag 0 as compared to lags 1 and 2. (see Tables 3, 4, and 5). In fact, for 22 of the 24 participants, effects were strongest at the immediately following time period (lag 0). Thus, for all ARIMA and between-group analyses, only those relationships at lag 0 were used.

In ARIMA, serial dependencies can be identified in both the regression parameters (known as autoregression [AR]) and the error terms (moving average [MA]).

The autoregressive term (denoted as *p* in ARIMA) signifies the relationship between the current observation and the previous observations of that same variable. An AR(1) relationship (meaning a value at time *t* is affected by the value at time *t* - 1) is represented in the equation

$$Y_t = aY_{t-1} + e_t$$

where Y_t is the endogenous variable, Y_{t-1} is the endogenous variable at the previous observation, a is an unknown parameter, and e_t is the random disturbance term. The moving average term signifies the effect of previous error terms on current error terms in the model, and an MA(1) relationship is represented in the equation

$$e_t = v_t - d_1 v_{t-1}$$

where e_t is the random disturbance term, v_t is a random effect term, d_1 is the Durbin-Watson d-statistic (which assesses the randomness of the estimated residuals), and v_{t-1} is the random effect term at the previous observation. Previous values of both AR and MA processes are referred to as lags. In the above example, the value at time $t - 1$ is known as lag 1. A value at the same time point is known as lag 0.

Because the time series data must be stationary (i.e., the distributions of the data are not influenced by time) to use ARIMA modeling, analysis involves identifying any serial dependencies in the data and removing them by differencing the series. In statistical terms, differencing involves converting each *i*th element of the series into its difference from the $i - k$th element, with *k* being the observation with which *i* is significantly correlated. In ARIMA, the differencing structural parameter is denoted as *d*. Thus, the complete model is generally referred to as an ARIMA(*p*, *d*, *q*) model, with *p*, *d*,

and *q* being integers greater than or equal to zero. The *p, d,* and *q* integers refer to the autoregressive, differencing, and moving average parts of the model, respectively.

Using ARIMA modeling, tests for the assumptions of time series regression were conducted; that is, the error terms having a mean of zero and containing constant variance across all observations, and those corresponding to different points in time not being correlated (Ostrom, 1990). After testing assumptions, study hypotheses were tested.

The following primary hypotheses were tested: moving closer than expected towards a given goal will result in less effort planned for that goal in the control group and *more* effort planned for that goal in the bipolar I disorder group; for participants in both groups, moving closer than expected towards a given goal will result in more positive affect; increases in positive affect will result in less effort planned for those in the control group and *more* effort planned for those in the bipolar I disorder group (Figure 1).

If the above hypotheses were supported for a given participant, then the hypothesis that the relationship between velocity and subsequent effort was mediated by positive affect would be tested. Per Baron and Kenny's (1986) suggestion, the mediational hypothesis is supported if all three regression equations are statistically significant and the correlation between the dependent variable (subsequent effort) and the independent variable (velocity) is attenuated in the equation with the mediator variable (positive affect) present in the equation.

Between-person analyses were explored to identify what predictors, if any, explained variability between the two groups in the relationships between goal-striving indices and affect, as well as if groups differed on any key variables. Random-intercepts

linear regression analyses were used to examine between-group predictors. These models were used because, unlike linear regression, they do not assume that each observation is independent, but rather allow for a cluster of variables within each person (see Hedeker, Gibbons, and Flay, 1994). *Z*-scores of the relationship between goal velocity and effort planned at that same time point (lag 0) were calculated. These values were termed the "velocity-effort" *Z*-scores.

Chapter 3: Results

Sample Characteristics

In all, 40 people were screened for the study. Two people were not interested in participating in the study. Of the remaining people screened, two were excluded because they did not meet DSM-IV criteria for bipolar I disorder, two were excluded because of substance abuse or dependence within the previous six months, and two were excluded because they met criteria for a current manic or major depressive mood episode. As mentioned above, data were lost for the first three bipolar I disorder participants using Palm Pilots. After switching to paper-and-pencil measures, attrition rates were comparable between groups. Among the bipolar I disorder group, three did not finish the study, while two participants did not complete the study in the control group. There were no differences in demographic information between those who completed the study and those who did not.

Demographic variables are presented in Table 1. Groups did not differ on age, gender, and ethnicity as tested using *t* tests and chi-square analyses. Consistent with previous research in bipolar I disorder (e.g., Hirschfeld, Lewis, & Vornik, 2003), a significantly higher percentage of this group was single or divorced, unemployed, and completed fewer years of formal education than the control group. These group differences were examined as potential confounds in analyses described below.

Preliminary Analyses

Among demographic and clinical variables, less than 1% of the data was missing. Among the experience-sampling variables (i.e., GASS and SPANA), 5.8% (1,744 points out of a possible 30,240 points) of the data was missing. This completion rate was higher

than that reported by previous researchers (see Conner Christensen, Feldman Barrett, Bliss-Moreau, Lebo, & Kaschub, 2003). Because there were no specific patterns identified for the missing data, it was assumed that the data were missing at random.

Several methods for handling missing data exist (see Allison, 2002; Kreindler & Lumsden, 2006; Schafer & Graham, 2002 for reviews). Single imputation based on the Expectation Maximization (EM) algorithm was chosen to handle the missing data. EM involves the repetition of two distinct steps that function to obtain maximum likelihood estimates of the missing data. Step 1 (expectation) involves imputing new values by calculating regression coefficients based on all available data from initial parameter values. Once the missing data have been imputed, parameter estimates are re-calculated (maximization step) and used as the starting values for replications of the two steps for a set number of iterations (or until the estimates begin to converge).

Other traditional (e.g., pairwise deletion, mean substitution, regression imputation) and more complex (e.g., multiple imputation [MI]) methods may not be as appropriate as single imputation EM for the present study. MI simulations take into account the additional error produced by imputation, introducing more variability in the standard error estimates, while single imputation techniques do not. Simple imputation, however, also involves simulation and provides almost identical estimates to MI when very few data are missing (Little & Rubin, 1987), as is the case for the current study. Thus, single imputation was used because it does not involve several (perhaps unnecessary) complications associated with MI. SPSS Missing Values Analysis software was used to carry out this analysis (see Hill, 1997 for a more complete description of this method).

Univariate distributions of the SPANA were inspected for each participant separately. Namely, values of skew and kurtosis were examined. The SPANA positive affect score for one participant was highly positively skewed (4.29) and leptokurtic (19.68). Due to virtually no variance in the participant's scores, however, the skewness and kurtosis (3.82 and 15.03, respectively) were still unacceptable after using a natural logarithmic transformation, and were thus not transformed. SPANA negative affect scores for 10 participants (3 in the bipolar I disorder group, 7 in the control group) were positively skewed and leptokurtic. These scores were transformed by taking their natural logarithm. Again, because of a lack of variability in negative affect among these participants, transformations resulted in acceptable skew and kurtosis values (i.e., less than 2 and 4, respectively) for only 4 of 10 participants. These four participants' data were transformed. The remaining participants' variables had skew and kurtosis values less than the recommended absolute values of 2 and 4, respectively (Kline, 1998). Because SPANA low-energy and high-energy positive affect scores were nearly identical to the overall positive affect scores, only these scores were used in the analyses.

Confound Analyses

Before conducting primary analyses, potential confounds and covariates were sought. In the case of categorical variables, associations were tested using chi-square; relationships between continuous variables were examined using bivariate correlations and their group differences tested using independent *t* tests. The following demographic variables were evaluated to determine if they represented confounds: gender, employment status, marital status, ethnicity, and level of education. Variables had to be significantly associated with both the outcome (i.e., velocity-effort *Z*-scores) and

predictor (group variable) to be considered as confounds. No variables met this criterion. Although those in the bipolar I disorder group did differ from those in the control group on marital status, employment status, and education status, these variables were not significantly associated with outcome. In terms of covariates, female gender was significantly correlated with the velocity-effort *Z*-scores ($r = .47$) but was unrelated to group status. Thus, gender was considered a covariate and was controlled for to increase the power of the test.

The rated importance of each goal was examined to see if it correlated with velocity-effort *Z*-scores. Participants rated 1.63 out of a possible 3 goals as "important" throughout the study ($Mdn = 2.00$). On average, 5 participants rated all 3 of their goals as "important," 5 rated 2 of their goals as "important," and 14 rated only 1 of their goals as "important." In looking at the two groups separately, both rated a median of 2 of their 3 goals, on average, as "important." Using random-intercepts regression analysis, levels of importance were not significantly related to velocity-effort *Z*-scores, and were thus not included in further analyses.

The types of goals participants selected were also examined for their potential relationships with outcome. Goals were divided into five categories: financial ($n = 2$), interpersonal ($n = 13$), health ($n = 28$), and work ($n = 29$). The two groups did not differ in the frequencies of each goal category. In addition, goal categories were not related to velocity-effort *Z*-scores, and were thus also not included in further analyses.

Clinical Variable Analyses

Because clinical variables are conceptually related to bipolar I disorder status, they were not considered as potential confounds. Nonetheless, group differences were

examined for the following variables: subscales of the BIS/BAS, WASSUP, MHRSD, BRMS, MASQ, and total positive and negative affect scores. No BIS/BAS or WASSUP scores were significantly different between the two groups. Given there were only 12 participants in each group, this finding makes sense. As would be expected, scores on both the interview-derived and self-report symptom measures differed significantly (with the exception of the MASQ – Anhedonic Depression subscale; see Table 1). Nonetheless, MHRSD and BRMS scores in both groups were still well below accepted cut-offs for depression and mania, respectively. In addition, ratings of positive affect were significantly higher among those without a history of mood disorder and ratings of negative affect were significantly higher among those in the bipolar I disorder group. After controlling for MHRSD scores, however, these differences in positive and negative affect were no longer significant.

The following clinical variables were significantly correlated with the velocity-effort *Z*-scores. These included MHRSD ($r = .54$), BIS ($r = .32$), BAS – Reward ($r = .28$), WASSUP – Financial ($r = .35$), and WASSUP – Popular fame ($r = .32$). BAS – Fun-seeking, BAS - Drive, other WASSUP subscales, BRMS, MASQ, positive affect, and negative affect variables were unrelated to velocity-effort *Z*-scores.

Because heightened BIS has been shown to overlap with current depression (Kasch, Rottenberg, Arnow, & Gotlib, 2002), regression analysis was used to examine MHRSD and BIS as concurrent predictors of velocity-effort *Z*-scores. After controlling for MHRSD scores, BIS was no longer a significant predictor of velocity-effort *Z*-scores.

