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BRIEF REPORT

Affective forecasting and self-rated symptoms of depression, anxiety, and hypomania: Evidence for a dysphoric forecasting bias

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Emerging research has examined individual differences in affective forecasting; however, we are aware of no published study to date linking psychopathology symptoms to affective forecasting problems. Pitting cognitive theory against depressive realism theory, we examined whether dysphoria was associated with negatively biased affective forecasts or greater accuracy. Participants ($n = 325$) supplied predicted and actual emotional reactions for three days surrounding an emotionally evocative relational event, Valentine's Day. Predictions were made a month prior to the holiday. Consistent with cognitive theory, we found evidence for a *dysphoric forecasting bias*—the tendency of individuals in dysphoric states to overpredict negative emotional reactions to future events. The dysphoric forecasting bias was robust across ratings of positive and negative affect, forecasts for pleasant and unpleasant scenarios, continuous and categorical operationalisations of dysphoria, and three time points of observation. Similar biases were not observed in analyses examining the independent effects of anxiety and hypomania. Findings provide empirical evidence for the long-assumed influence of depressive symptoms on future expectations. The present investigation has implications for affective forecasting studies examining information-processing constructs, decision making, and broader domains of psychopathology.

Keywords: Affective forecasting; Depression; Dysphoria; Anxiety; Hypomania; Impact bias.

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Anticipated emotions often guide choice, and difficulties in accurately foreseeing future emotional states are thought to contribute to significant societal problems, such as buyer's remorse, job dissatisfaction, limited health planning, divorce, and death by suicide (see Hoerger & Quirk, 2010, for a review). Research on affective forecasting (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998) has shown that predicted and actual emotional reactions often diverge (see E. W. Dunn & Laham, 2006, for a review). For example, people typically overestimate how happy they will feel in response to future pleasant events and how distressed they will feel after unpleasant events. In an effort to understand these discrepancies, researchers have examined demographics as well as individual differences in working memory, personality, and related constructs, such as coping strategies, attachment styles, and emotional intelligence (E. W. Dunn, Brackett, Ashton-James, Schneiderman, & Salovey, 2007; Hoerger & Quirk, 2010; Hoerger, Quirk, Lucas, & Carr, 2009, 2010; Tomlinson, Carmichael, Reis, & Aron, 2010). It has been theorised that dysphoric individuals are negatively biased in predicting the emotional consequences of future events (Beck, 1976), but we are aware of no published study linking dysphoria or other psychopathology symptoms to affective forecasting problems.

Two competing information processing theories are relevant to understanding the influence of dysphoric symptoms upon affective forecasting (B. D. Dunn, Dalgleish, Lawrence, & Ogilvie, 2007). Cognitive theory (Beck, 1976) posits that dysphoric schemas lead to interpretations of events that are characterised by negativistic biases. Based on this theory, it is hypothesised that dysphoria will be associated with negatively biased forecasts for both pleasant and unpleasant events. In contrast, depressive realism theory (Allan, Siegel, & Hannah, 2007; Alloy & Abramson, 1988) has shown that dysphoria is marked by the absence of normative positivity biases in particular contexts, such as evaluating oneself or estimating the probability of future events, often leading to more realistic judgements. Depressive realism theory would predict that dysphoria is associated with greater "accuracy" in affective forecasts—less overall error. The relative merit of either theory in the forecasting domain remains an open question (see B. D. Dunn et al., 2007; Rinck & Becker, 2005, for reviews), implicating the need for studies directly testing the role of dysphoria in affective forecasting.

Two known studies have addressed this issue (Werhan, 2009; Yuan & Kring, 2009), yielding null or inconsistent findings. These investigations compared groups of high (>18) and low (<10) scorers on the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996), with neither study finding a consistent relationship between depression severity and biased forecasts for laboratory stimuli. Specifically, the first study found that depressive symptoms were unrelated to the accuracy of affective forecasts in a dating game involving confederates (Werhan, 2009). In a second study involving affective forecasting about a gambling task, depressive symptoms were unrelated to the accuracy of affective forecasts about contentment, irritation, and disappointment, but were associated with a small tendency to overestimate happiness, contrary to both depressive realism theory and cognitive theory (Yuan & Kring, 2009). Potential limitations included the use of artificial laboratory stimuli, reliance upon a single depression measure, lack of attention to co-occurring symptoms, and low power, supporting the need for a follow-up investigation.

