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Biases in Short-Term Mood Prediction in Individuals with Depression and Anxiety Symptoms

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Abstract

We used ecological momentary assessment to explore depressive and anxious biases in within-day negative and positive mood predictions. Participants (N = 120) who were higher in depression symptoms demonstrated stronger biases (i.e., were more pessimistically biased) in the prediction of negative mood and weaker biases (i.e., were less optimistically biased) in the prediction of positive mood (b_{01} = .002, SE = .001, p = .031 and b_{01} = −.008, SE = .002, p < .001, respectively). Anxiety symptoms were not associated with short-term mood prediction biases (p's > .10). Such biases might influence daily decisions and experiences as well as impact longer-term outcomes. Limitations and future research directions are discussed.

Keywords

depression; anxiety; experience sampling; affective forecasting

Introduction

The average person exhibits an impact bias in affective forecasting. That is, we tend to overestimate both the intensity and duration of our emotions in response to particular events (Wilson & Gilbert, 2005). Since most of the decisions we make are based on the pain or pleasure that we expect our choices to bring, the impact bias could have negative repercussions. An incorrect positive expectation could drive someone to a goal which in the end would disappoint. A false negative prediction could cause someone to avoid an advantageous opportunity.

However, some believe that the impact bias may have adaptive functions (Wilson & Gilbert, 2005). With regard to positive affective predictions, for example, not only do people tend to be more optimistic than accurate, but they also believe that they *should be even more optimistic* than they are, even if they know that such optimism is unrealistic (Armor, Massey, & Sackett, 2008). Unrealistic optimism might be beneficial at times. For example, someone who believes that he will feel permanently elated if he loses excess weight will probably be more likely to change unhealthy diet and exercise habits than someone who (more correctly) believes that he will experience a less intense and shorter-lasting mood

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boost. Similarly, someone who expects an enduring increase in her self-esteem if she gets a graduate degree might be more likely to push herself academically and professionally than someone who suspects that her sense of achievement will be more short-lived.

Importantly, research has only recently begun to consider the influence of individual difference variables on affective forecasting biases. Such work is vital because between-person factors might impact the strength or direction of these biases. People high in emotional intelligence appear to be more accurate forecasters (Dunn, Brackett, Ashton-James, Schneiderman, & Salovey, 2007; Hoerger, Chapman, Epstein, & Duberstein, 2012). Coping style (Hoerger, Quirk, Lucas, & Carr, 2009), working memory capacity (Hoerger, Quirk, Lucas, & Carr, 2010), personality (Hoerger & Quirk, 2010), dysphoria (Hoerger, Quirk, Chapman, & Duberstein, 2012), and attachment style (Tomlinson, Carmichael, Reis, & Aron, 2010) have also been linked with accuracy of affective forecasts.

We previously found that depression symptoms were associated with stronger negative mood prediction biases and weaker positive mood prediction biases over the course of a week, while anxiety symptoms were associated only with stronger negative mood prediction biases (Wenze, Gunthert, & German, 2012). In the present study we used experience sampling to determine whether these biases held over very short timeframes (i.e., over the course of several hours). Such biases might impact short-term decision-making and planning; if one thinks one is going to be in a bad mood in the upcoming few hours, it could impact the activities, social functions, and everyday routines in which one chooses to engage. Further, the accumulation of small errors in affective forecasting could be harmful in the long-term, for example, by serving to maintain or exacerbate symptoms of depression or anxiety. As far as we are aware, no research attention has been paid to biases in within-day affective forecasting.

Information-Processing Biases in Anxiety and Depression

The convergent validity of both self-report and clinical ratings of anxiety and depression has called into question the precise nature of the relationship between the two disorders (Clark & Watson, 1991). Further, individuals with depression symptoms and those with anxiety symptoms exhibit similar information-processing biases, such as biased judgments of the probability that negative events will happen to them (Butler & Mathews, 1983; Williams, Watts, MacLeod, & Mathews, 1988). However, there are some differences in the information-processing biases they each present. For example, depressed individuals estimate that they have less control than non-depressed individuals and display pessimism about both future and past events (Mineka & Sutton, 1992; Pyszcynski, Holt, & Greenberg, 1987). Alternatively, compared to non-anxious individuals, anxious individuals show heightened attention to threatening and ambiguous cues in the environment (Eysenck, Mogg, May, Richards, & Matthews, 1991). Of relevance, Clark and Watson's (1991) tripartite model posits that anxiety and depression share a common, general distress factor (i.e., elevated levels of negative mood) but also possess specific factors that are uniquely characteristic of each; low positive affect is specifically associated with depression, while somatic arousal is the distinguishing feature of anxiety.