Time Series Analyses of Goal-Striving and Affect

ARIMA modeling was then used to test the primary hypotheses. Within each participant, the velocity-effort *Z*-scores were examined. The hypotheses were that, for the bipolar I disorder participants, increased velocity would predict *increases* in subsequent goal effort planned but, for control group participants, increased velocity would predict *decreases* in goal effort planned. As can be seen in Table 3, these relationships varied substantially among different goals. In all, 20 of the possible 35 goals (12 participants x 3 goals, minus one goal that was not assessed because there was no variability in the effort planned variable) assessed in the bipolar I disorder participants showed a significant positive relationship between increases in velocity and effort planned. Among control group participants, only 4 of the possible 36 goals showed this relationship. On the other hand, increased velocity predicted *decreased* effort in 3 goals assessed in the bipolar I disorder participants and 4 goals assessed in the control participants.

The next step involved testing the combined velocity of all three goals as a predictor of overall positive affect within each participant. Because there was only one measure of positive affect at each time point, goal velocity z-scores were summed across the three goals for each individual before being entered as predictors. The hypothesis was that higher goal velocity (moving closer than expected) would predict higher positive affect in both groups. Table 4 shows the ARIMA parameters for each participant. Four of the 12 control participants demonstrated significant increases in positive affect in response to increased goal velocity, while no participants in the bipolar I disorder group displayed a significant increase in positive affect in response to increased goal velocity. Thus, one-third of participants in the control group showed a relationship consistent with

the hypothesis that increases in goal velocity should predict increases in positive affect. There was no consistent evidence that goal velocity significantly predicted positive affect in the bipolar I disorder group.

The relationship between positive affect and effort planned was then examined within participants for each goal. Although consideration was given to using an aggregated effort score across the three goals, the goals were considered separately, in parallel with goal velocity analyses, to facilitate building a full mediational model (see Figure 1). Table 5 displays the results of these analyses. Positive affect predicted significantly more effort planned in 13 of the possible 36 goals in the bipolar I disorder group and 11 of the possible 36 goals in the control group. Positive affect predicted significantly *less* effort planned in only one goal of the control group, and in no goals of the bipolar I disorder group. Thus, about one-third of the goals in the bipolar I disorder group displayed a relationship consistent with the hypothesis that positive affect should predict increases in goal effort planned. Contrary to hypothesis, about one-third of the goals in the control group displayed this same relationship, and only one goal displayed the relationship consistent with the hypothesis that positive affect should predict *less* goal effort planned.

Testing Positive Affect as a Mediator of the Link between Goal Velocity and Effort

The final step in mediational analysis was to introduce positive affect in the time series regression equations for goal velocity predicting goal effort planned. The first three assumptions for mediation had to be met before conducting this analysis. Hypotheses were that those in the control group would show the following relationships: *diminished* goal effort in response to higher goal velocity (Hypothesis 1), increased positive affect in

response to higher goal velocity (Hypothesis 2), and diminished goal effort in response to increased positive affect (Hypothesis 3). Participants in the bipolar I disorder group were hypothesized to demonstrate *increased* goal effort in response to higher goal velocity (Hypothesis 1), increased positive affect in response to higher goal velocity (Hypothesis 2), and *increased* goal effort in response to increased positive affect (Hypothesis 3). Hence positive affect was only tested as a mediator for persons who demonstrated significant effects in the hypothesized directions for all three direct paths (see Figure 1). Hypotheses 1 and 3 were tested separately for each goal within each person. Because affect was measured in relation to all 3 goals combined, Hypothesis 2 was measured across goals for each person. For the bipolar I disorder group, Hypotheses 1 was supported in 20 of the possible 35 goals and Hypothesis 3 was supported in 12 of the possible 35 goals. Hypothesis 2 was not supported by any participants. For the control group, 4 of the possible 36 goals supported Hypothesis 1, 4 of 12 participants supported Hypothesis 2, and 1 of the possible 36 goals supported Hypothesis 3. In sum, no participants in the study displayed significant relationships for all three regressions tested. Thus, beyond the first three steps of mediation, no model was supported.

Between-Person Analyses of Goal-Striving

Further analyses were conducted to examine whether bipolar I disorder and control participants differed in time series relationships. To do so, *Z*-scores representing the time-series correlations for each individual were used as dependent variables in *t*-tests. First, *Z*-scores for the effect of positive affect on effort planned for each goal were calculated. *Z*-scores for bipolar I disorder and control participants did not differ significantly (bipolar I disorder group mean *Z*-score = 1.16, control group mean *Z*-score =

1.41, $t(69) = .50$, $p = .62$), meaning positive affect had the same effect on effort planned for both groups.

Next, group differences in the *Z*-scores (aggregated across the three goals) of the effects of goal velocity on effort planned were examined for each participant. The mean velocity-effort *Z*-score for the control group ($M = .47$, $SD = 2.28$) was significantly lower than that of the bipolar I disorder group ($M = 2.28$, $SD = 3.52$; $t(69) = -2.58$, $p < .05$). That is, the mean degree of anti-coasting in the bipolar I disorder group was significantly higher than in the control group. Evidence of anti-coasting was twice as common in those with bipolar I disorder than those without a history of mood disorder (83% versus 42% of the goals in each group, respectively, demonstrated a mean *Z*-score that was significantly positive).

The above analyses, though, fail to account for two issues. First, there was significant heterogeneity in *Z*-scores across goals. Second, gender was correlated with velocity-effort *Z*-scores. To address these issues, random-effects regression models were then used to examine gender, group status, and their interaction as predictors of the velocity-effort *Z*-scores. In this analysis, the three goals were clustered within persons. Results indicated that bipolar I disorder status significantly predicted velocity-effort *Z*-scores (see Table 6). That is, those in the bipolar I disorder group were significantly more likely than those in the control group to plan *increases* in effort in response to moving closer to a goal than expected. In addition, although the relationship between gender and the velocity-effort *Z*-scores only approached significance ($p = .05$), the interaction between group status and gender was highly significant. To partition these effects, post-hoc analyses were conducted using the velocity-effort *Z*-scores by group and gender. In

the control group, velocity-effort *Z*-scores were comparable between women ($M = .37$) and men ($M = .54$, $t(34) = .21$, $p = .83$). In the bipolar I disorder group, however, women were significantly more likely to anti-coast than men (mean *Z*-scores were 3.65 and -1.67, respectively, $t(33) = -5.19$, $p < .001$). In addition, women in the bipolar I disorder group were significantly more likely to anti-coast than women in the control group, $t(45) = -4.14$, $p < .001$. What is more, men were more likely to coast in the bipolar I disorder group than were men in the control group, $t(22) = 2.09$, $p < .05$ (Figure 2).

Chapter 4: Discussion

The current study is one of the first to examine goal dysregulation in bipolar I disorder using experience-sampling methodology. Data collection for this study involved up to 63 observations for each participant, yielding over 1,500 observations (and over 30,000 data points) in all. The current study included a carefully defined sample of persons with bipolar I disorder in a euthymic state—without comorbid substance abuse or psychosis outside of mood episodes—providing some of the first naturalistic data on the daily course of goal-striving and affect among those with bipolar I disorder in remission. In addition, these are among the first naturalistic findings of Carver's (2003) theory of coasting.

Primary Findings

In regards to affect, findings did not support hypotheses. For most people, increases in positive affect were not predicted by increases in goal velocity, nor did increases in positive affect predict changes in effort planned. In fact, increases in goal velocity predicted significantly *less* positive affect in some cases. There was also little evidence that positive affect differentially influenced planned effort for people with and without bipolar I disorder. Hence, the model of positive affect as a mediator of coasting effects was not supported. Possible methodological explanations are discussed below.

Beyond examining the role of affect, a core goal of the current study was to examine the role of goal velocity as a predictor of subsequent effort. One of the major findings was that anti-coasting was significantly more common in those with bipolar I disorder than those without a history of mood disorder. That is, consistent with hypotheses, between-group analyses revealed those with bipolar I disorder were more

likely to plan an *increase* in effort towards a goal in response to moving closer than expected towards that goal. These findings, however, were specific to women: women in the bipolar I disorder group were significantly more likely than women in the control group to anti-coast, and men in the bipolar I disorder group did not show signs of anti-coasting. In fact, men in the bipolar I disorder group were more likely to coast than men in the control group. This finding was contrary to the hypothesis that all participants should be more likely to anti-coast in the bipolar I disorder group than in the control group. Anti-coasting in bipolar I disorder, then, could be a gender-specific phenomenon, with women showing evidence and men not. Speculatively, women in general may place more emphasis on sub-goals, or goals required to achieve larger, more abstract goals, than men, which may influence goal-striving behaviors. This, however, does not explain why women in the control group did not show significant signs of anti-coasting.

Beyond examining a model of group differences in coasting, further analyses were conducted to determine whether key variables that have been previously found to correlate with bipolar I disorder (Johnson & Carver, 2006; Johnson, Eisner, & Carver, 2008) could help explain the pattern of anti-coasting. More specifically, a set of variables that have been previously related to bipolar I disorder were examined as potential predictors of anti-coasting. These included the Reward Responsiveness subscale of the Behavioral Activation Scale, the Financial Ambitions and Popular Fame subscales of the Willingly Approached Set of Statistically Unlikely Pursuits scale, the Behavioral Inhibition Scale, and the Modified Hamilton Rating Scale for Depression. Reward responsiveness and heightened financial and popular fame ambitions were significantly positively related to anti-coasting. These variables, though intriguing, were not

significantly related to group or gender, so could not account for the basic effects observed. Rather, it appears that people who are highly reward responsive and those with heightened life ambitions tend to engage in intensified goal pursuit in the face of an early success. An important avenue for future research will be to examine how this form of goal regulation might operate among highly ambitious populations that are not prone to mania.

Interestingly, levels of current depressive symptoms (MHRSD) predicted more anti-coasting. This finding is hard to understand, given depression has been shown to be related to less goal pursuit in many studies (cf. Martin & Tesser, 1996). A possible explanation for this finding, though, is that people with bipolar I disorder who are experiencing current symptoms of depression may feel the need to ramp up their goal effort in hopes of relieving these symptoms, consistent with the "manic defense" theory (Lyon, Startup, & Bentall, 1999). In addition, it is possible that those experiencing symptoms of depression may interpret increases in velocity towards goals as a sign that their symptoms are improving, and thus feel the desire to increase effort towards these goals to continue feeling better or make up for lost time.