In order to study emotional reactions in a real-world context, the current investigation examined affective forecasting for Valentine's Day of 2007 among young adults. Previous forecasting studies have demonstrated success in studying emotionally evocative relational events in early adulthood (Gilbert et al., 1998; Tomlinson et al., 2010), including Valentine's Day of 2006 (Hoerger & Quirk, 2010). These studies document that people typically overpredict positive reactions to relational events that are normatively considered to be pleasant (e.g., starting a new relationship, having a date on Valentine's Day, etc.) and overpredict negative reactions to events considered unpleasant (e.g., enduring a break up, being dateless on

Valentine's Day, etc.). Although we expected a normative overprediction bias, our investigation focused on the role of dysphoria in affective forecasting problems. Depressive realism theory was pitted directly against cognitive theory, with the former predicting dysphoria to be associated with increased overall forecasting accuracy, and the latter predicting dysphoria to be associated with forecasts that were more inaccurate and negatively biased. In addition to measuring dysphoria, we also assessed symptoms of anxiety and hypomania. These three symptom domains often overlap, and the measurement of potential confounds is a necessary and often overlooked step in ruling out alternative explanations, such as the possibility that observed findings are due to nonspecific stress or emotionality, rather than dysphoric symptoms in particular (B. D. Dunn et al., 2007; Gruber, Oveis, Keltner, & Johnson, 2011; Rinck & Becker, 2005). Further, building on prior studies (Werhan, 2009; Yuan & Kring, 2009), we enhanced statistical power by using repeated observations of forecasting behaviour, administering multiple measures of symptoms, and operationalising dysphoria as a continuous construct. Through this design, we aimed to answer the following question: Is dysphoria associated with affective forecasting?

METHOD

Participants

Participants ($n = 339$) were recruited from a broader subject pool at a large Midwestern university in the USA to complete a study on affective forecasting about Valentine's Day. Those providing complete data ($n = 325$) were included in the present analyses. Participants were 18 to 38 years old ($M = 19.8$, $SD = 2.1$), more often in a relationship (54.8%), and predominantly female (80.3%) and white (92.6%). All analyses involving symptom measures controlled for gender, though gender differences in affective forecasting were negligible ($R^2 < .01$, $ps > .15$). Further, following prior research (see Hoerger & Quirk, 2010), subgroup analyses examined those having a date on Valentine's Day (presumed pleasant event; $n = 88$, 27.1%) versus not having a date (unpleasant event; $n = 237$, 72.9%). Being in a relationship was correlated, but not synonymous, with having a date on Valentine's Day, $\Phi = .37$, $p < .001$, presumably due to long-distance relationships, school workload, and other factors. Finally, dating status was unrelated to scores on symptom measures (depression, anxiety, and hypomania) in the present sample ($R^2 < .01$, $ps > .20$).

Procedures

All study measures were administered online via SurveyMonkey.com, due to the benefits of internet-mediated research for recruitment, longitudinal retention in short-term studies, and real-time data collection (Hoerger, Quirk, & Weed, 2011). A month prior to Valentine's Day of 2007, participants completed several symptom measures, including the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977), Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995), and General Behaviour Inventory (GBI; Depue et al., 1981). Participants also rated what they predicted their emotional states would be on the evenings of Valentine's Day and each of the two subsequent days, both in the event of having a date and not having a date. Then, on Valentine's Day and each of the two subsequent days (after 8 p.m.), they rated the actual emotional states they were currently experiencing. On Valentine's Day, they also reported whether they had a date ("Did you go on a date for Valentine's Day?"). Although participants predicted their reactions both to having and not having a date, predicted reactions were only retained for the event they later experienced (i.e., daters' predicted reactions to having a date; non-daters' predicted reactions to being dateless).

Measures

CES-D. The 20-item CES-D (Radloff, 1977) is a self-report survey of depression symptom severity. Participants rated the severity of symptoms (e.g., "I had crying spells") experienced during the

prior week, using a scale from 0 (*Rarely or none of the time, <1 day*) to 3 (*Most or all of the time, 5–7 days*). Scores on the measure have previously shown evidence for predictive validity, construct validity, and favourable item discrimination when compared to the BDI-II (Zich, Attkisson, & Greenfield, 1990).