Anxiety and Depression in Affective Forecasting

Since anxiety is characterized by hyper-vigilance toward future threat and high levels of negative mood, one might expect that anxious individuals would be negatively biased regarding future negative mood (Mineka & Sutton, 1992). However, anxiety appears unrelated to positive mood levels, so positive mood predictions might resemble those of non-anxious, non-depressed individuals (which is to say, optimistically biased; Clark & Watson, 1991). On the other hand, depression involves pervasive pessimism, which affects predictions about the future (Pyszcynski et al., 1987), and is associated not only with high levels of negative mood, but also low levels of positive mood (Clark & Watson, 1991). As such, depressed individuals might anticipate experiencing more negative mood and less positive mood than non-depressed individuals.

We found support for these patterns in a previous report from the current dataset, in which we investigated the relationship between depression and anxiety symptoms and biases in affective forecasting and recall over the course of a week (Wenze et al., 2012). In that study, participants were asked to predict and remember the average amount of a range of positive and negative emotions that they would feel (or felt) during that week. Participants who were higher in depression demonstrated stronger negative mood prediction biases, marginally stronger negative mood recall biases, and weaker (i.e., less optimistic) positive mood prediction and recall biases. Participants who were higher in anxiety demonstrated stronger negative mood prediction biases, but positive mood prediction biases that were on par with those who were lower in anxiety. Anxiety was not associated with mood recall biases. Our findings were not explained by bias in event prediction, giving undue weight to the most significant anticipated (or remembered) event (i.e., focalism), or peak or final mood recall.

The present study is focused on within-day affective forecasting; we sought to determine whether the aforementioned biases were evident over an even shorter timeframe (i.e., 3–4 hours). The accumulation of small errors in predictions about mood states in the very short-term future could impact decision-making and planning on a daily basis in ways that ultimately serve to maintain or exacerbate negative mood. We hypothesized that participants who were higher in depression symptoms would display greater bias in the prediction of negative mood and less bias in the prediction of positive mood, while participants who were higher in anxiety symptoms would display greater bias only in the prediction of negative mood.

Method

Participants

One hundred and fifty-one undergraduate students were recruited from psychology classes and were compensated with course extra credit and cash. Two participants withdrew after consenting. We discarded 29 (12 male, 17 female) participants' data because they did not complete at least 14 (50%) of the PDA assessments. Included participants' depression and anxiety scores did not differ from the scores of participants who were not included ($t(148) = -1.084$, $p = .231$; $t(148) = -0.577$, $p = .371$, respectively). Our final sample included 120 participants (81 women, 39 men); 75% were Caucasian, 4% were African American, and

8% were Asian American. Nine percent identified as another ethnicity and 4% did not answer this question. Participants ranged in age from 18 to 25 (M = 19.720, SD = 1.579).

Procedure

The current study was an outgrowth of an earlier investigation using the same dataset, in which we explored affective forecasting and recall biases over the course of a week (Wenze et al., 2012). Participants completed a measure of depression and anxiety symptoms and rated the degree to which they expected to feel a range of positive and negative emotions over the course of the following week. They also judged the likelihood of a variety of positive and negative events occurring during that week, described their most significant anticipated event during that timeframe, and predicted their affective reactions to that event. For the next seven days, participants recorded their mood four times a day on a PDA. At the end of the week, they completed retrospective measures of mood and events. This design allowed us to compare mood predictions and recall with actual mood experiences, to differentiate between affective forecasting biases and event forecasting biases, and to determine whether focalism underlies affective forecasting and recall biases.

In the present paper we focus on very short-term affective forecasting biases, by using the depression and anxiety scores obtained at the baseline study visit, as well as data obtained from the 28 momentary assessments. During the study week, the PDA alarm sounded four times a day between 11:00AM and 10:00 PM on a semi-random schedule (between-class timeslots were over-sampled). Alarms sounded on average every 3 hours and 25 minutes (205.190 minutes; SD = 31.140), and alerted participants to respond to questions assessing positive and negative mood, as well as predictions about positive and negative mood at the next momentary assessment.