Limitations

A major limitation of the current study was related to the measure of affect used. For one, affect was measured globally (e.g., "How happy are you feeling at this moment?") rather than in reference to specific goals. Affect ratings were unrelated to key indices of goal-striving and likely reflected not just goal progress, but life events and other variables. Although there was an item on the SPANA designed to assess significant life events, this item was rarely endorsed. As easing back, or coasting, from a given goal

should be specific to the goal in which one is doing better than expected (Carver, 2003), it thus makes sense that affect was unrelated to aggregated velocity toward the goals. It would have been preferable to assess each participant's affect in terms of its specific relation to each goal. This assessment, however, did not seem feasible in the current design. In addition, given that previous laboratory studies have shown that positive affect influences goal engagement (cf. Carver, 2003), it is possible that the failure to support hypotheses related to affect is related to issues in the naturalistic measurement of affect. Lastly, there should be differential relationships between coasting and high versus low arousal positive affect. That is, coasting should be associated more with low arousal (e.g., content) than high arousal (e.g., excited) positive affect. There were not enough adjectives for low arousal positive affect to examine differences in how these different affects might relate to outcomes in the current study. In sum, more research is needed on the role of affect and coasting.

Another limitation of the current study involves the use of paper-and-pencil measures. Initially, Palm Pilots were used, but these proved unfeasible for participants in the current study, primarily because they had little exposure to this technology. Hence, it is uncertain whether data were completed in a timely fashion (Feldman Barrett & Barrett, 2001). Also, there may have been differences in the accuracy of reporting across participants. Nonetheless, participants were reminded to complete the questionnaires twice each week by phone and reminded at each assessment point by alarms.

Reactivity effects may be important to consider as well. It is well established that one of the most effective types of behavioral intervention is self-monitoring (Febbaro & Clum, 1998; O'Hara, & Rehm, 1979). What is more, many participants in the current

study spontaneously reported that they found that daily mood and goal monitoring might be a good treatment intervention. Thus, participation in the study itself may have unduly influenced participant goal-striving behaviors. To minimize the effects of study participation on these behaviors, though, participants were encouraged to focus on goals towards which they were already striving.

The samples in the current study were not well-matched: those in the bipolar I disorder group were more likely to be single or divorced, unemployed, and not college graduates. Most importantly, participants in the bipolar I disorder group were all taking mood stabilizing medication. Numbers of previous manic or depressive episodes and number of psychotropic medications, however, were unrelated to goal-striving indices.

Conceptually, there is another limitation of the findings among women. Menstrual phase was not recorded among female participants in the current study. Recent research has shown that women may be more sensitive to reward during the midfollicular phase of their menstrual cycle than during the luteal phase (Dreher et al., 2007). This heightened reward sensitivity may contribute to increased goal-striving behaviors among women in this menstrual phase, and thus presents a potential limitation to the current study.

Another conceptual issue is that there was tremendous heterogeneity in the levels of coasting or anti-coasting for the different goals assessed. That is, there were several instances, in both groups, where participants would generally coast on one or two goals and anti-coast on another, or vice versa. Goal importance did not appear to explain this heterogeneity. Analyses examined an aggregated *Z*-score for each individual, as a way of determining whether effects were significant across goal

Although analyses focused on lag 0, it is important to note that there was also considerable heterogeneity both within and across individuals in how the time course of effects operated. Differences would also occur between lags, where, for example, a person may coast on a goal at lag 0, anti-coast at lag 1, and then coast again at lag 2. For 22 of the 24 participants, effects were strongest at the immediately following time period (lag 0), but there was variability in whether effects were sustained and consistent across longer lag time periods. Hence, there is a gap in our basic understanding of how individuals respond to different forms of goals, and for how long.

Future Directions and Clinical Implications

Findings from the current study are generally consistent with previous research suggesting that responses to goal progress may differ for people with bipolar I disorder as compared to those without a history of mood disorder. Several studies suggest that manic symptoms increase after life events involving goal attainment, among students with a bipolar spectrum disorder (Nusslock, Abramson, Harmon-Jones, Alloy, & Hogan, 2007) and persons with bipolar I disorder (Johnson, Sandrow, et al., 2000; Johnson et al., in press). A key question, though, has been What mechanisms might drive these effects? One lab study indicated that college students at risk for mania became engaged in higher goal setting in response to success (Johnson, Ruggero, & Carver, 2003). Thus, internal mechanisms (e.g., the behavioral activation system) may respond to external positive feedback by increasing effort towards goals.

Like these studies, the current study provides evidence of the relationship between making progress on life goals and subsequently increasing effort towards these goals

among those with bipolar I disorder. Yet this is the first study examining the real-time effects of goal velocity on subsequent goal-striving in bipolar I disorder.

The finding that those with bipolar I disorder are more likely than those without a history of mood disorder to anti-coast is potentially important for several reasons. First, previous findings indicate that goal striving predicts increases in manic symptoms (Lozano & Johnson, 2001). Indeed, increased goal-directed activity is a one of the formal diagnostic criteria for mania. Thus, anti-coasting may be a warning sign for those with bipolar I disorder to regulate their goal-striving behaviors. It is of great interest that some participants without a history of mood disorder also exhibited signs of anti-coasting. A possible explanation for this finding is that those without a history of mood disorder may exhibit goal-striving behaviors similar to those with a history of mania, but that these behaviors are not severe enough to lead to full-blown manic episodes. Identifying the mechanisms that differentiate healthy versus non-healthy anti-coasting behaviors will be critical to understanding the role of these phenomena in mania. Even within the bipolar disorder population, anti-coasting may sometimes contribute to functional outcomes. For example, evidence of anti-coasting may help explain findings of increased achievement-striving among those with bipolar disorder and their family members (Akiskal, Hirschfeld, & Yerevanian, 1983; Coryell et al., 1989).

Although findings are promising, there are several ways in which researchers can more carefully examine goal-striving and affect in bipolar disorder. Future studies could benefit from more refined measurements of affect. For example, designing measures that assess affect specific to a given goal would allow one to more carefully examine the role of affect in coasting and anti-coasting. Because affect was assessed generally in the

current study, it was impossible to measure the relationship between goal progress and affect related directly to that progress.

More broadly, studies should be conducted to examine goal-striving and affect as people go through major, naturalistically occurring successes (e.g., college graduation, achieving career goals, getting married). It would be interesting to see what happens once a major life goal is attained. Data obtained from tracking responses to life events involving goals that are more tied to self-concept would be invaluable in understanding how coasting and anti-coasting work in a more naturalistic way, as these events should have the strongest influence on goal engagement.

Despite the need for more careful research, the current findings may suggest some important clinical implications. Findings provide further evidence of goal dysregulation in bipolar I disorder, and that this phenomenon can be documented outside of a lab setting. The finding that those without a history of mood disorder also anti-coast could aid researchers in designing studies to help understand why these behaviors do not spin out of control for healthy persons. Finally, it will be important to determine if gender differences observed here replicate in other samples. If so, different models of goal dysregulation in bipolar I disorder may apply for men as compared to women. The current study helps contribute to moving lab findings into real world settings, potentially creating a bridge towards the development of treatments focused on goal dysregulation in bipolar I disorder (e.g., Johnson & Fulford, in press).

References

Akiskal, H. S., Hirschfeld, R. M. A., & Yerevanian, B. I. (1983). The relationship of personality to affective disorders, *Archives of General Psychiatry, 40*, 801–810.

Alliger, G. M., & Williams, K. J. (1993). Using signal-contingent experience sampling methodology to study work in the field: A discussion and illustration examining task perceptions and mood. *Personnel Psychology, 46*(3), 525-549.

Allison, P. D. (2002). Missing Data. *Sage University Paper Series on Quantitative Applications in the Social Sciences, 136*. Newbury Park, CA: Sage.

Alloy, L. B., Abramson, L. Y., Walshaw, P. D., Cogswell, A., Smith, J. M., Neeren, A. M. et al. (2006). Behavioral Approach System (BAS) sensitivity and bipolar spectrum disorders: A retrospective and concurrent behavioral high-risk design. *Motivation and Emotion, 30*, 143-155.

American Psychiatric Association (1994). Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: Author.

Austin, J. T., & Vancouver, J. B. (1996). Goal constructs in psychology: Structure, process, and content. *Psychological Bulletin, 120*(3), 338-375.

Averill, J. R., Clore, G. L., LeDoux, J. E., Panksepp, J., Watson, D., Clark, L. A., Ekman, P., & Davidson, R. J. (1994). What influences the subjective experience of emotion? In P. Eckman & R. J. Davidson (Eds.), *The Nature of Emotion: Fundamental Questions* (pp. 377-407). New York, NY: Oxford University Press.

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Bech, P. (2002). The Bech-Rafaelsen Mania Scale in clinical trials of therapies for bipolar disorder: A 20-year review of its use as an outcome measure. *CNS Drugs, 16*(1), 47-63.

Bech, P., Bolwig, T. G., Kramp, P., & Rafaelsen, O. J (1979). The Bech-Rafaelsen Mania Scale and the Hamilton Depression Scale: Evaluation of homogeneity and inter-observer reliability. *Acta Psychiatrica Scandinavica, 59*(4), 420-430.

Blackwood, D. H. R., He, L., Morris, S. W., McLean, A., Whitton, C., Thomson, M. et al. (1996). A locus for bipolar affective disorder on chromosome 4p. *Nature Genetics, 12*, 427-430.

Box, G. E. P., & Jenkins, G. M. (1976). *Time Series Analysis: Forecasting and Control* (rev. ed.). Oakland, CA: Holden-Day.

Bozarth, M.A. (1991). The mesolimbic dopamine system as a model reward system. In P. Willner and J. Scheel-Kruger (eds.), *The Mesolimbic Dopamine System: From Motivation to Action* (pp. 301-330). London: John Wiley & Sons.

Butzlaff, R. L., & Hooley, J. M. (1998). Expressed emotion and psychiatric relapse: a meta-analysis. *Archives of General Psychiatry, 55,* 547–552.

Carver, C. S. (2003). Pleasure as a sign you can attend to something else: Placing positive feelings within a general model of affect. *Cognition and Emotion, 17*(2), 241-261.

Carver, C. S., Lawrence, J. W., & Scheier, M. F. (1996). A control-process perspective on the origins of affect. In L. L. Martin & A. Tesser (Eds.), *Striving and Feeling: Interactions among Goals, Affect, and Self-regulation.* (pp. 11-52). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. *Journal of Personality and Social Psychology, 67*(2), 319-333.

Carver, C. S. & Scheier, M. F. (1998). On the self-regulation of behavior. New York, NY: Cambridge University Press (439 pp.).

Cohen, A. N., Hammen, C., Henry, R. M., & Daley, S. E. (2004). Effects of stress and social support on recurrence in bipolar disorder. *Journal of Affective Disorders, 82*(1), 143-147.