DASS. The 21-item DASS (Lovibond & Lovibond, 1995) is a self-report inventory of symptoms of depression, anxiety, and stress. Participants rated the degree to which symptoms (e.g., "I felt that life was meaningless") applied to themselves over the past week, using a scale from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much, or most of the time*). The depression and anxiety subscales were used in this study, and scores from these scales have previously shown evidence for construct validity (Lovibond & Lovibond, 1995).

GBI. The 73-item GBI (Depue et al., 1981) screens for symptoms of bipolar disorder. Participants rated the lifetime frequency of symptomatic behaviours (e.g., "Have there been periods of time when you felt a persistent sense of gloom?"), using a scale from 1 (*Never or hardly ever*) to 4 (*Very often or almost constantly*). Participants did not report on suicidal ideation (item #73) due to Institutional Review Board (IRB) concerns; this item was scored as a 1 for all participants. Scores on these depression and hypomanic subscales of the GBI have previously shown validity in identifying unipolar depression and bipolar disorder (Depue et al., 1981).

Emotion ratings. Participants rated predicted and actual emotional reactions for Valentine's Day and each of the two subsequent days. Participants rated all reactions along six emotion words identified through pilot testing to be sensitive to Valentine's Day: happiness, sadness, pleasure, gloominess, enjoyment, and misery. Using previously established procedures (e.g., Gilbert et al., 1998; Hoerger & Quirk, 2010), predicted ratings were made both for the hypothetical scenarios of having and not having a date, for all three days, along all six emotion words (36 ratings, e.g., "Please rate how you expect to feel at the end of the day on Valentine's Day (2/14) if you have a date, in terms of . . . Happiness" or "Please rate how you expect to feel two days after Valentine's Day (2/16) if you don't have a date on Valentine's Day, in terms of . . . Enjoyment"). Actual emotional reactions were then obtained on Valentine's Day and the two subsequent days, using comparable response scales (e.g., "Please rate how you currently feel, in terms of . . . Happiness"). Responses were rated on 9-point Likert-type scales (e.g., 1 = *Not at all happy*, 9 = *Extremely happy*). Predicted and actual ratings were examined for positive affect, negative affect, and a composite mood scale. Positive affect and negative affect ratings were highly correlated, average $r = -.69$, $p < .001$. Analyses used the composite mood scale unless otherwise noted. The emotion ratings scales demonstrated excellent internal consistency across predicted and actual ratings for positive and negative affect, among daters and non-daters, across all three days (average $\alpha = .91$).

Statistical analyses

Data reduction. Scores on the CES-D, DASS-Depression subscale, and GBI-Depression subscale were highly correlated (average $r = .74$, $p < .001$) and yielded similar results in core analyses. Principal axis factoring was used to combine scores on these three measures into a composite indicator of dysphoria, accounting for common variance across depression symptom measures. The dysphoria factor accounted for 75% of the variance in individual measures and was used in all reported analyses.

Findings were similar across all three days (Valentine's Day, Day 2, and Day 3), so we collapsed emotion ratings across days for all reported analyses, providing composite indicators of predicted mood and actual mood. Supplemental analyses report effect sizes separately for positive and negative affect ratings, as well as daters and non-daters. Interactions on these variables were non-significant, but we caution

that the study was not powered to explore interactions.

Analytic approach. First, we conducted analyses of basic descriptive statistics. Second, we examined the association between symptom scores and affective forecasting problems. Affective forecasting research (Tomlinson et al., 2010) has distinguished between two levels of forecasting problems: overall inaccuracy (total error) and particular forecasting biases (errors in a particular direction, such as toward negativity or positivity). Thus, we examined both inaccuracy and bias. Inaccuracy was measured as the average deviation between predicted and actual ratings (see E. W. Dunn et al., 2007). Bias scores were calculated using residualised difference scores (Cohen, Cohen, West, & Aiken, 2003; Hand & Taylor, 1987), or the residual variation in predicted reactions (averaged across days and six emotion ratings), after using regression to control for actual reactions (see Hoerger & Quirk, 2010). These bias scores represent variation in predicted reactions that is unaccounted for by actual emotional reactions. Residualised difference scores are more appropriate than simple difference scores for determining bias when the intention is to correlate bias scores with other measures, and have advantages for interpretability and replicability (Cohen et al., 2003; Hand & Taylor, 1987); nonetheless, we also footnote findings for simple difference scores. Finally, acknowledging that researchers disagree as to whether psychopathology is best understood on a continuum or as a discrete phenomenon, we included post hoc analyses examining our findings using dysphoria as a categorical, rather than continuous, variable.

