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Pushing and Coasting in Dynamic Goal Pursuit: Coasting Is Attenuated in Bipolar Disorder

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Abstract

In an experience-sampling study, we tested the influence of goal progress on subsequent effort toward that goal among persons with bipolar disorder (BD) and among control subjects without BD. We hypothesized, overall, that unexpectedly low progress toward a goal would lead to an increase in subsequent effort toward that goal, and unexpectedly high progress would lead to a decrease in effort (permitting effort to be shifted to another goal). Drawing on literature relating BD to elevated goal-approach sensitivity, we hypothesized that persons with BD would be less responsive to unexpectedly high progress than would control subjects. Participants answered questions three times a day, for 21 days, about three goals. The results of the study confirmed our overall hypothesis. In addition, although the reactions of persons with BD did not differ from the reactions of control subjects after lower-than-expected goal progress, persons with BD decreased effort toward goals significantly less than did control subjects after better-than-expected goal progress.

Keywords

bipolar disorder, goal pursuit, coasting, effort

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An organizing principle in contemporary psychology is that human behavior reflects the pursuit of goals (and the avoidance of punishments, e.g., Carver & Scheier, 1998; Davidson, 2000; Elliot, 2008; Higgins, 1997; Morsella, Bargh, & Gollwitzer, 2009; Shah & Gardner, 2008). This principle promotes research on choice, effort, and persistence regarding goals. Most of this work has examined one goal of a participant at a time. However, people generally have multiple goals, not just one (cf. Atkinson & Birch, 1970). An important question, then, is how people distribute effort among their various goals (Dreisbach & Goschke, 2004; Louro, Pieters, & Zeelenberg, 2007; Shallice, 1978; Shin & Rosenbaum, 2002).

An approach to this question is suggested by Carver and Scheier's (1998) model of effort regulation via two layers of feedback processes. This model posits a process that regulates rate of goal approach.¹ If goal progress falls below an implicit criterion (e.g., expected progress or intended progress), negative affect arises and effort toward that goal increases; if goal progress exceeds the implicit criterion, positive affect arises and effort toward that goal decreases.²

Carver (2003) later applied this reasoning to multitasking. Following Simon (1967), he assumed that negative affect—a

signal of falling behind—is a call for higher priority for that goal, resulting in increased effort toward it. If that goal was not previously focal, it would now become focal, thus causing a shift in the person's priorities. Carver reasoned that positive affect—a signal of surging ahead—may mean that the goal to which it relates can assume a lower priority; less effort would be expended toward this goal, which would free attention and resources for other needs. If another goal needs attention at that point, effort might shift to it; this again represents a reordering of priorities.

Thus, Carver (2003) proposed that temporarily surging ahead of and falling behind the criterion of expected progress is a determinant of shifts in effort among multiple goals. The overall result would be “satisficing” regarding the goals as a group (Simon, 1953). The argument made by Simon (1967) is not that the shifting among goals is intentional, or cannot be overcome, or even that it is advisable (indeed, it clearly is not

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the best choice regarding the initial goal), but simply that tendencies toward this pattern exist.

The idea that people increase effort when they are lagging behind is not controversial.³ In contrast, however, the idea that people reduce effort when they are doing unexpectedly well is not intuitive. Further, not much evidence bears on this idea. Mizruchi (1991) found that professional basketball teams in playoffs tend to lose games immediately after winning games, but it is unclear whether the previously winning team slacked off, the previously losing team tried harder, or both. In a series of less ambiguous studies, Louro et al. (2007) explicitly examined the role of positive feelings resulting from surging ahead in multiple-goal pursuit. Across three studies, they found that when people were relatively close to a goal, positive feelings prompted a decrease in effort toward that goal and a shift of effort toward an alternate goal.

This article reports a further test of this general idea. We used a rather intensive experience-sampling methodology: Participants recorded information concerning progress toward three goals, three times a day, for 21 consecutive days. We predicted that falling short of expected progress would cause participants to increase subsequent effort and that exceeding expected progress would cause participants to reduce subsequent effort.