Conner Christensen, T., Feldman Barrett, L., Bliss-Moreau, E., Lebo, K., & Kaschub, C. (2003). A practical guide to experience-sampling procedures. *Journal of Happiness Studies, 4,* 53-78.

Coryell, W., Endicott, J., Keller, M., Andreasen, N., Grove, W., Hirschfeld, R. M. A. et al. (1989). Bipolar affective disorder and high achievement: A familial association, *American Journal of Psychiatry 146*, 983–988.

Depue, R. A., & Iacono, W. G. (1989). Neurobehavioral aspects of affective disorders. *Annual Review of Psychology, 40,* 457-492.

Depue, R. A., Krauss, S., Spoont, M. R., & Arbisi, D. (1989). General Behavior Inventory identification of unipolar and bipolar conditions in a non-clinical university population. *Journal of Abnormal Psychology, 98*(2), 117-126.

Depue, R.A. & Zald, D.H. (1993). Biological and environmental processes in nonpyschotic psychopathology: A neurobiological perspective. In C.G. Costello (ed.), *Basic Issues in Psychopathology* (pp. 127-237). New York: Guilford Press.

Dreher, J., Schmidt, P. J., Kohn, P., Furman, D., Rubinow, D., & Berman, K. F. (2007). Menstrual cycle phase modulates reward-related neural function in women. *Proceedings of the National Academy of Sciences of the United States of America, 104*(7), 2465-2470.

Dreisbach, G., & Goschke, T. (2004). How positive affect modulates cognitive control: Reduced perseveration at the cost of increased distractibility. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30*(2), 343-353.

Eisner, L. E., Johnson, S. L., & Carver, C. S. (2008). Cognitive responses to failure and success relate uniquely to bipolar depression versus mania. *Journal of Abnormal Psychology, 117*(1), 154-163.

Ekman, P., & Davidson, R. J. (Eds.). (1994). *The nature of emotion: Fundamental questions* (xiv ed.). New York, NY, US: Oxford University Press.

Elliot, A. J., & Thrash, T. M. (2002). Approach-avoidance motivation in personality: Approach and avoidance temperaments and goals. *Journal of Personality and Social Psychology, 82*(5), 804-818.

Ewald, H., Flint, T., Kruse, T. A., & Mors, 0. (2002). A genome-wide scan shows significant linkage between bipolar disorder and chromosome 12q24.3 and suggestive linkage to chromosomes 1p22-21, 4p16, 6q14-22, 10q26 and 16p13.3. *Molecular Psychiatry, 7*(7), 734-744.

Febbaro, G. A. R., & Clum, G. A. (1998). Meta-analytic investigation of the effectiveness of self-regulatory components in the treatment of adult problem behaviors. *Clinical Psychology Review, 18*(2), 143-161.

Feldman Barrett, L. & Barrett, D. J. (2001). An introduction to computerized experience sampling in psychology. *Social Science Computer Review, 19*(2), 175-185

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. (1996). Structured Clinical Interview for DSM-IV Axis I Disorders - Patient Edition (SCID-I/P, Version 2.0). New York: Biometrics Research Department, New York State Psychiatric Institute.

Fowles, D. C. (1988). Psychophysiology and psychopathology: A motivational approach. *Psychophysiology, 25*(4), 373-391.

Fowles, D. C. (1980). The three arousal model: Implications of gray's two-factor learning theory for heart rate, electrodermal activity, and psychopathy. *Psychophysiology, 17*(2), 87-104.

Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion, 19*(3), 313-332.

Gauggel, S., & Hoop, M. (2004). Goal-setting as a motivational technique for neurorehabilitation. In W. M. Cox & E. Klinger (Eds.), *Handbook of motivational counseling: Concepts, approaches, and assessment* (pp. 439-455). New York, NY, US: John Wiley and Sons Ltd.

Geddes, J. R., Burgess, S., Hawton, K., Jamison, K., & Goodwin, G. M. (2004). Long-term lithium therapy for bipolar disorder: Systematic review and meta-analysis of randomized controlled trials. *American Journal of Psychiatry, 161*(2), 217-222.

Gerner, R. H., Post, R. M., & Bunney, W. E. (1976). A dopaminergic mechanism in mania. *American Journal of Psychiatry, 133*(10), 1177-1180.

Gianfrancesco, F. D., Wang, R. H., & Yu, E. (2005). Effects of patients with bipolar, schizophrenic, and major depressive disorders on the mental and other healthcare expenses of family members. *Social Science and Medicine, 61*(2), 305-311.

Gitlin, M., Swendsen, J., Heller, T. L., & Hammen, C. (1995). Relapse and impairment in bipolar disorder. *American Journal of Psychiatry, 152*(11), 1635-1640.

Gray, J. A. (1987). Perspectives on anxiety and impulsivity: A commentary. *Journal of Research in.Personality, 21*(4), 493-509.

Gray, J. A. (1978). The neuropsychology of anxiety. *British Journal of Psychology, 69*(4), 417-434.

Gruber, J., Johnson, S. L., Oveis, C., & Keltner, D. (2008). Risk for mania and positive emotional responding: Too much of a good thing? *Emotion, 8*(1), 23-33.

Harrow, M., Goldberg, J. F., Grossman, L. S., & Meltzer, H. Y. (1990) Outcome in manic disorders: A naturalistic follow-up study. *Archives of General Psychiatry, 47*(7), 665-671.

Hayden, E. P., Bodkins, M., Brenner, C., Shekhar, A., Nurnberger Jr., J. I., O'Donnell, B. et al. (2008). A multimethod investigation of the Behavioral Activation System in bipolar disorder. *Journal of Abnormal Psychology, 117*(1), 164-170.

Hedeker, D., Gibbons, R. D., & Flay, B. R. (1992). Random-effects regression models for clustered data with an example from smoking prevention research. *Journal of Consulting and Clinical Psychology, 62*(4), 757-765.

Hestenes, D. (1992). A neural network theory of manic-depressive illness. In D.S. Levine, S. J. Leven, J. Samuel, et al. (Eds.) *Motivation, emotion, and goal direction in neural networks* (pp. 209-257). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Hill, M. A. (1997). *SPSS Missing Value Analysis 7.5.* SPSS Inc.

Hirschfeld, R. M. A., Lewis, L., & Vornik, L. A. (2003). Perceptions and impact of bipolar disorder: How far have we really come? Results of the National Depressive and Manic-Depressive Association 2000 survey of individuals with bipolar disorder. *Journal of Clinical Psychiatry, 64*, 161-174.

Hsee, C. K. & Abelson, R. P. (1991) Velocity relation: Satisfaction as a function of the first derivative of outcome over time. *Journal of Personality and Social Psychology, 60*(3), 341-347.

Johnson, S. L. & Carver, C. S. (2006). Extreme goal-setting and vulnerability to mania among undiagnosed young adults. *Cognitive Therapy and Research, 30*(3), 377-395.

Johnson, S. L., Kizer, A., Ruggero, C., Perlman, C., Goodnick, P., & Miller, I. (in press). Negative and goal-attainment life events: Predicting the course of mania and depression. *Journal of Abnormal Psychology*.

Johnson, S. L., & Fulford, D. (in press). Preventing mania: A preliminary examination of the GOALS program. *Behavior Therapy*.

Johnson, S. L., Meyer, B., Winett, C. A., & Small, J. (2000). Social support and self-esteem predict changes in bipolar depression but not mania. *Journal of Affective Disorders, 58*(1), 79-86.

Johnson, S. L. & Miller, I. (1997). Negative life events and time to recovery from episodes of bipolar disorder. *Journal of Abnormal Psychology, 106*(3), 449-457.

Johnson, S. L., Ruggero, C. J., & Carver, C. S. (2005). Cognitive, behavioral, and affective responses to reward: Links with hypomanic symptoms. *Journal of Social and Clinical Psychology, 24*(6), 894-906.

Johnson, S. L. & Ruggero, C. J. (under review). Self-esteem and bipolar disorder.

Johnson, S. L., Sandrow, D., Meyer, B., Winters, R., Miller, I., Solomon, D., & Keitner, G. (2000). Increases in manic symptoms after life events involving goal attainment. *Journal of Abnormal Psychology, 109*(4), 721-727.

Johnson, S. L., Turner, R. J., & Iwata, N. (2003). BIS/BAS levels and psychiatric disorder: An epidemiological study. *Journal of Psychopathology and Behavioral Assessment, 25*(1), 25-36.

Johnson, S. L., Winett, C. A., Meyer, B., Greenhouse, W. J., & Miller, I. (1999). Social support and the course of bipolar disorder. *Journal of Abnormal Psychology, 108*(4), 558-566.

Kasch, K. L., Rottenberg, J., Arnow, B. A., & Gotlib, I. H. (2002). Behavioral Activation and Inhibition Systems and the severity and course of depression. *Journal of Abnormal Psychology, 111*(4), 589-597.

Ketter, T. A., Winsberg, M. E., DeGolia, S. G., Dunai, M., Tate, D. L., & Strong, C. M. (1998). Rapid efficacy of olanzapine augmentation in nonpsychotic bipolar mixed states. *Journal of Clinical Psychiatry, 59*(2), 83-85.

Kline, R. B. (1998). *Principles and practice of structural equation modeling*. New York: Guilford.

Knoth, R. L., Chen, K., & Tafesse, E. (2004). Costs associated with the treatment of patients with bipolar disorder in a managed care organization. *Psychiatric Services, 55*(12), 1353.

Kreindler, D. M. & Lumsden, C. J. (2006). The effects of the irregular sample and missing data in time series analysis. *Nonlinear Dynamics, Psychology, and Life Sciences, 10*(2), 187-214.

Kupfer, D. J. (2005). The increasing medical burden in bipolar disorder. *JAMA: Journal of the American Medical Association, 293*(20), 2528-2530.

Lam, D., Wright, K., & Sham, P. (2005). Sense of hyper-positive self and response to cognitive therapy in bipolar disorder. *Psychological Medicine, 35*(1), 69-77.

Lawrence, J. W., Carver, C. S., & Scheier, M. F. (2002). Velocity toward goal attainment in immediate experience as a determinant of affect. *Journal of Applied Social Psychology, 32*(4), 788-802.

Leahy, R.L. (1999). Decision making and mania. *Journal of Cognitive Psychotherapy, 13*(2), 83-105.

Leahy, R.L. (2000). Mood and decision-making: Implications for bipolar disorder. *Behavior Therapist*, *23*(3), 62-63.