RESULTS

Descriptive overview

The sample's descriptive statistics for the symptom measures were as follows: CES-D ($M = 14.52$, $SD = 9.00$), DASS-Depression ($M = 2.50$, $SD = 3.10$), GBI-Depression ($M = 71.26$, $SD = 21.96$), DASS-Anxiety ($M = 2.18$, $SD = 2.67$), and GBI-Hypomania ($M = 33.18$, $SD = 8.25$). Scores on the dysphoria factor were correlated with anxiety symptoms on the DASS-Anxiety subscale ($r = .63$, $p < .001$) and with lifetime hypomanic symptoms on the GBI-Hypomania subscale ($r = .46$, $p < .001$).

Averaging across days, daters predicted Valentine's Day to be a more pleasant event than did non-daters, $d = 0.75$, $t(323) = 14.84$, $p < .001$. Consistent with the normative tendency to overpredict the intensity of emotional reactions, daters' predicted reactions ($M = 7.86$, $SD = 0.87$) were more pleasant than their actual reactions ($M = 7.42$, $SD = 1.01$), $d = 0.57$, repeated-measures $t(87) = 5.35$, $p < .001$, and non-daters' predicted reactions were more unpleasant ($M = 5.96$, $SD = 1.37$) than their actual reactions ($M = 6.59$, $SD = 1.13$), $d = 0.56$, repeated-measures $t(236) = 8.44$, $p < .001$. The average correlation between predicted and actual reactions was $r = .50$, $p < .001$.

Dysphoria was associated with negative predicted and actual reactions, and accounted for 11% more variance in predicted reactions ($r = -.61$, $p < .001$) than actual reactions ($r = -.51$, $p < .001$) on the composite mood scale, which was a statistically significant difference, $Z = 2.45$, $p = .01$.

Dysphoria and affective forecasting problems

Table 1 summarises the association between symptoms and affective forecasting problems. The correlations indicate that symptoms of dysphoria, anxiety, and hypomania were associated with affective forecasting that was more inaccurate and negatively biased. However, upon entering dysphoria, anxiety, and lifetime hypomanic symptoms into simultaneous regression analyses, only dysphoria was uniquely associated with affective forecasting inaccuracy and bias. This finding was upheld for negative affect ratings, positive affect ratings, and the composite

Table 1. *Dysphoria is associated with greater inaccuracy in affective forecasting due to a negative bias in prediction, including when controlling for anxiety symptoms and lifetime hypomanic symptoms*

	Prediction inaccuracy						*Negative bias*					
	Negative affect		*Positive affect*		*Composite mood*		*Negative affect*		*Positive affect*		*Composite mood*	
Measure	*r*	*β*	*r*	*β*	*r*	*β*	*r*	*β*	*r*	*β*	*r*	*β*
Dysphoria factor	.36***	.34***	.19***	.16*	.32***	.29***	.43***	.41***	.37***	.40***	.44***	.45***
Anxiety	.24***	0.01	.10	−0.04	.20***	−0.01	.27***	0.02	.21***	−0.01	.27***	0.00
Hypomania	.20***	0.04	.14*	−0.08	.20***	0.06	.20***	0.00	.12*	−0.06	.18**	−0.03

Notes: $n = 325$. Dysphoria factor is the principal axis factor based on the CES-D, GBI-Depression, and DASS-Depression scales. Anxiety is the DASS-Anxiety subscale. Hypomania is lifetime symptoms on the GBI-Hypomania subscale. β = standardised beta, when the dysphoric factor, anxiety, and hypomania scores are entered into a simultaneous regression equation. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

mood scale.[1] In subgroup analyses of daters and non-daters (not shown tabularly), dysphoria was still associated with greater inaccuracy (daters: $r = .32$, $p < .001$; non-daters: $r = .31$, $p < .001$) and bias (daters: $r = .50$, $p < .001$; non-daters: $r = .40$, $p < .001$). Findings were consistent with hypotheses derived from cognitive theory because dysphoria was associated with negatively biased predictions and greater overall inaccuracy.