Bipolar Disorder

We also examined a potentially important individual difference in the phenomena described in the preceding paragraphs. The behavioral activation, or goal-dysregulation, model of bipolar disorder (BD) posits that mania is etiologically related to a highly sensitive reward system (e.g., Depue & Iacono, 1989; Johnson, 2005; Urošević, Abramson, Harmon-Jones, & Alloy, 2008). People with BD display manic symptoms after life events involving success (Johnson et al., 2008); they respond to thwarting of goals with an increase in approach engagement (Harmon-Jones et al., 2008; Wright, Lam, & Brown, 2008), and they report setting high goals for themselves (Johnson, Eisner, & Carver, 2009). Of particular interest is the fact that elevations in goal engagement and life events involving success predict increases in mania over time (Johnson et al., 2008; Lozano & Johnson, 2001). These tendencies all suggest a person who is ultra-goal-engaged (Johnson, 2005). Indeed, despite the disruption that mania creates for people who experience it, BD has been linked repeatedly to high goal attainment (Coryell et al., 1989; Johnson, 2005).

This characterization of persons with BD suggests a particularly intriguing hypothesis: that persons with BD may be less likely than persons without BD to respond to unexpectedly good progress toward a goal by reducing effort toward that goal. If normal functioning involves slacking off after exceeding expectations, and if persons with BD are deficient in this regulatory response, a pathway would be suggested by which manic symptoms are triggered. Specifically, an initial success in some domain would lead persons with BD not to a

temporary letup but to unabated efforts in that domain; these efforts could spiral to greater intensity and eventually yield manic symptoms (see Johnson, 2005).

Method

Participants

Diagnostic information came from the Mania, Depression, Psychosis Disorders, and Substance Abuse and Dependence modules of the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996). Current depression symptoms were assessed using the Modified Hamilton Rating Scale for Depression (MHRSD; Miller, Bishop, Norman, & Maddever, 1985), an interviewer-administered scale; current mania symptoms were assessed using the Bech-Rafaelson Mania Scale (BRMS; Bech, Bolwig, Kramp, & Rafaelsen, 1979). These measures are all widely used in research on disorders.

Initially, 18 subjects were recruited for the BD group, and 15 subjects were recruited for the no-mood-disorder group. Inclusion criteria for the BD group were bipolar I disorder as diagnosed by the SCID; no current episode of depression, as indicated by an MHRSD score below 10 (1 participant excluded from the study for this reason); no current episode of mania, as indicated by a BRMS score below 7 (1 participant excluded); and an age between 18 and 70 years. Criteria for the no-mood-disorder group were no lifetime history of depression or mania as assessed by the SCID and an age between 18 and 70 years. Further exclusion criteria for both groups were SCID-defined substance abuse or substance dependence within the past 6 months (2 participants excluded, 1 from each group), SCID-defined history of psychosis outside of mood episodes (no participants excluded), central nervous system disease other than BD (no participants excluded), and inability to complete self-report measures because of cognitive or language barriers (no participants excluded).

Five persons, 3 who had BD and 2 who did not, enrolled in the study but completed no procedure beyond the initial diagnostic interview (no data beyond demographics were obtained). The final sample consisted of 12 persons diagnosed with BD (4 males and 8 females) and 12 persons with no history of mood disorder (5 males and 7 females).

Procedure

Participants were recruited by advertisements targeted to the community and to participants in other studies, and by word of mouth. The study was characterized as an examination of processes involved in attaining life goals. Advertisements asked interested persons to phone; after procedures were briefly explained to them, persons who were still interested made individual appointments. At that time, they completed written informed consent, the SCID, measures of current symptoms of

depression and mania, demographic information (age, gender, partner status, medication status), and other measures not relevant to this article. They also identified three goals for future pursuit and received a booklet for reporting on goal-related perceptions.

Goals. Participants were asked to identify three goals they would be striving toward in the coming weeks. The interviewer helped them choose tangible goals that (a) participants were confident they would put effort into, (b) could be attained during the length of the study, (c) required more than minimal effort, and (d) were defined as approach related (i.e., moving toward a desired outcome rather than away from an undesired outcome). These criteria were intended to ensure that the goals identified would require enough time and effort to be of significance to the participants. Participants were also encouraged to identify goals for which they were already striving. Examples such as the following were provided to establish the general level of abstraction desired: “Eat 2 healthy meals each day for the 3-week period (meals less than 500 calories with a vegetable component),” “Spend 2 hours each day on a specific work project,” and “Spend 1 hour each day of ‘quality time’ with my son.”⁴

Experience sampling. Each participant received a questionnaire booklet in a strap-on pack. The three goals the participant had identified were written (and numbered) on the inside cover of his or her booklet. Each booklet page contained a series of self-report items. Participants were asked to complete these items three times each day for 21 consecutive days, for a total of 63 possible *assessments* for each participant. Each assessment included a full item set for each goal, for a total of 189 possible goal-related *reports* per person. The time and date of each assessment were recorded in the booklet. A signaling device notified the participant to complete the measures in the morning, at midday, and in the evening. We called participants twice per week to check their progress and ensure they had no problems completing the questionnaires.