Li, T., Liu, X., Sham, P. C., Aitchison, K. J., Cai, G., & Arranz, M. J. et al. (1999). Association analysis between dopamine receptor genes and bipolar affective disorder. *Psychiatry Research, 86*(3), 193-201.

Little, R .J .A. & Rubin, D.B. (1987) *Statistical Analysis with Missing Data*. J. Wiley & Sons, New York.

Lozano, B. E. & Johnson, S. L. (2001). Can personality traits predict increases in manic and depressive symptoms? *Journal of Affective Disorders, 63*(1-3), 103-111.

Lyon, H. M., Startup, M., & Bentall, R. P. (1999). Social cognition and the manic defense: Attributions, selective attention, and self-schema in bipolar affective disorder. *Journal of Abnormal Psychology, 108*(2), 273-282.

Martin, L. L. & Tesser, A. (1996). *Striving and feeling: Interactions among goals, affect, and self-regulation*. Hillsdale, NJ: Lawrence A. Erlbaum Associates.

Matza, L., de Lissovoy, G., Sasane, R., Pesa, J., & Mauskopf, J. (2004). The impact of bipolar disorder on work loss. *Drug Benefit Trends, 16*(9), 476-481.

McDowall, D., McCleary, R., Meidinger, E. E., & Hay, R. A., Jr. (1980). *Applied Time Series Analysis for the Social Sciences*. Beverly Hills, CA: Sage.

Mendlewicz, J. & Rainer, J. D. (1977) Adoption study supporting genetic transmission in manic-depressive illness. *Nature, 268*(5618), 327-329.

Merikangas, K. R., Akiskal, H. S., Angst, J., Greenberg, P. E., Hirschfeld, R. M. A, Petukhova, M., et al. (2007). Lifetime and 12-month prevalence of bipolar spectrum disorder in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 64*(5), 543-552.

Meyer, B., Beevers, C. G., Johnson, S. L., & Simmons, E. (2007). Unique association of approach motivation and mania vulnerability. *Cognition and Emotion, 21*(8), 1647-1668.

Meyer, B., Johnson, S. L., & Carver, C. S. (1999). Exploring behavioral activation and inhibition sensitivities among college students at risk for bipolar spectrum symptomatology. *Journal of Psychopathology and Behavioral Assessment, 21*(4), 275-292.

Meyer, B., Johnson, S. L., & Winters, R. (2001). Responsiveness to threat and incentive in bipolar disorder: Relations of the BIS/BAS scales with symptoms. *Journal of Psychopathology and Behavioral Assessment, 23*(3), 133-143.

Miklowitz, D. J., Goldstein, M. J., Nuechterlein, K. H., Snyder, K. S. & Mintz, J. (1988). Family factors and the course of bipolar affective disorder. *Archives of General Psychiatry, 45*(3), 225-231.

Miklowitz, D. J., Wisniewski, S. R., Miyahara, S., Otto, M. W., & Sachs, G. S. (2005). Perceived criticism from family members as a predictor of the one-year course of bipolar disorder. *Psychiatry Research, 136*(2-3), 101-111.

Millar, A., Espie, C. A., & Scott, J. (2004). The sleep of remitted bipolar outpatients: A controlled naturalistic study using actigraphy. *Journal of Affective Disorders, 80*(2-3), 145-153.

Miller, I. W., Bishop, S. B., Norman, W. H., & Maddever, H. (1985). The Modified Hamilton Rating Scale for Depression: Reliability and validity. *Psychiatry Research, 14*(2), 131-142.

Miller, G. A., Galanter, E., & Pribram, K. H. (1960). *Plans and the Structure of Behavior* (222 pp.). New York, NY: Henry Holt and Co., Inc.

Miller, I. W., Uebelacker, L. A., Keitner, G. I., Ryan, C. E., & Solomon, D. A. (2004). Longitudinal course of bipolar I disorder. *Comprehensive Psychiatry, 45*(6), 431-440.

Morissette, J., Villeneuve, A., Bordeleau, L., Rochette, D., Laberge, C., Gagne, B., et al. (1999). Genome-wide search for linkage of bipolar affective disorders in a very large pedigree derived from a homogeneous population in Quebec points to a locus of major effect on chromosome 12q23-q24. *American Journal of Medical Genetics, 88*(5), 567-587.

Nusslock, R., Abramson, L. Y., Harmon-Jones, E., Alloy, L. B., & Hogan, M. E. (2007). A goal-striving life event and the onset of hypomanic and depressive episodes and symptoms: Perspective from the Behavioral Approach System (BAS) dysregulation theory. *Journal of Abnormal Psychology, 116*(1), 105-115.

O'Connell, R. A., Mayo, J. A., Flatow, L., Cuthbertson, B., & O'Brien, J. D. (1991). Outcome of bipolar disorder on long-term treatment with lithium. *British Journal of Psychiatry, 159*, 123-129.

O'Croinin, F., Zibin, T., & Byrne, A. (1994). Life events and relapse in bipolar disorder. *British Journal of Psychiatry, 164*, 417.

O'Hara, M. W., & Rehm, L. P. (1979). Self-Monitoring, activity levels, and mood in the development and maintenance of depression. *Journal of Abnormal Psychology. 88*(4), 450-453.

Ostrom, C. W., Jr. (1990). Time series analysis: regression techniques. *Sage University Paper Series on Quantitative Applications in the Social Sciences, 9*. Newbury Park, CA: Sage.

Pizzagalli, D. A., Sherwood, R. J., Henriques, J. B., & Davidson, R. J. (2005). Frontal brain asymmetry and reward responsiveness. A source-localization study. *Psychological Science, 16*(10), 805-813.

Post, R. M. (2005). The impact of bipolar depression. *Journal of Clinical Psychiatry, 66(Suppl5),* 5-10.

Salavert, J., Caseras, X., Torrubia, R., Furest, S., Arranz, B., Duenas, R. et al. (2007). The functioning of the Behavioral Activation and Inhibition Systems in bipolar I euthymic patients and its influence in subsequent episodes over an eighteen-month period. *Personality and Individual Differences, 42*, 1323-1331.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7*(2), 147-177.

Serretti, A., Mandelli, L., Lattuada, E., Cusin, C., & Smeraldi, E. (2002). Clinical and demographic features of mood disorder subtypes. *Psychiatry Research, 112*(3), 195-210.

Shah, J. (2003). Automatic for the people: How representations of significant others implicitly affect goal pursuit. *Journal of Personality and Social Psychology, 84*(4), 661-681.

Shih, R. A., Belmonte, P. L., & Zandi, P. P. (2004). A review of the evidence from family, twin and adoption studies for a genetic contribution to adult psychiatric disorders. *International Review of Psychiatry, 16*(4), 260-283.

Spitzer, R. L., Williams, J. B., Gibbon, M., & First, M. B. (1992). The Structured Clinical Interview for DSM-III-R (SCID): I. History, rationale, and description. *Archives of General Psychiatry, 49*(8), 624-629.

Stellar, J.R. & Stellar, E. (1985). *The Neurobiology of Motivation and Reward*. New York: Springer-Verlag.

Stone, A. A., Kessler, R. C., & Haythornthwaite, J. A. (1991). Measuring daily events and experiences: Decisions for the researcher. *Journal of Personality, 59*(3), 575-607.

Swerdlow, N. R., & Koob, G. F. (1987). Dopamine, schizophrenia, mania, and depression: Toward a unified hypothesis of cortico-striato-pallido-thalamic function. *Behavioral and Brain Sciences, 10*, 197-245.

Trehub, A. (1991). *The Cognitive Brain* (329 pp.). Cambridge, MA: The MIT Press.

Vallacher, R. R., & Kaufman, J. (1996). Dynamics of action identification: Volatility and structure in the mental representation of behavior. In Gollwitzer, Peter M (Ed), & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behavior* (pp. 260-282). New York, NY, US: Guilford Press.

Watson, D. & Clark, L. A. (1991). *The Mood and Anxiety Symptom Questionnaire*. Unpublished manuscript, University of Iowa, Department of Psychology, Iowa City.

Watson, D., Weber, K., Assenheimer, J. S., Clark, L. A., Strauss, M. E., & McCormick, R. A. (1995). Testing a tripartite model: I. Evaluating the convergent and discriminant validity of anxiety and depression symptom scales. *Journal of Abnormal Psychology, 104*(1), 3-14.

Wender, P. H., Kety, S. S., Rosenthal, D., Schulsinger, F., Ortmann, J., & Lunde, I. (1986). Psychiatric disorders in the biological and adoptive families of adopted individuals with affective disorders. *Archives of General Psychiatry, 43*(10), 923-929.

West, S. G. & Hepworth, J. T. (1991). Statistical issues in the study of temporal data: Daily experiences. *Journal of Personality, 59*(3), 609-662.

Williams, J. B., Gibbon, M., First, M. B., Spitzer, R. L., Davies, M., Borus, J., et al. (1992). The Structured Clinical Interview for DSM-III-R (SCID). II. Multisite test-retest reliability. *Archives of General Psychiatry, 49*(8), 630-636.

Winokur, G., Tsuang, M. T., & Crowe, R. R. (1982). The Iowa 500: Affective disorder in relatives of manic and depressed patients. *American Journal of Psychiatry, 139*(2), 209-212.

Winters, R., Johnson, S. L., & Cuellar, A. Regulatory deficits in bipolar and unipolar disorders. Under review.

Young, L. T. & Joffe, T. J. (1997). *Bipolar Disorder: Biological Models and Their Clinical Application* (304 pp.). New York, NY: Marcel Dekker, Inc.

Young, L. T., Warsh, J. J., Kish, S. J., Shannak, K., & Hornykiewcz, O. (1994). Reduced brain 5-HT and elevated NE turnover and metabolites in bipolar affective disorder. *Biological Psychiatry, 35*(2), 121-127.

Table 1

Demographic Information and Questionnaire Scores as a Function of Mood Disorder (n =12 for each group).