Measures

Depression and Anxiety Symptoms—Since a primary goal of this study was to distinguish between the effects of depression and anxiety symptoms on short-term mood prediction biases, we used the Mood and Anxiety Symptom Questionnaire (MASQ; Watson & Clark, 1991) as our measure of depression and anxiety. The MASQ is a 62-item self-report measure that is based on Clark and Watson's (1991) tripartite model of depression and anxiety. The MASQ differentiates between the general distress that is common to both depression and anxiety (via the 11-item General Distress Anxious Symptoms [GDA] subscale and the 12-item General Distress Depressive Symptoms [GDD] subscale), symptoms such as low positive affect and loss of interest that are unique to depression (via the 22-item Anhedonic Depression [AD] subscale), and symptoms such as somatic arousal that are unique to anxiety (via the 17-item Anxious Arousal [AA] subscale). Sample items include "was trembling or shaking" (AA), "felt like nothing was very enjoyable" (AD), "felt uneasy" (GDA) and "felt sad" (GDD). MASQ items are rated on a 5-point scale (1 = *not at all*, 5 = *extremely*). We used the specific, rather than general, subscales in order to tap into the unique effects of depression and anxiety symptoms. Hence, we used the AD subscale as our depression measure and the AA subscale as our anxiety measure. Internal reliability was high for both subscales (Cronbach's alpha = .938 and .850, respectively).

Momentary Mood and Short-Term Mood Predictions—At each momentary assessment, participants specified the extent (1 = *not at all*, 7 = *a lot*) to which they were currently feeling each of 6 negative mood items (*sad, angry, nervous, jittery, hostile, lonely)* and 4 positive mood items (*happy, enthusiastic, excited, content*). Items were drawn from the Positive and Negative Affect Schedule–Expanded Form (PANAS-X; Watson & Clark, 1994) and from previous studies of affective forecasting (Buehler & McFarland, 2001). They also used the same 7-point scale to indicate the amount of each emotion that they expected to feel at the *next* momentary assessment. Negative mood items and negative mood prediction items were moderately inter-correlated (Cronbach's alpha = .664 and .661, respectively; Snijders & Bosker, 1999). Positive mood items and positive mood prediction items were strongly inter-correlated (Cronbach's alpha = .831 and .775, respectively). Momentary negative and positive mood were negatively correlated at the between-person ($r(2561) = -.282$, $p < .001$) and within-person levels ($r(2561) = -.400$, $p < .001$).

Results

Descriptive Analyses

All analyses were conducted using SPSS 19.0 and HLM 6.01. Average AD and AA scores (56.378 [*SD* = 15.316] and 25.716 [*SD* = 8.014], respectively) were comparable to what has been reported in similar populations (Buckby, Yung, Cosgrove, & Killackey, 2007). AD and AA scores were moderately correlated ($r(118) = .408$, $p < .001$). Included participants completed an average of 21 usable momentary assessments (range = 14 to 28). We included data from all assessments that were completed a minimum of 2 hours apart. If 2 or more assessments were completed less than 2 hours apart, we included the assessment that was completed soonest after the alarm and deleted all others. AD and AA scores were not associated with number of assessments completed ($r(118) = -.146$, $p = .112$; $r(118) = -.141$, $p = .127$, respectively). The median amount of time it took to initiate an assessment in response to the alarm was 180 seconds. Participants answered 75% of the momentary assessments within 15 minutes.

Affective Forecasting

Experienced mood—We used a multilevel modeling design to calculate mean scores and SDs for momentary items (Bryk & Raudenbush, 1992), and to predict momentary outcomes as a function of depression and anxiety. For example, the level 1 regression equation modeling the average momentary negative mood in our sample is:

$$\mathrm{NM}_{ij} = \pi_{0i} + e_{ij}$$

where NM_{ij} is participant i's negative mood at assessment j; π_{0i} is the intercept (the average negative mood for person i); and e_{ij} is the error term for person i. At level 2, we estimate how depression and anxiety symptoms affect the average momentary negative mood across the week. The level-1 intercept is modeled as a function of an intercept component, two slope components (reflecting the effects of depression and anxiety), and a random error component:

$$\pi_{0i}=b_{00}+b_{01}(\mathrm{MASQ-AD})+b_{02}(\mathrm{MASQ-AA})+r_{0i}$$

Because AD and AA scores are grand mean centered, b_{00} is the average negative mood in our sample (negative mood for the person with an average level of depression and anxiety symptoms), b_{01} is the change in negative mood for every point increase on the MASQ-AD, and b_{02} is the change in negative mood for every point increase on the MASQ-AA.

On average, participants reported low levels of negative momentary mood (M = 1.786 [SD = 0.585]) and moderate levels of positive momentary mood (M = 3.450 [SD = 0.819]). Depression and anxiety symptoms significantly and independently predicted negative mood (b_{01} = .012, SE = .003, p < .001; b_{02} = .022, SE = .006, p < .001, respectively). Depression symptoms predicted positive mood (b_{01} = −.031, SE = .004, p < .001) but anxiety symptoms did not (b_{02} = .004, SE = .007, p = .605). In sum, participants with more depression symptoms experienced more negative mood and less positive mood than those with fewer depression symptoms, while those with more anxiety symptoms only experienced more negative mood.