Post hoc analyses examined findings using a dichotomous operationalisation of dysphoria (10%–90% split). According to interpretive guidelines (Lovibond & Lovibond, 1995; Zich et al., 1990), participants in the top 10% ($n = 33$) of the dysphoria factor were in the major depression range on the CES-D ($M = 32.39$, $SD = 5.74$) and moderate depression range on the 21-item DASS ($M = 9.45$, $SD = 3.73$), whereas participants in the bottom 90% ($n = 292$) were in the normal range on both scales (CES-D: $M = 12.50$, $SD = 6.80$; DASS: $M = 1.72$, $SD = 1.75$). Participants in the high dysphoria group demonstrated greater affective forecasting inaccuracy than the comparison group on negative affect ratings, $d = 0.80$, $t(323) = 4.34$, $p < .001$, positive affect ratings, $d = 0.52$, $t(323) = 2.81$, $p = .005$, and the composite mood scale, $d = 0.76$, $t(323) = 4.14$, $p < .001$. As shown in Figure 1, the high dysphoria group was approximately 1 *SD* more negatively biased than the comparison group for negative affect ratings, $d = 1.10$, $t(323) = 5.93$, $p < .001$, positive affect ratings, $d = 0.81$, $t(323) = 4.40$, $p < .001$, and the composite mood scale, $d = 1.08$, $t(323) = 5.79$, $p < .001$.[2] Thus, post hoc categorical analyses also supported hypotheses derived from cognitive theories of depression.

DISCUSSION

This is the first study of which we are aware to show a relationship between mood symptoms and affective forecasting problems. Findings support what we call a *dysphoric forecasting bias*—the tendency of individuals in dysphoric states to overpredict negative emotional reactions to future events. The dysphoric forecasting bias was robust across ratings of positive and negative affect, forecasts for pleasant and unpleasant scenarios, continuous and categorical operationalisations of dysphoria, and three time points of observation.

[1]Residualised difference scores are the preferable option for calculating affective forecasting bias in this context (Cohen et al., 2003; Hand & Taylor, 1987). If bias were calculated using simple difference scores, the correlation between dysphoria and bias on the composite mood scale would be $r = .35$, $p < .001$, instead of $r = .44$, $p < .001$.

[2]If bias were calculated using simple difference scores, this effect for the composite mood scale would be $d = 0.47$, $t(323) = 2.45$, $p = .01$.

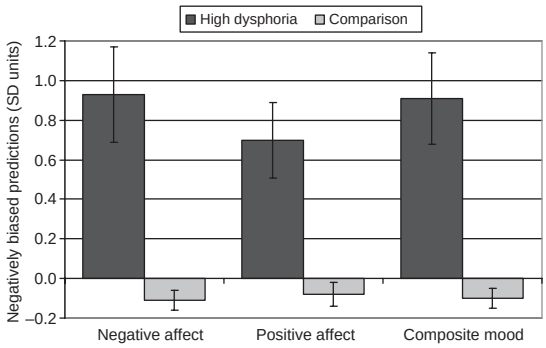

Figure 1. *High dysphoria participants are more negatively biased in affective forecasting than comparison participants. n = 325. High dysphoria = top 10% (n = 33) on the dysphoria factor. Comparison = bottom 90% (n = 292) on the dysphoria factor. Dysphoria scores were determined using principal axis factoring, based on the CES-D, DASS-Depression, and GBI-Depression scales.*

Furthermore, dysphoric symptoms were independently associated with biased forecasts in analyses controlling for anxiety symptoms and lifetime hypomanic symptoms. In order to elucidate the dysphoric forecasting bias, we built upon the strengths and limitations of prior studies (Werhan, 2009; Yuan & Kring, 2009) and used theory to guide hypotheses (Allan et al., 2007; Alloy & Abramson, 1988; Beck, 1976).