Variable	Bipolar I Disorder	No Mood Disorder
Mean Age (years)	44.17	38.67
Gender		
Percent Female	75%	58%
Ethnicity		
Caucasian	42%	42%
Hispanic	25%	33%
African-American	33%	17%
Asian	0%	8%
Marital Status		
Single	42%	25%
*Married**	8%	50%
Divorced	50%	25%
Employment Status		
*Full-Time**	25%	66%
Part-Time	17%	17%
*Unemployed**	58%	17%

Education Status		
*High-School or some college**	42%	17%
*BA or higher**	58%	83%
BAS – Drive	11.50 (2.43)	11.58 (2.35)
BAS – Fun	13.00 (2.80)	12.67 (2.06)
BAS – Reward	17.42 (2.61)	17.33 (2.35)
BIS	20.83 (3.90)	19.08 (3.23)
MASQ – GDA**	22.09 (8.20)	14.42 (2.07)
MASQ – AA*	26.67 (12.30)	18.75 (1.48)
MASQ – GDD**	26.80 (11.20)	14.17 (2.17)
MASQ – AD	52.12 (10.45)	54.43 (13.55)
WASSUP – Pop fame	12.58 (8.75)	9.75 (5.93)
WASSUP – Friends	10.67 (4.33)	9.83 (3.46)
WASSUP – World	3.17 (2.12)	2.58 (1.38)
WASSUP – Politics	2.67 (1.07)	2.42 (0.90)
WASSUP – Family	12.92 (6.76)	13.83 (6.66)
WASSUP – Money	8.08 (4.72)	8.50 (4.48)
WASSUP – Create	12.58 (4.42)	12.17 (5.17)
BRMS**	3.92 (3.60)	0.67 (1.23)
MHRSD**	5.50 (4.80)	1.17 (2.08)
SPANA Positive Affect**	3.61 (1.89)	5.20 (1.84)
SPANA Negative Affect**	2.03 (1.63)	1.30 (1.04)

Note. Means are reported with standard deviations in parentheses. BAS: behavioral activation system from the BIS/BAS scales; BIS: behavioral inhibition system from the BIS/BAS scales; BRMS: Bech-Rafaelson Mania Scale; MASQ: Mood and Anxiety Symptom Questionnaire (GDA: General Distress – Anxiety subscale; AA: Anxious Arousal subscale; GDD: General Distress – Depression subscale; AD: Anhedonic Depression subscale); MHRSD: Modified Hamilton Rating Scale for Depression; SPANA: Scale of Positive And Negative Affect; WASSUP: Willingly Approached Set of Statistically Unlikely Pursuits.

$*p < .05$. $**p < .01$

Table 2

Averaged SPANA Ratings of Positive and Negative Affect Across Time for Each Participant (n = 63).

Participant	Positive Affect		Negative Affect		Participant	Positive Affect		Negative Affect	
	M	*SD*	*M*	*SD*		*M*	*SD*	*M*	*SD*
B1	1.06	.20	1.92	.44	C1	4.46	1.91	1.22	.44
B2	2.14	.62	3.83	.99	C2	6.88	.30	3.34	.10
B3	6.56	1.48	1.44	.66	C3	6.14	.71	1.14	.30
B4	4.93	1.31	2.12	.82	C4	6.03	.81	1.04	.15
B5	3.33	1.28	2.51	1.23	C5	3.37	1.25	1.19	.26
B6	4.61	1.28	1.13	.27	C6	3.72	1.42	1.25	.33
B7	2.54	1.33	1.75	1.23	C7	5.84	.94	1.06	.16
B8	3.92	1.94	4.65	1.97	C8	5.49	.79	1.42	.59
B9	3.48	.85	1.34	.74	C9	3.13	1.46	1.47	.44
B10	4.16	2.06	2.21	1.62	C10	4.10	2.16	2.50	2.01
B11	3.43	1.05	1.19	.33	C11	7.44	1.09	1.06	.27
B12	3.18	1.42	2.39	1.12	C12	5.77	.92	1.11	.22

B = Bipolar I disorder group; C = Control group; SPANA = Scale of Positive And Negative Affect

Table 3

Autoregressive Integrated Moving Average (ARIMA) Parameters of Goal Velocity (IV) Predicting Subsequent Effort Planned (DV) for Each Goal.

Participant	Model Type (p, d, q)	b(SE)	t	p
B1				
Goal 1	(0, 0, 0)	.323(.231)	1.401	.167
Goal 2	(0, 0, 0)	-.231(.087)	-2.672	.010*
Goal 3	(0, 0, 0)	-.046(.120)	-3.83	.703
B2				
Goal 1	(0, 0, 0)	.223(.079)	2.829	.006**
Goal 2	(0, 0, 0)	.245(.058)	4.204	<.001**
Goal 3	(1, 0, 0)	-.005(.122)	-.044	.965
B3				
Goal 1	(1, 0, 0)	.332(.129)	2.569	.013*
Goal 2	(0, 0, 1)	.487(.071)	6.848	<.001**
Goal 3	(0, 0, 1)	.188(.114)	1.644	.106
B4				
Goal 1	(0, 0, 1)	.324(.081)	4.019	<.001**
Goal 2	(1, 0, 0)	.605(.080)	7.564	<.001**
Goal 3	(0, 0, 1)	.711(.088)	8.054	<.001**

B5				
Goal 1	(0, 0, 0)	-.114(.115)	-.992	.325
Goal 2	(0, 0, 0)	.090(.128)	.703	.485
Goal 3	(0, 0, 0)	.090(.128)	.703	485
B6				
Goal 1	(0, 0, 0)	- 350(.074)	-4.715	<.001**
Goal 2	(0, 0, 0)	-.251(.058)	-4.31	<.001**
Goal 3	(0, 0, 0)	-.152(.116)	-1.312	.195
B7				
Goal 1	(1, 0, 0)	.738(.084)	8.743	<.001**
Goal 2	(1, 0, 0)	.663(.081)	8.146	<.001**
Goal 3	(1, 0, 0)	.545(.088)	6.207	<.001**
B8				
Goal 1	(0, 0, 0)	.698(.095)	7.337	<.001**
Goal 2	(2, 0, 0)	.253(.105)	2.415	.019*
Goal 3	(0, 0, 1)	.441(.151)	2.929	.005*
B9				
Goal 1	(0, 0, 0)	.056(.027)	2.052	.044*
Goal 2	(0, 0, 0)	.045(.083)	.546	.587
Goal 3	(0, 0, 0)	.132(.062)	2.117	.039*
B10				
Goal 1	(0, 0, 0)	.263(.148)	1.775	.081
Goal 2	(1, 0, 0)	.271(.107)	2.531	.014*

Goal 3	(1, 0, 0)	.180(.118)	1.523	.133
B11				
Goal 1	(0, 0, 0)	-	-	-
Goal 2	(0, 0, 0)	.275(.067)	4.105	<.001**
Goal 3	(0, 0, 0)	.202(.054)	3.766	<.001**
B12				
Goal 1	(0, 0, 0)	.290(.114)	2.546	.013*
Goal 2	(0, 0, 0)	-.174(.105)	-1.658	.103
Goal 3	(1, 0, 0)	.270(.128)	2.110	.039*
C1				
Goal 1	(0, 0, 1)	.037(.116)	.318	.751
Goal 2	(0, 0, 0)	.182(.113)	1.615	.112
Goal 3	(0, 0, 0)	.049(.082)	.591	.557
C2				
Goal 1	(0, 0, 0)	.499(.124)	4.029	<.001**
Goal 2	(1, 0, 0)	.321(.169)	1.899	.063
Goal 3	(0, 1, 1)	.505(.119)	4.233	<.001**
C3				
Goal 1	(2, 0, 0)	.005(.121)	.042	.967
Goal 2	(0, 0, 0)	.164(.116)	1.404	.166
Goal 3	(0, 0, 0)	-.067(.128)	-.524	.602

C4				
Goal 1	(0, 0, 0)	-.316(.077)	-4.103	<.001**
Goal 2	(2, 0, 1)	.023(.114)	.200	.842
Goal 3	(0, 1, 0)	.201(.106)	1.887	.064
C5				
Goal 1	(1, 0, 0)	-.239(.074)	-3.240	.002*
Goal 2	(1, 0, 0)	-.199(.121)	-1.641	.106
Goal 3	(0, 0, 0)	-.243(.215)	-1.129	.264
C6				
Goal 1	(0, 0, 0)	.356(.132)	2.693	.009**
Goal 2	(0, 0, 1)	.651(.096)	6.775	<.001**
Goal 3	(0, 1, 1)	.248(.088)	2.804	.007*
C7				
Goal 1	(0, 0, 0)	- .477(.124)	-3.855	<.001**
Goal 2	(0, 0, 0)	-.111(.155)	-.717	.477
Goal 3	(0, 0, 0)	-.037(.130)	-.286	.776
C8				
Goal 1	(2, 0, 1)	-.222(.273)	-.815	.419
Goal 2	(0, 0, 0)	-.048(.150)	-.321	.749
Goal 3	(0, 0, 0)	.020(.217)	.094	.926
C9				
Goal 1	(0, 0, 0)	-.083(.132)	-.630	.531
Goal 2	(0, 0, 0)	-.249(.137)	-1.808	.076

Goal 3	(0, 0, 0)	.059(.132)	.446	.658
C10				
Goal 1	(1, 0, 0)	.155(.203)	.760	.451
Goal 2	(0, 0, 0)	.181(.161)	1.128	.264
Goal 3	(0, 0, 1)	.391(.133)	2.942	.005*
C11				
Goal 1	(0, 0, 1)	.216(.087)	2.495	.016*
Goal 2	(0, 0, 0)	.043(.088)	.492	.624
Goal 3	(0, 0, 0)	.086(.106)	.814	.419
C12				
Goal 1	(0, 0, 0)	-.197(.058)	-3.429	.011*
Goal 2	(2, 0, 2)	.041(.103)	.400	.691
Goal 3	(1, 1, 0)	.136(.097)	1.401	.167

B = Bipolar I disorder group; C = Control group

p = autoregressive component, *d* = differencing component, *q* = moving average component

*$p < .05$, **$p < .01$

Note: Analyses could not be conducted for goal 1 of participant E11 due to no variability in their effort scores.

Table 4

Autoregressive Integrated Moving Average (ARIMA) Parameters of Aggregated Goal Velocity (IV) Predicting Positive Affect (SPANA Pos Affect; DV).