Each report was a set of questions pertaining to one goal. Participants were asked to answer all questions with regard to the first goal, then with regard to the second goal, and finally with regard to the third goal. Participants were given instructions on how to answer the items and were probed before they left the initial session to ensure that they understood the procedures completely. Participants were instructed to try as hard as possible to complete every assessment. At the end of 3 weeks, they returned to the laboratory with their booklets and received a payment of \$50. There was a high rate of compliance, with participants missing only 4% of the assessments (see the Analytic Procedures section).

Experience-sampling data aggregation

Each assessment included the following questions (and possible responses) for each goal:

“How much effort have you put toward [goal] since the last assessment?” *no effort at all* (0), *minimal effort* (1), *some effort* (2), *a lot of effort* (3), *maximal effort/finished* (4)

“How much closer have you come to [goal] since the last assessment?” *not at all closer* (0), *a little closer* (1), *moderately closer* (2), *a lot closer* (3), *reached* (4)

“How much closer do you expect to get to [goal] by the next assessment?” *not at all closer* (0), *a little closer* (1), *moderately closer* (2), *a lot closer* (3), *finished* (4)

Responses to these questions at various time points were used to construct the *event cycles* that were ultimately analyzed. Recall that according to the reasoning behind the study, perception of falling behind a goal-progress criterion induces a subsequent increase in effort toward the associated goal, whereas overshooting the criterion induces a tendency to coast, or reduce effort, toward the associated goal. Thus, our predictions involved derived variables (Fig. 1). Deviation of progress from expectation (for a given cycle) was calculated by subtracting the expected upcoming progress toward a goal reported at time t from the perceived progress reported at time $t + 1$. Positive values indicate more progress than expected (positive deviation); negative values indicate less progress than expected (negative deviation); zero indicates the expected progress (no deviation). Change in subsequent effort toward a goal was calculated by subtracting the effort reported at time $t + 1$ from the effort reported at time $t + 2$. Positive values indicate increase in effort; negative values indicate decrease in effort; zero indicates no change.

Thus, each event cycle, beginning with the cycle that used data from times 1 through 3, used data from three separate assessments. Each cycle consisted of the computed deviation of the perception at time $t + 1$ from expectancy at time t , and the computed change in effort from time $t + 1$ to time $t + 2$. Cycles that lacked any of the data required to compute these indices were omitted.

Because there was no theoretical reason to distinguish one goal from another in this study, all usable data were treated as distinct observations without nesting observations within goals. Because there was no expectation of oscillation in any particular rhythm, the data were not fixed in any defined order; the cycles were simply treated as repeated information sources and were ordered as they accumulated. Each cycle contained a code to indicate whether the cycle began at the start of a day, in the middle of a day, or at the end of a day. This coding allowed us to determine whether time of day made a difference in any effect uncovered.

Analytic procedures

Given the nested structure of the data (cycles nested within participants), we performed multilevel modeling using Hierarchical Linear Modeling (HLM) Version 6.0 (Raudenbush, Bryk, & Congdon, 2004). Only 4% of the observations were missing