Predicted mood—Participants predicted that they would experience low levels of negative mood (M = 1.780 [SD = 0.660]) and moderate levels of positive mood (M = 3.603 [SD = 0.943]) at the next assessment. Depression symptoms and anxiety symptoms significantly and independently predicted negative mood predictions (b_{01} = .015, SE = .003, p < .001; b_{02} = .021, SE = .007, p = .005, respectively). Depression symptoms predicted positive mood predictions (b_{01} = −.039, SE = .005, p < .001) but anxiety symptoms did not (b_{02} = .010, SE = .008, p = .214). In other words, participants with more depression symptoms predicted that they would experience more negative mood and less positive mood than those with fewer depression symptoms, while participants with more anxiety symptoms only predicted that they would experience more negative mood.

Short-term mood prediction biases—Our primary research question was whether depression or anxiety symptoms influence bias in short-term affective predictions. To answer this question, we first computed bias in negative and positive mood predictions for each participant at each momentary assessment. We operationalized short-term bias as the difference between previously-predicted and current negative and positive mood. Positive values represent over-prediction of mood and negative values represent under-prediction of mood.

The average short-term negative mood prediction bias in our sample was not significant (b_{00} = −.016, SE = .016, p = .316). Across the sample, participants tended to be unbiased in their predictions about negative mood at the subsequent assessment. Depression scores significantly predicted short-term negative mood prediction bias (b_{01} = .002, SE = .001, p = .031), such that those participants who were higher in depression showed stronger prediction bias for negative mood at the next assessment. Anxiety did not predict short-term negative mood prediction bias (b_{02} = −.002, SE = .002, p = .523).

Across the sample, participants tended to over-predict positive mood at the subsequent assessment (b_{00} = .144, *SE* = .031, $p < .001$), revealing an optimistic bias in the average participant. Depression symptoms significantly predicted short-term positive mood prediction bias (b_{01} = −.008, SE = .002, $p < .001$), such that participants who were higher in depression showed *less* short-term positive mood prediction bias (and hence were *less optimistically biased*) than those who were lower in depression. Anxiety was not predictive of short-term positive mood prediction bias (b_{02} = .006, *SE* = .004, $p = .132$).

Discussion

We previously demonstrated that anxiety and depression symptoms impact patterns of affective forecasting biases in characteristic ways (Wenze et al., 2012). In the current study we sought to determine whether these patterns are evident over very short timeframes. Such biases could influence daily decisions and experiences as well as impact longer-term outcomes. Additionally, documenting biases over even very short time frames provides some support for the pervasiveness of the affective forecasting bias. If individuals are systematically biased in their projections of their upcoming emotions, even when those projections are focused on just a few hours from now, it speaks to the degree to which these biases are likely manifested on an everyday basis.

Depression Symptoms and Short-Term Affective Forecasting Biases

Consistent with our hypotheses, participants who were higher in depression symptoms were more pessimistic in their predictions about negative mood in the short-term future. In other words, even over *very short periods of time*, these participants tended to believe that their upcoming mood was going to be worse than it was. Conversely, participants who were higher in depression symptoms were more *realistic* regarding their short-term predictions of positive mood. On average, people over-estimated the amount of positive mood they would experience from one momentary assessment to the next. Participants who reported more depression symptoms were *less* biased in their positive mood predictions and thus, they were more realistic.

These results are in accord with our previous research (Wenze et al., 2012). Further, they fit with and extend the tripartite theory (Clark & Watson, 1991) by suggesting that people with symptoms of depression may *expect to experience* more negative mood and less positive mood on a daily basis. Our results are also consistent with research which characterizes depression as a disorder involving pervasive pessimism about both past *and* future events (Pyszczynski et al., 1987). Our findings suggest that this pessimism is so pervasive that it extends to predictions about *emotional* experiences, even within a single day or on a very short-term basis.

Interestingly, our results can be seen as contributing to the long-standing debate over the depressive realism hypothesis. While some studies have suggested that depressed individuals' judgments are more accurate than the judgments of non-depressed individuals, approximately as many studies suggest the opposite (Ackermann & DeRubeis, 1991). The present findings indicate that, at least in a non-clinical sample, realism (i.e., a dampened optimistic bias) and pessimism (i.e., a negative affective forecasting bias) can be seen within

the same individuals at the same time. It remains to be seen whether this effect holds in clinically depressed samples.