Participant	Model Type (p, d, q)	b(SE)	t	p
B1	(0, 0, 0)	-.006(.020)	-.275	.785
B2	(0, 0, 0)	.033(.038)	.853	.397
B3	(1, 0, 0)	.006(.105)	.053	.958
B4	(1, 0, 0)	.096(.069)	1.383	.172
B5	(1, 0, 0)	-.016(.052)	.299	.766
B6	(0, 0, 0)	-.021(.041)	-.514	.609
B7	(0, 0, 0)	.171(.089)	1.922	.060
B8	(0, 0, 0)	.196(.228)	.859	.394
B9	(0, 0, 0)	.051(.055)	.924	.359
B10	(0, 0, 0)	-.051(.126)	-.404	.687
B11	(0, 0, 0)	-.437(.050)	-8.775	<.001**
B12	(0, 0, 0)	-.018(.079)	-.233	.817
C1	(0, 0, 0)	-.112(.100)	-1.116	.269
C2	(0, 0, 0)	.004(.027)	.130	.897

C3	(0, 0, 0)	.069(.052)	1.333	.188
C4	(0, 0, 0)	-.094(.044)	2.137	.037*
C5	(0, 0, 0)	.182(.146)	1.247	.218
C6	(0, 0, 0)	.591(.075)	7.846	<.001**
C7	(0, 0, 0)	-.020(.058)	-.343	.733
C8	(0, 0, 1)	.032(.056)	.572	.569
C9	(0, 0, 0)	.308(.095)	3.233	.002**
C10	(1, 0, 0)	.572(.121)	4.723	<.001**
C11	(0, 0, 0)	.133(.035)	3.842	<.001**
C12	(0, 0, 0)	.091(.049)	1.850	.070

B = Bipolar I disorder group; C = Control group

p = autoregressive component, *d* = differencing component, *q* = moving average component

*$p < .05$, **$p < .01$

Table 5

Autoregressive Integrated Moving Average (ARIMA) Parameters of Positive Affect (SPANA Pos Affect; IV) Predicting Subsequent Effort Planned for Each Goal (DV).

Participant	Model Type (p, d, q)	b(SE)	t	p
B1				
Goal 1	(0, 0, 0)	-.120(.677)	-.178	.859
Goal 2	(0, 0, 0)	-.522 (.491)	-1.063	.292
Goal 3	(0, 0, 0)	-.128(.545)	-.235	.815
B2				
Goal 1	(0, 0, 0)	.561(.228)	2.466	.017*
Goal 2	(0, 0, 0)	.299(.106)	2.816	.007**
Goal 3	(0, 0, 0)	.236(.134)	1.760	.084
B3				
Goal 1	(1, 0, 0)	-.001(.108)	-.007	.994
Goal 2	(0, 0, 0)	-.017(.074)	-.229	.820
Goal 3	(0, 0, 1)	-.074(.088)	-.837	.406
B4				
Goal 1	(0, 0, 0)	-.013(.073)	-.179	.858
Goal 2	(1, 0, 0)	-.018(.099)	-.183	.855

Goal 3	(0, 0, 0)	.276(.116)	2.381	.021*
B5				
Goal 1	(0, 0, 0)	.550(.169)	3.248	.002**
Goal 2	(0, 0, 0)	.241(.166)	1.456	.151
Goal 3	(0, 0, 0)	.256(.125)	2.050	.045*
B6				
Goal 1	(0, 0, 0)	-.034(.178)	-.191	.849
Goal 2	(0, 0, 0)	.078(.072)	1.077	.286
Goal 3	(1, 0, 0)	-.087(.160)	-.546	.587
B7				
Goal 1	(1, 0, 0)	.411(.088)	4.656	<.001**
Goal 2	(1, 0, 0)	.432(.085)	5.062	<.001**
Goal 3	(1, 0, 0)	.366(.084)	4.337	<.001**
B8				
Goal 1	(0, 0, 0)	.286(.083)	3.451	.001**
Goal 2	(0, 0, 0)	.046(.058)	.802	.426
Goal 3	(0, 0, 0)	.117(.068)	1.707	.093
B9				
Goal 1	(0, 0, 0)	.174(.068)	2.563	.013*
Goal 2	(0, 0, 0)	.192(.070)	2.754	.008**
Goal 3	(0, 0, 0)	.180(.073)	2.477	.016*
B10				
Goal 1	(0, 0, 0)	-.062(.150)	-.414	.680

Goal 2	(1, 0, 0)	.065(.086)	.757	.452
Goal 3	(1, 0, 0)	.144(.070)	2.046	.045*
B11				
Goal 1	N/A	-	-	-
Goal 2	(0, 0, 1)	-.027(.041)	-.670	.506
Goal 3	(0, 0, 1)	-.027(.041)	-.670	.506
B12				
Goal 1	(0, 0, 0)	-.123(.125)	-.985	.329
Goal 2	(0, 0, 0)	.103(.110)	.931	.356
Goal 3	(1, 0, 0)	-.223(.120)	-1.850	.070
C1				
Goal 1	(0, 0, 0)	.071(.124)	.572	.570
Goal 2	(0, 0, 0)	.154(.067)	2.284	.026*
Goal 3	(0, 0, 0)	-.018(.075)	-.238	.812
C2				
Goal 1	(1, 0, 1)	.145(.479)	.303	.763
Goal 2	(0, 0, 0)	.686(.669)	1.025	.310
Goal 3	(0, 0, 0)	-.293(.392)	-.747	.458
C3				
Goal 1	(2, 0, 0)	-.002(.170)	-.014	.989
Goal 2	(0, 0, 0)	-.002(.158)	-.013	.990
Goal 3	(0, 0, 0)	.224(.189)	1.188	.240

C4				
Goal 1	(0, 0, 0)	.214(.130)	1.642	.106
Goal 2	(0, 0, 0)	.567(.125)	4.554	<.001**
Goal 3	(0, 0, 0)	.056(.111)	.502	.618
C5				
Goal 1	(0, 0, 1)	-.033(.028)	-1.203	.234
Goal 2	(0, 0, 0)	.023(.060)	.377	.707
Goal 3	(0, 0, 0)	-.108(.069)	-1.567	.123
C6				
Goal 1	(0, 0, 0)	.283(.058)	4.897	<.001**
Goal 2	(0, 0, 0)	.375(.038)	9.784	<.001**
Goal 3	(0, 1, 1)	.130(.043)	3.036	.004**
C7				
Goal 1	(0, 0, 0)	-.581(.261)	-2.225	.030*
Goal 2	(0, 0, 0)	-.206(.169)	-1.218	.228
Goal 3	(0, 0, 0)	.258(.196)	1.316	.193
C8				
Goal 1	(2, 0, 1)	.205(.217)	.945	.349
Goal 2	(0, 0, 0)	-.136(.198)	-.687	.495
Goal 3	(0, 0, 0)	-.220(.212)	-1.039	.303
C9				
Goal 1	(0, 0, 0)	.049(.094)	.524	.602
Goal 2	(0, 0, 0)	.010(.099)	.097	.923

Goal 3	(0, 0, 0)	.074(.107)	.688	.494
C10				
Goal 1	(1, 0, 0)	.264(.056)	4.729	<.001**
Goal 2	(1, 0, 0)	.228(.055)	4.184	<.001**
Goal 3	(0, 0, 1)	.199(.050)	3.977	<.001**
C11				
Goal 1	(0, 0, 1)	.142(.138)	1.029	.308
Goal 2	(0, 0, 0)	.445(.137)	3.254	.002*
Goal 3	(0, 0, 0)	.375(.137)	2.742	.008**
C12				
Goal 1	(0, 0, 0)	.236(.122)	1.942	.057
Goal 2	(0, 0, 0)	.386(.111)	3.471	.001**
Goal 3	(0, 0, 0)	.053(.095)	.552	.583

B = Bipolar I disorder group; C = Control group;

p = autoregressive component, d = differencing component, q = moving average component

**$p < .01$, * $p < .05$

Note: Analyses could not be conducted for goal 1 of participant E11 due to no variability in their effort scores.

Table 6

Random-Effects Regression Parameters for Gender, Group Status, and Their Interaction Predicting Velocity-Effort Z-Scores for Each Goal.

	β	*SE*	*Z*	*p* value
Intercept	7.42	4.33	1.71	.09
Group	-7.21	2.93	-2.46	.01*
Gender	-5.00	2.56	-1.95	.05
Group X Gender Interaction	5.16	1.69	3.06	.002**

Intra-class correlation of *Z*-Scores = .43

* $p < .05$, ** $p < .01$

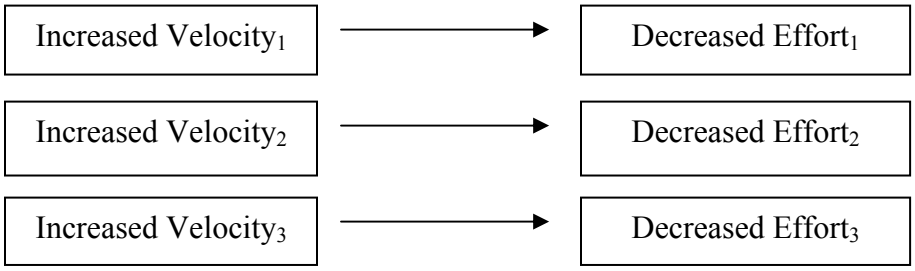
Figures

Figure Caption

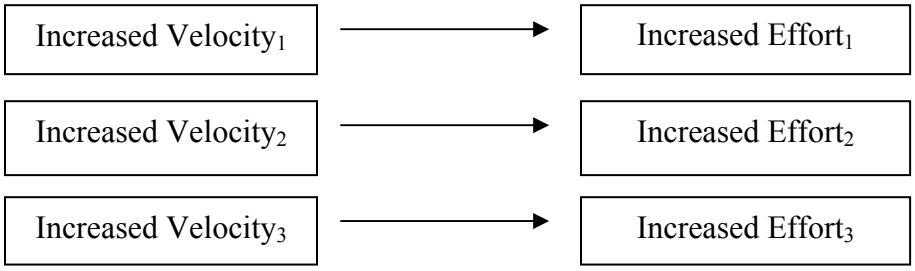
Figure 1. Hypothetical schematics of the three primary time series regression and mediation analyses. Relationships are split between the control group and the bipolar I disorder group. Numbers in subscripts denote goal number.