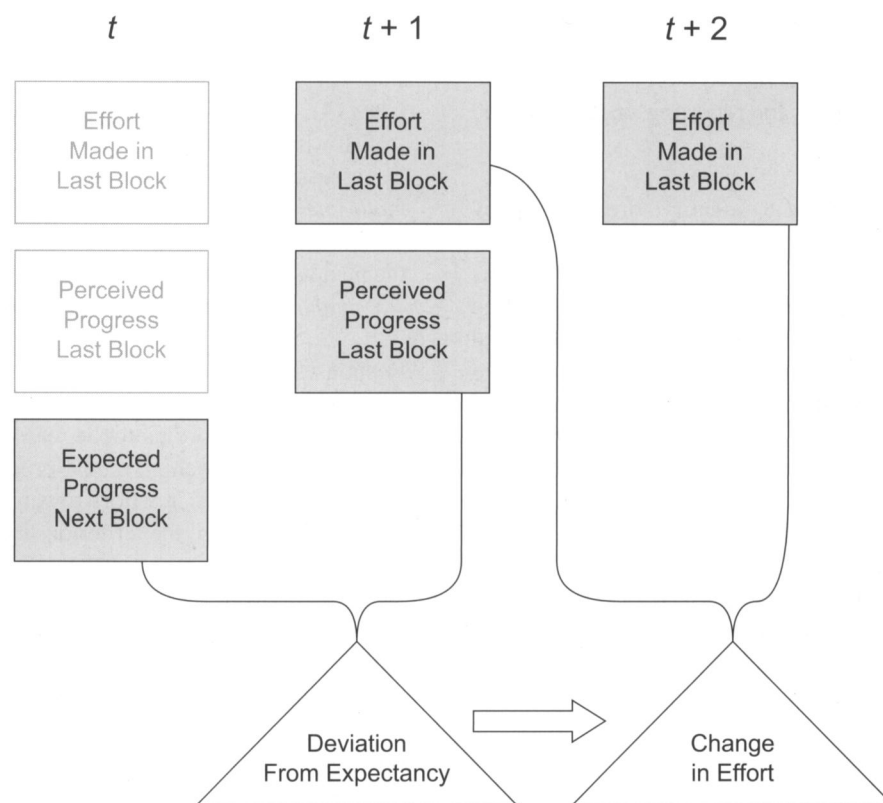


Fig. 1. Computing the derived variables for analysis of an event cycle. All three raw responses (effort made, perceived progress, and expected progress) were reported at each time point; information in boxes with a gray background was used in computing a given variable. Deviation from expectancy was calculated by subtracting expectancy at time t from perceived progress at time $t + 1$. Change in effort was calculated by subtracting effort at time $t + 1$ from effort at time $t + 2$. Deviation from expectancy was then used to predict change in effort.

(518 out of a possible 13,608; slightly more data were missing for control subjects than for BD subjects); this completion rate is quite high for this type of research (Conner Christensen, Barrett, Bliss-Moreau, Lebo, & Kaschub, 2003). As no specific pattern was identified for the missing data, missing values were treated as missing completely at random, and parameters were estimated with full-information maximum likelihood. Cycles were treated as repeated measures (at Level 1) that were nested within persons (Level 2). Group status (BD vs. no mood disorder) was examined as a Level 2 predictor. The structure of the Level 1 data for each cycle was the deviation between perceived progress at $t + 1$ and expected progress at t , and the difference between effort reported at $t + 2$ and effort reported at $t + 1$. Deviation in progress was treated as a time-varying predictor, and the change in subsequent effort was treated as the outcome.

A problem in interpretation would be created by treating performance relative to expectation as a single continuum (i.e., combining overshoots with undershoots). Specifically, such a procedure would provide no way to disentangle responses to negative deviations from responses to positive deviations. To solve this problem, we created two dummy vectors, in a piecewise fashion, to code overshoot and undershoot separately. The undershoot vector consisted of all instances in which deviations

ranged from zero to negative values; the overshoot vector consisted of all instances in which deviations ranged from zero to positive values. In these vectors, a zero deviation was coded as zero, a variable-relevant deviation was coded with its true value, and a variable-irrelevant deviation was coded as zero.

These goal-progress vectors were the Level 1 predictors and were entered simultaneously; thus, the effects obtained were unique (controlling for each other). The Level 1 model was represented by the following equation:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{overshoot})_{ij} + \beta_{2j}(\text{undershoot})_{ij} + r_{ij},$$

where Y_{ij} represents the change in effort at cycle i for participant j , β_{0j} represents the mean change in effort corresponding to zero deviation from expectation for participant j , β_{1j} represents the slope associated with positive deviation for participant j , β_{2j} represents the slope associated with negative deviation for participant j , and r_{ij} represents the residual change in effort for the cycle i for participant j . In a subsequent Level 1 model, we also included dummy vectors to represent time of day (morning as the time of reference) to see whether changes in effort were significantly predicted by the time of day in which the cycles began.