Our findings suggest that cognitive theory (Beck, 1976) better accounted for the dysphoric forecasting bias than did depressive realism theory (Allan et al., 2007; Alloy & Abramson, 1988). This reinforces therapeutic efforts to address cognitive-emotional distortions in depression, and raises the question of whether bias-reduction strategies that have shown promise in basic affective forecasting research (e.g., Hoerger et al., 2009, 2010) might also have practical benefit for treating aspects of clinical depression. Given that depressive realism theory has garnered support in other research contexts, particularly those involving self-evaluation and risk perception (B. D. Dunn et al., 2007), the theory's explanatory power may be greater for task domains involving rational judgements than those involving intuitive emotional processes, such as affective forecasting. Finally, our findings could differ from past investigations of affective forecasting in dysphoria (Werhan, 2009; Yuan & Kring, 2009) due to methodological differences, including the emotional events, sample characteristics, or other moderators.

Findings also contribute more broadly to our understanding of dysphoria in affective forecasting. Consistent with prior research (E. W. Dunn & Laham, 2006; Gilbert et al., 1998; Hoerger & Quirk, 2010; Hoerger et al., 2009, 2010), participants were found to overpredict positive emotional reactions to a future pleasant event (having a date) and overpredict negative reactions to an unpleasant event (not having a date). However, these normative biases are not universal, as dysphoria was associated with negatively biased expectations for pleasant and unpleasant events. Thus, findings support the importance of further research on dysphoria as well as other symptoms of psychopathology in affective forecasting, and provide continued support for the relevance of basic emotion research in differentiating between various forms of psychopathology (Gruber et al., 2011).

Several limitations of the present investigation can be noted. Results were based on a sample of young, primarily white, college students, assessed using self-report measures rather than a structured clinical interview, and our hypomania measure tapped total lifetime symptoms rather than just state hypomania. The generalisability of findings to older adults, diverse participants, community samples, and clinical samples warrants further study. Further, findings were based on affective forecasting for a particular target event. Situational moderators, such as interpersonal or achievement salience, could differentially impact the activation of dysphoric schemas, influencing observed effects.

The study was also balanced by several strengths. One, the study maximised power. Two, measurement reliability was strong. Multiple observations of affective forecasting were aggregated, and we incorporated multiple indicators of dysphoria. Three, the study included measures of anxiety symptoms and lifetime hypomanic symptoms to test for potential confounds. Finally, study hypotheses were grounded

in existing theories of information processing in depression.

Future studies on forecasting biases can examine mediators, decisional consequences, and other domains of psychopathology symptoms. Foremost, drawing upon cognitive theory (Beck, 1976; Rinck & Becker, 2005), researchers can begin by investigating information processing constructs that explain the relationship between dysphoria and biased forecasts. For example, affective forecasting research indicates that people often rely upon their memory of emotional reactions to prior personal experiences when predicting reactions to relevant future events (E. W. Dunn & Laham, 2006). It could be that negativistic biases in autobiographical memory or selective attention perpetuate affective forecasting problems for individuals in dysphoric states (Joormann & Gotlib, 2010). Second, the decisional consequences of the dysphoric forecasting bias also warrant further attention. For example, cognitive theory emphasises that negatively biased future expectations lead to behaviours that maintain depression, such as rumination or social withdrawal (Rinck & Becker, 2005). Furthermore, in contexts that are normatively highly emotional, such as healthcare decision making, people often regulate negative anticipatory emotions through decisional avoidance. Thus, researchers might examine whether individuals in dysphoric states are more avoidant of proactive behaviours or behavioural intentions, such as seeking genetic screening for hereditary disorders, getting tested for HIV, or inquiring about palliative care in the end of life. Finally, a potentially fruitful line of research would involve examining affective forecasting within the context of other domains of psychopathology symptoms. For example, symptoms of social avoidance may be more related to affective forecasts than actual hedonic experience (Quirk, Subramanian, & Hoerger, 2007). Further, among individuals with suicidal ideation, changes in affective forecasting could increase risk of suicide attempts. Thus, findings suggest the need for a network of related studies on psychopathology and affective forecasting.

In closing, this study provides compelling evidence for a dysphoric forecasting bias, consistent with the cognitive theory of depression. These findings contribute to the generalisability of research on affective forecasting problems, demonstrate that forecasting biases vary substantially across individuals, and implicate the need for further research on the role of psychopathology in affective forecasting.

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