Mood-Induced Shifts in Attentional Bias to Emotional Information
Predict Ill- and Well-Being

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Previous research has suggested that biased attention toward emotional (typically threatening) stimuli contributes to ill-being (e.g., high levels of anxiety), but its contribution to well-being is less clear. The researchers assessed naturalistic shifts in attentional bias toward threatening and pleasant schematic face cues in response to five induced mood states in college students. They also assessed state anxiety and satisfaction with life concurrently and 3 weeks later. Controlling for concurrent anxiety, a fear-induced shift in attention to threatening cues was associated with increased levels of later anxiety. Controlling for concurrent life satisfaction, a happiness-induced shift in attention to emotional cues (both threatening and pleasant) was associated with increased levels of later life satisfaction. These results suggest that mood-induced changes in deployment of attention to emotional information may accumulate in ways that impact psychological functioning, yet these effects depend on mood state and the emotional cues afforded by the context.

Keywords: attentional bias, emotion induction

Emotions may have evolved as predispositions to action, and as such, the evocation of emotion results in a cascade of experiential, expressive, physiological, neurobiological, and cognitive changes (Bradley & Lang, 2000). One such cognitive effect is a focusing of attention on emotionally salient information in the environment, which may be adaptive in identifying threats or potential resources (Öhman & Mineka, 2001). However, an exaggeration of this preference for emotional stimuli in attention is implicated in elevated anxiety.

Indeed, over the last several decades, an impressive body of research has demonstrated that people with high levels of trait anxiety, including patients with anxiety disorders, exhibit biased attention toward disorder-relevant, emotional, or threatening information (Mathews & MacLeod, 1994; Mogg & Bradley, 1998; Yiend, 2010). For instance, Rutherford, MacLeod, and Campbell (2004) found that compared to people low in trait anxiety, people high in trait anxiety exhibit increased attentional bias toward threat after a period of elevated state anxiety (examination period in college). This result suggests that increases in state anxiety may cause an increased attentional bias to threat in vulnerable (i.e., high trait anxious) individuals. However, as is true of many studies in this literature, the results of Rutherford et al. were essentially correlational. The opposite causal direction is also plausible. Namely, increased attentional bias toward threat in response to an emotional challenge could cause elevations in state anxiety.

Consistent with this possibility, research has demonstrated that attentional biases to emotional information may play a causal role in the experience of anxiety. In a seminal study by MacLeod, Rutherford, Campbell, Ebworthy, and Holker (2002), for example, participants trained to attend to threat experienced elevated anxiety in response to a laboratory stressor. Inspired by this work, other studies have shown that training anxious people to avoid threat on attentional bias tasks results in symptom reduction over time (e.g., Schmidt, Richey, Buckner, & Timpano, 2009; See, MacLeod, & Bridle, 2009). Of interest, individuals appear to differ in the ease with which they acquire attentional bias in these training programs. For instance, Clarke, MacLeod, and Shirazei (2008) found that ease of acquiring a threat bias in an attentional training paradigm predicted shifts in trait anxiety over the first semester of university study. This research design, while intriguing, leaves open the question of whether individual differences in a more reflexive or naturalistic adoption of attention bias (i.e., not in the context of a laboratory-controlled training program) can similarly predict psychological functioning.

In addition, because they focused on trait anxiety, Clarke, MacLeod, and Shirazei’s (2008) intriguing results leave open the question of whether shifts in one’s natural level of attentional bias predict changes in state anxiety. State anxiety, by definition, is a construct that changes over time and varies according to situational factors. As such, it exhibits less stability over time than measures of trait anxiety (Usala & Hertzog, 1991). Importantly, such associations between concurrent level of attentional bias and later changes in state anxiety might critically depend on concurrent
mood state. For example, someone who readily adopts an attentional bias toward threat when induced to feel fear in the laboratory setting may be someone who routinely does so in response to fear- or anxiety-provoking situations in their daily lives, and this may encourage increases in state anxiety over time. This possibility has not previously been investigated.

Finally, whereas some researchers have included positive stimuli in their paradigms in order to explore attentional bias toward emotion (“emotional selectivity”) versus threat (“negative selectivity”; e.g., Rutherford et al., 2004), the bulk of the work on attentional bias to emotional information has clearly focused on attentional bias to threat. Moreover, the majority of existing work has focused on relations between attentional bias to threat and indices of ill-being (e.g., anxiety). Might people also demonstrate attentional biases to positive emotional information? Tamir and Robinson (2007) found that induction of positive moods resulted in attentional bias toward rewarding words, and Wadlinger and Isaacowitz (2006) demonstrated that inducing a positive mood increased attention to peripheral positive and neutral images. In addition, using the logic adopted above for attentional bias to threat and increases in later state anxiety, might someone who readily adopts an attentional bias toward positive cues when induced to feel happiness in the laboratory setting be someone who routinely does so in response to fear-provoking situations in their daily lives? If so, might this encourage increases in well-being (e.g., life satisfaction) over time? To our knowledge, no studies have addressed this important question.