The Level 2 predictor variable was diagnostic group (0 = no mood disorder, 1 = BD). Random components in the intercepts and slopes were modeled as free to vary. Thus, the Level 2 model was represented by the following equations:

$$\begin{aligned}\beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{group}) + u_{0j} \\ \beta_{1j} &= \gamma_{10} + \gamma_{11}(\text{group}) + u_{1j} \\ \beta_{2j} &= \gamma_{20} + \gamma_{21}(\text{group}) + u_{2j},\end{aligned}$$

where γ_{00} represents the mean change in effort corresponding to zero deviation from expectation for the no-mood-disorder group, γ_{01} represents the difference in mean change in effort corresponding to zero deviation from expectation between the no-mood-disorder and the BD groups, γ_{10} represents the mean positive-deviation slope for the no-mood-disorder group, γ_{11} represents the difference in positive-deviation slope between the two groups, γ_{20} represents the mean negative-deviation slope for the no-mood-disorder group, γ_{21} represents the difference in negative-deviation slopes between groups, u_{0j} represents deviation of the j th participant from his or her group's mean change in effort associated with zero deviation from performance expectancy, u_{1j} represents the deviation of the j th participant from his or her group's positive-deviation slope, and u_{2j} represents the deviation of the j th participant from his or her group's negative-deviation slope.

Results

Modeling changes in effort

The primary model tested whether overshoot predicted decrease in effort, whether undershoot predicted increase in effort, and whether group moderated either relationship. Collapsing across groups, there was a significant relationship between undershoot and increases in subsequent effort toward that goal, $b = -0.25$, $t(23) = -4.06$, $p < .01$. This negative estimate reflects the fact that greater undershoot (more negative values) was related to greater subsequent increase in effort (more positive values). Thus, overall, making less progress than expected toward a goal resulted in increasing subsequent effort toward that goal.

This analysis also yielded a significant relationship between overshoot and subsequent reduction in goal effort, $b = -0.34$, $t(23) = -6.38$, $p < .001$. The negative loading in this case reflects the fact that greater overshoot (positive values) was related to greater reduction in effort (more negative values). Thus, overall, making unexpectedly high progress toward a goal was followed by reduced effort toward that goal.

Moderation effects

Moderation of these two effects was tested by entering the Level 2 predictor, diagnostic group, into the model. Diagnostic group did not significantly predict the undershoot vector, $b = -0.19$, $t(22) = -1.60$, $p = .13$. That is, persons with BD did

not differ significantly from control subjects in the extent to which they increased efforts in response to undershoots. Nonetheless, examination of the groups separately indicated a significant tendency to increase effort after undershoots among persons with BD, $b = -0.34$, $t(11) = -4.03$, $p < .01$, with the comparable effect among control subjects without BD only approaching significance, $b = -0.16$, $t(11) = -1.97$, $p = .07$.

The analysis did yield a significant effect of diagnostic group on the overshoot vector, however. The form of the interaction indicated that participants with BD decreased effort significantly less than did control subjects after making unexpectedly high progress, $b = 0.32$, $t(22) = 4.02$, $p < .01$. Nonetheless, examination of the groups separately revealed that both did coast after overshoots—BD group: $b = -0.19$, $t(11) = -4.19$, $p < .01$; control subjects: $b = -0.50$, $t(11) = -7.65$, $p < .001$.

Supplemental analyses

We tested whether these effects varied significantly according to the time of day by repeating the analysis and incorporating a dummy-coded vector representing time of day (morning, midday, evening) of the $t + 1$ element of the cycle. Including this variable failed to change appreciably the relationships described in the previous section.⁵ That is, even with this control, there was significant decrease in subsequent effort after overshoots, $b = -0.32$, $t(23) = -6.34$, $p < .001$, and the moderation of this effect by diagnostic group remained significant, $b = 0.29$, $t(22) = 3.98$, $p < .01$. The relationship between undershoots and subsequent increases in effort remained significant for the sample as a whole, $b = -0.26$, $t(23) = -5.16$, $p < .001$, and the lack of moderation by group was also maintained, $b = -0.13$, $t(23) = -1.37$, $p = .18$.