Regression 1

Control Group

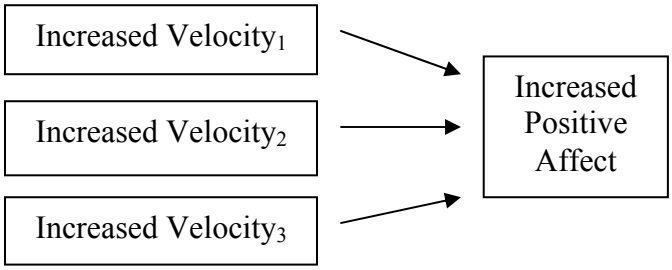


Bipolar I Disorder Group



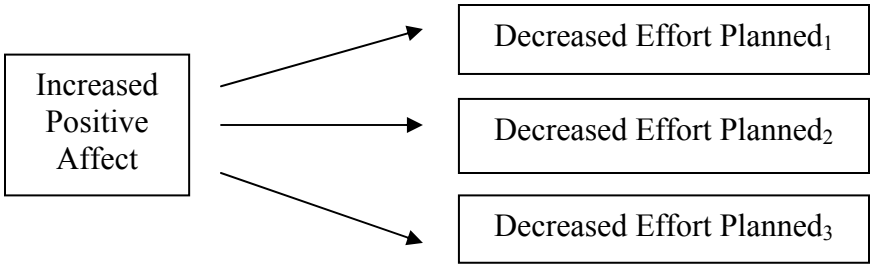
Regression 2

Both Groups

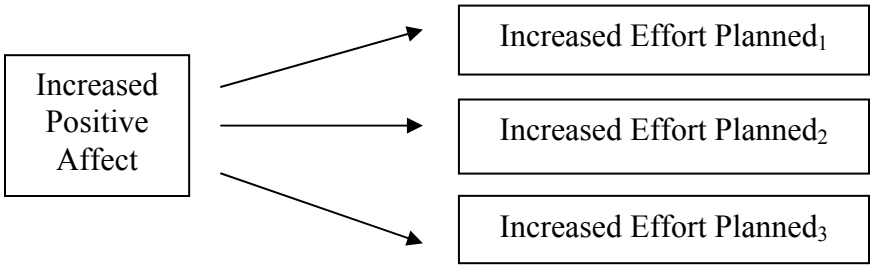


Regression 3

Control Group

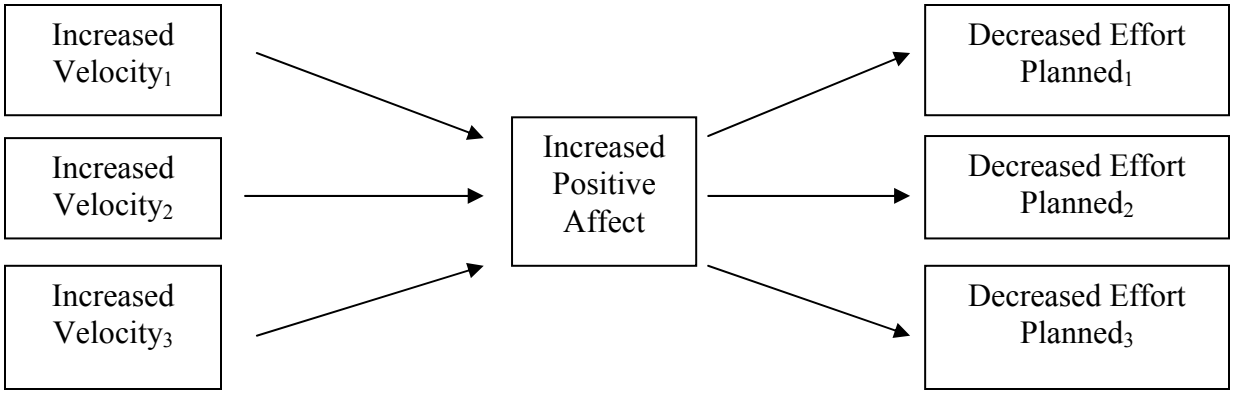


Bipolar I Disorder Group



Mediation

Control Group



Bipolar I Disorder Group

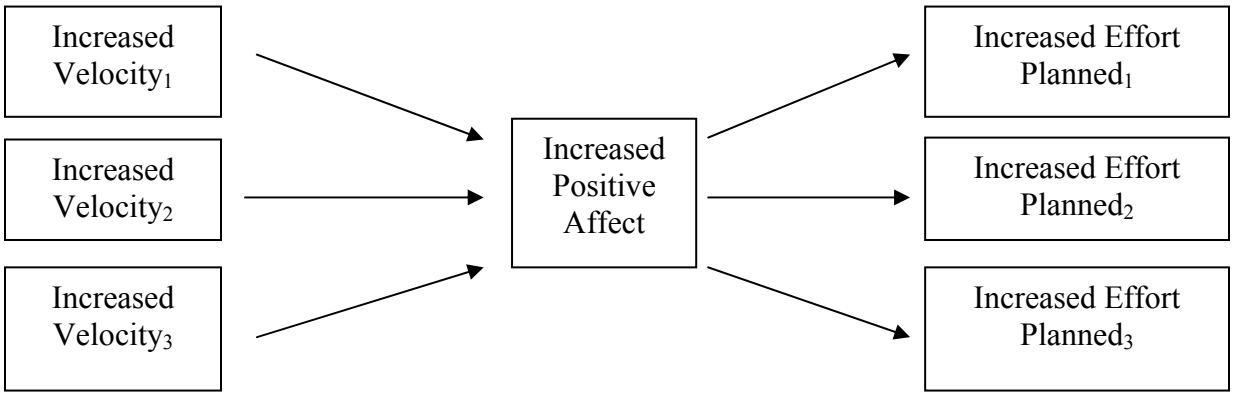
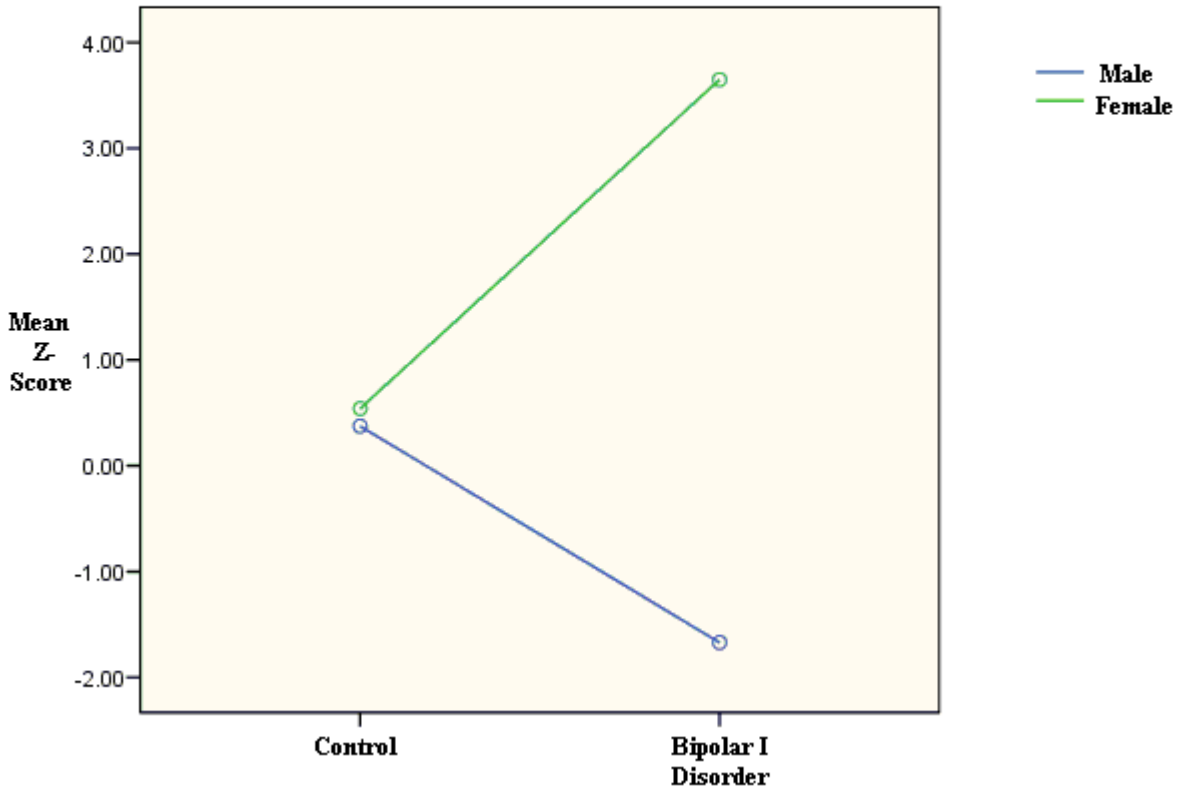


Figure 2. Mean velocity-effort *Z*-scores by group and gender. Negative *Z*-scores indicate coasting; positive *Z*-scores indicate anti-coasting.



Appendices

Appendix A: Script for Determining Goals

I would like you to choose three things that you want to accomplish that you will be working toward during the next three weeks. These should be things that you are confident you will be putting effort toward in these coming weeks. Do not choose things that you might put aside. On the other hand, do not choose things that are so easy they will be attained immediately or with little effort. Please choose things that you believe are possible to accomplish within this time span but not too easy to accomplish. The goals can be work-related, interpersonal, or any domain of life you wish. Examples of these things may include the following:

- eating 2 of 3 meals per day on average for a period of 3 weeks

-working 2 hours per day on average completing a project at work

-spending 4 hours per week on average looking for a job

-working towards mending a difficulty in a relationship at least 3 times a week

-working towards getting a particular person to fall for me at least twice a week

Please choose three things that are important for you to complete and that you believe you will put a good amount of effort toward throughout the next three weeks.

Goal 1:

_____

Goal 2:

_____

Goal 3:

_____

Appendix B: Scale of Positive and Negative Affect (SPANA)

This is a list of words that describe the way people sometimes feel. Please indicate how each of these words describe the way you feel **at this moment**. Indicate the degree to which you feel each emotion by choosing from the following responses:

1	2	3	4	5	6	7	8	9
(Not at all)		(A little)		(Some)		(A lot)		(Extremely—The most I've ever experienced)

_____ 1. Sad

_____ 2. Happy

_____ 3. Content

_____ 4. Enthused

_____ 5. Worthless

_____ 6. Cheerful

_____ 7. Frustrated

_____ 8. Lively

_____ 9. Unhappy

Appendix C: Goal Attainment and Striving Scale (GASS)

1. How important is (insert goal here) to you right now?

0	1	2	3	4
Not at all important	A little important	Important	Very important	Crucial

2. How much effort have you put toward (insert goal here) since the last assessment?

0	1	2	3	4
No effort at all	Minimal effort	Some effort	A lot of effort	Maximal effort/Finished

3. How much closer have you come to (insert goal here) since the last assessment?

0	1	2	3	4
Not at all closer	A little closer	As close as I suspected	Closer than suspected	Reached

4. How much closer do you expect to get to (insert goal here) by the next assessment?

0	1	2	3	4
Not at all closer	A little closer	Moderately closer	A lot closer	Finished

5. How much effort do you plan on putting toward (insert goal here) by the next assessment?

0	1	2	3	4
No effort at all	Minimal effort	Some effort	A lot of effort	Maximal effort/Finish

6. Are you going to raise your goal, lower your goal, or keep it the same by the next assessment?

0	1	2
Raise	Lower	Keep the same

7. Did anything significantly negative or positive happen to you since the last assessment?

0	1
No	Yes