The aim of the current study was to assess the degree to which mood-induced attentional shifts (MIASs) toward both threatening and/or pleasant cues would be associated with changes in state anxiety and life satisfaction over time in college students. We assessed attentional bias toward threatening and pleasant schematic faces using a spatial cueing task before and after induction of two positive (Happy, Mirth), two negative (Sad, Fear), or a neutral mood state. We included two different positive and two different negative inductions in order to determine whether attentional bias depends on the nature of one’s mood state (or if, instead, findings would fall out as a function of positive or negative valence). To assess variation in psychological functioning, we measured self-reported levels of state anxiety and well-being concurrently (along with attentional bias) and again 3 weeks later. We chose 3 weeks as a time period during which we could reasonably expect that participants would have experienced a sufficient number of mood-eliciting events that might prompt MIASs and, therefore, small changes in levels of state anxiety and/or well-being.

In light of the extensive literature documenting mood-congruent effects on cognitive processing (e.g., Bower, 1981; Gilboa-Schechtman, Revelle, & Gotlib, 2000) and the previously reviewed literature on the association between attentional bias to threat and anxiety, we expected that MIAS toward threat would predict changes in state anxiety over the follow-up period. We thought this might emerge only in the negative mood conditions and would be strongest after fearful mood induction. Similarly, we expected that MIAS toward pleasant faces would predict changes in future satisfaction with life. We thought this might be strongest after happy and mirth mood inductions. Importantly, in these analyses, we controlled for current state anxiety and well-being so as to be sure we were assessing individual differences in change in these variables over time. Whereas our primary focus was on predicting changes over time, we also examined whether MIAS to threatening and/or pleasant cues would predict concurrent and future levels of psychological functioning.

Method

Participants

One hundred forty-seven students at Tufts University participated in this study (95 female; 100 Caucasian). The second-largest ethnic group self-identified as Asian American/Pacific Islander (18 participants) and Hispanic/Latino American (11 participants). Participants were randomized to one of five mood conditions, described below. The mean number of days between the initial visit (Time 1) and the 3-week follow-up visit (Time 2) was 23.19 (SD = 5.55); our retention rate was 84.4%. Participants returning for follow-up did not differ from the rest of the sample on age, anxiety, satisfaction with life, or any of our measures of attentional bias.

Materials and Procedures

Mood induction using film clips. At Time 1, all participants viewed a 5.44-minute neutral aquatic clip at the beginning of the experiment as a baseline. In a between-participants manipulation, they were then randomized to one of five mood-induction clips (Happy: Dirty Dancing, n = 29; Mirth: Saturday Night Live clips; n = 31; Neutral: Gosford Park, n = 30; Fear: The Shining, n = 26; Sad: Stepmom, n = 31). Film clips ranged in duration from approximately 5–6 min; they were validated as effective in eliciting the target mood in a pilot study.

Spatial cueing task. At Time 1, participants completed a spatial cueing task (Posner, Walker, Friedrich, & Rafal, 1984) twice, once before, and once after mood induction. This task assessed attentional biases by comparing trials in which a threatening, pleasant, or neutral schematic face cue (from Öhman, Lundqvist, & Esteves, 2001) accurately predicted a target (valid trials) to those in which the cue did not accurately predict the target (invalid trials). As shown in Figure 1, using a valid trial as an example, participants saw two empty rectangles with a fixation cross between them. They were instructed to press the space bar whenever the target, a small black box, appeared in the lower half of one of the boxes. Face cues were presented in the upper half of one of the boxes on each trial.

Each iteration of the spatial cueing task consisted of 120 trials (40 threatening, 40 pleasant, and 40 neutral). The cue was presented on the right for 50% of the trials. It was presented on the left for the remaining 50% of trials. The schematic face accurately predicted the location of the target (valid trials) on 75% of the trials. The schematic face did not accurately predict the location of the target (invalid trials) on the remaining 25% of trials. Participants are generally faster on valid than invalid trials due to an engagement of attention on valid trials (leading to faster responses) and costs associated with having to disengage attention and shift it to the target on invalid trials (leading to slower responses).