The accumulation of small errors in momentary expectations for negative mood (and less optimistic expectations for positive mood) might bode poorly for individuals who are higher in depression symptoms in the long term. We know that repeated negative day-to-day experiences are problematic, particularly for people who report or who are vulnerable to psychiatric distress. For example, daily hassles are more strongly associated with physical health status than major life events (DeLongis, Coyne, Dakof, Folkman, & Lazaurs, 1982) and they predict future psychiatric symptoms (e.g., Monroe, 1983; Tessner, Mittal, & Walker, 2011). Repeated pessimism and/or dampened optimism, even on a small scale, about upcoming mood states might also contribute to future psychiatric symptomatology and other negative outcomes. Further, if these individuals make daily decisions based on their anticipated moods, they might choose to avoid activities, which could prove to be pleasurable and which could ultimately ameliorate negative mood (Fichman, Koestner, Zuroff, & Gordon, 1999).

Finally, individuals who experience less optimism about upcoming positive mood states may be lacking important protective functions afforded by such optimism. For example, optimism can be called upon when a person is faced with a particularly challenging or threatening event (Taylor, 1983; Folkman & Moskowitz, 2000), and has been linked with higher levels of subjective well-being during times of adversity and greater use of adaptive coping strategies (Carver, Scheier, & Segerstrom, 2010). Optimism has also been associated with a broad range of other positive outcomes, including positive health behaviors, better physical health, better interpersonal functioning, higher income, and greater perseverance with respect to educational efforts (Carver et al., 2010). People with depression symptoms may experience this “resource of optimism” (even if it is unwarranted optimism) to a lesser degree and thus may be more vulnerable to psychological, physiological, and environmental stressors.

Anxiety Symptoms and Short-Term Affective Forecasting Biases

Anxiety was unrelated to bias in short-term positive mood prediction, a finding which is theoretically consistent with the tripartite model of anxiety and depression (Clark & Watson, 1991). However, we had expected anxiety to be associated with stronger negative mood prediction biases; we found this to be the case over longer prediction periods in our previous research (Wenze et al., 2012). It could be that participants felt they had a better sense for what their next few hours would be like, than for what their next seven days would be like, and this greater certainty translated to more realistic expectations for short-term negative mood. In other words, although anxiety operates on future potential threat and future ambiguity, over shorter periods of time there is typically less ambiguity about what may or may not occur. Given that anxious people tend to assume the worst in the context of ambiguity, it seems likely that anxiety will have a larger impact over larger time intervals, where there is probably greater uncertainty about what will and will not occur.

Limitations and Directions for Future Research

The focus of this study was on affective forecasting without reference to particular events, and thus our findings are not directly comparable to previous research. Future work should explore whether symptoms of depression and anxiety are associated with affective forecasting biases in response to specific events that might occur in the course of a typical day. For example, do depressed individuals anticipate that their mood will brighten while having coffee with a friend? Do they expect to feel very down after arriving at work? Does someone suffering from anxiety make similar affective predictions? On a related note, future research should examine whether short-term affective forecasting biases do in fact impact daily decision-making behavior. For example, might a person's expectation for sad or lonely mood on a particular day lead them to cancel their coffee plans with their friend or call in sick to work?

Furthermore, our sample was non-clinical and was fairly restricted in that it was comprised of undergraduate students, primarily Caucasian females. It is possible that we would see different patterns of short-term affective forecasting biases in a more diverse, clinical sample. The fact that assessments of depression and anxiety were made via self-report and that momentary mood states were assessed using a limited number of items constitute additional limitations. We would also note that there is no agreed-upon time lag between assessments in experience sampling research, and the optimal lag would probably differ considerably depending on the phenomenon being studied. While this certainly does not invalidate our findings, results might have been different if assessments had been spaced closer together or farther apart. Finally, given the correlational nature of this study, we cannot draw causal conclusions about the relationship between symptoms of depression and biased short-term affective forecasting.

Despite these limitations, the current study represents a first step in our understanding of short-term affective forecasting biases, and the relationship between such biases and depression and anxiety symptoms. To date, the affective forecasting literature has been exclusively focused on longer-term mood predictions, and has only recently considered potentially important individual difference variables. The results of the present study suggest that even when projecting their mood a few hours into the future, people who are experiencing symptoms of depression see negative mood lingering on the horizon and do not anticipate experiencing a great deal of positive mood. Although these effects were modest, the accumulation of small errors regarding future negative mood (and repeated, blunted optimism regarding future positive mood) could be detrimental and could work to maintain or exacerbate depressive symptoms. In future work, it will be important to test whether these moment-to-moment processes prospectively predict the development or maintenance of depression.

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