We also tested two alternative interpretations of the findings. First, perhaps persons with BD coast less than persons without BD because they exert less effort to begin with. This possibility was tested in HLM using effort as the criterion variable and group status as a Level 2 predictor. Persons with BD reported significantly more overall effort than did control subjects without BD ($M = 1.81$ vs. 1.18), $b = 0.66$, $t(22) = 2.71$, $p = .01$. Thus, the results are not consistent with such an interpretation. Second, perhaps persons with BD experience fewer or smaller overshoots than do control subjects. Although persons with BD reported higher expectations for progress overall than did control subjects ($M = 1.65$ vs. 1.14), $b = 0.54$, $t(22) = 2.29$, $p = .03$, they did not overshoot less ($M = 0.31$ across the overshoot vector for both groups; distributions were virtually identical for the two groups). Thus, this second alternative interpretation also seems implausible. Nor did controlling for expectations affect the results materially.

Discussion

Limitations of this study that should be acknowledged include reliance on self-reports and lack of an electronic time stamp to verify when experience-sampling measures were completed.

Additionally, although the data set was large, the sample size was fairly small. Although caution in interpreting our results is warranted, the findings are relatively clear.

The study contributes two major findings. First, people responded to failure to meet expected goal progress by increasing subsequent effort toward that goal, and they responded to unexpectedly high goal progress by relaxing effort and coasting. The coasting response was particularly robust. This pattern is conceptually consistent with the results of Louro et al. (2007), but we used very different methods. In our study, participants chose their goals rather than monitoring goals specified by the research setting. Further, we focused assessment on expectations and perceptions of goal progress rather than on affect, thus establishing a way to operationalize overshoot and undershoot of expectations. Despite these differences, the results of our study converge nicely with the results of Louro et al. The overall pattern of results supports the broad notion that overshoot and undershoot of progress criteria are important principles underlying dynamic management of goal-directed effort.

The second main finding of this study is that the pattern of response to overshoots differs between persons without BD and persons with BD. Persons with BD did display a coasting response, but it was significantly smaller than the coasting response among control subjects. It is important to keep in mind, in this regard, that BD was in remission in all participants in this group. It is almost certainly unrealistic to expect a total absence of coasting in this state. If coasting were completely absent during remission, any overshoot at all might initiate a spiral into manic symptoms. It seems plausible that an attenuated coasting tendency, such as was observed here, would act synergistically with prodromal symptoms of a hypomanic episode, such that emergence of symptoms would lead coasting to become further attenuated and perhaps disappear altogether. This inference, of course, requires further testing.

Although evidence from other sources indicates that persons with BD respond to frustrations and setbacks with greater activation and effort than do persons without BD (Harmon-Jones et al., 2008; Wright et al., 2008), the comparable effect in this study was not significant. This may be partly attributable to the fact that the BD participants in our study were in remission and partly attributable to the study's small sample size.

Although not a main focus of this study, two other aspects of the data are also worth mentioning. First, persons with BD reported higher levels of goal-directed effort overall than did control subjects. This fact is consistent with the picture of people with BD as ultra-goal-engaged (Johnson, 2005). It also may help explain why BD only weakly moderated the increase in goal-directed effort after participants fell short of expected progress. That is, the interaction between group and progress already takes into account the group difference in effort overall. This difference may have been too much of an obstacle to overcome in this small sample.

Second, persons with BD reported higher expectations for goal progress overall than did control subjects without BD (though they did not report exceeding those expectations any

less than did control subjects). This fact is consistent with evidence that people with BD are more likely than people without BD to endorse high life goals (Johnson et al., 2009).

In sum, these findings add to a growing literature on goal dysregulation in BD. Previous evidence suggested that life events involving success can trigger robust increases in confidence and in manic symptoms among people with BD. The findings reported here begin to provide data for a dynamic model of how such changes may unfold and suggest the desirability of testing deficits in coasting as a potential predictor of mania.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Notes

1. We focus on approach throughout this article; for application of this model to avoidance, see Carver (2003).
2. This argument resembles somewhat the idea that dopaminergic neurons respond more intensely to an unexpected reward than to an expected reward and diminish further when an expected reward fails to occur (Schultz, 2000, 2006). This pattern suggests that dopamine neurons are involved in detecting when events are going better than expected and worse than expected (see also Holroyd & Coles, 2002).
3. Given enough failure, of course, effort eventually yields to disengagement (Wortman & Brehm, 1975).
4. Extensive examination yielded only one discernible difference in goals between groups: BD participants were more likely to name a diet or health goal.
5. Gender and age also did not appreciably influence these outcomes.

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