To reduce our familywise error rate, we computed composite attentional bias scores (as in Mogg, Holmes, Garner, & Bradley, 2008). Importantly, these composite scores incorporated bias in both engagement and disengagement of attention, because two
recent reviews concluded that attentional biases may be observed in both types of attention (Cisler, Bacon, & Williams, 2009; Yiend, 2010). We calculated one attentional bias score for each mood condition for threatening versus neutral and one for pleasant versus neutral cues, before (pre) and after (post) the mood-induction clip. With threat as an example, these were computed as follows: (RT invalid threat – RT valid threat) – (RT invalid neutral – RT valid neutral). In this example, the composite score represents the extent to which participants oriented their attention toward (RT valid neutral cue > RT valid emotional cue) and had difficulty disengaging from (RT invalid emotional cue > RT invalid neutral cue) threatening versus neutral stimuli. To evaluate shifts in attentional bias from pre- to postmood induction, we then calculated change scores for shifts in attentional bias (Δ = post–pre), yielding a total of 10 composite MIAS scores.

Mood reactivity. At Time 1, participants completed a shortened version of the Profile of Mood States scale (POMS-SF; McNair, Lorr, & Droppleman, 1992) before and after the baseline aquatic clip and again after the mood-induction clip to document the success of the mood inductions. The POMS-SF asks participants to indicate to what extent a series of 37 adjectives describes their current mood (e.g., “grouchy”, “furious”) and yields the same six subscales as the full version of the POMS. We focused on three of these scales (Tension-Anxiety, e.g., “anxious”, “uneasy”; Depression-Dejection, e.g., “sad”, “discouraged”; and Vigor-Activity, a measure of largely positively valenced arousal, e.g., “lively”, “cheerful”, “full of pep”).

Psychological functioning. At Time 1, which is also when participants completed the mood-induction and attentional bias assessment, participants completed self-report measures of current psychological functioning, namely, the Spielberger State-Anxiety Inventory, both state and trait versions (STAI-S and STAI-T, respectively; Spielberger, Gorsuch, & Lushene, 1970), and the Satisfication with Life Scale (SLS; Diener, Emmons, Larsen, & Griffin, 1985). At Time 2, participants returned to the lab and completed the STAI-S and SLS again (see Table 1 for means and standard deviations for Time 1 and Time 2). This was their only task at this second lab session.

Results

Success of Mood Induction

To verify that there were no significant differences in mood state before mood induction, we submitted the prefilm clip POMS-SF measures of Tension-Anxiety, Depression-Dejection, and Vigor-Activity to a one-way analysis of variance (ANOVA) with a between-subjects factor of mood condition. None of these comparisons were significant (smallest \( p = .31 \)). To evaluate whether the mood inductions were successful, we submitted the data to a series of one-way ANOVAs that compared the negative (Sad, Fear), positive (Happy, Mirth), and neutral conditions on postfilm clip POMS-SF factors of interest (Tension-Anxiety, Depression-Dejection, and Vigor-Activity). Mood condition had a significant effect on Tension-Anxiety, \( F(2, 144) = 12.56, p < .001 \), Depression-Dejection, \( F(2, 144) = 19.79, p < .001 \), and Vigor-Activity, \( F(2, 144) = 16.76, p < .001 \).

In follow-up analyses using Fisher’s least significant difference, we determined that people in the negative conditions reported greater levels of Tension-Anxiety and Depression-Dejection than people in either the positive (all \( p < .001 \)) or neutral (all \( p < .01 \)) conditions, who did not differ from one another. People in the positive conditions, on the other hand, reported greater levels of Vigor-Activity than people in the negative (all \( p < .001 \)) or neutral (all \( p < .001 \)) conditions.

Suggesting specificity in the induction of Fear and Sadness, people in the Fear condition reported significantly greater levels of Tension-Anxiety than any of the other conditions (all \( p < .01 \)), whereas people in the Sad condition reported significantly greater levels of Depression-Dejection than any of the other conditions (all \( p < .01 \)). People in both the Happy and Mirth conditions reported greater increases in Vigor-Activity than the other conditions (greatest \( p = .02 \)), but did not differ from one another (\( p = .58 \)).

Spatial Cueing Task

To prepare the spatial cueing task data for analysis, we first computed the number of errors separately by valence and validity at pre- and postmood induction. For each subject, we calculated the mean and standard deviation of response times on the correct trials (99% of the total trials) and deleted all data points lying outside 3 SDs from the mean (see Table 2 for response time means and standard deviations by timing [pre-, postmood induction] and mood condition). The percent of deleted outliers per subject averaged 1.41 (SD = 0.74). One-way ANOVAs comparing the mood

<table>
<thead>
<tr>
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<th>Concurrent (Time 1)</th>
<th>Follow-up (Time 2)</th>
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<tr>
<td>STAI-S</td>
<td>44.31 (8.56)</td>
<td>45.02 (9.44)</td>
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<tr>
<td>SLS</td>
<td>24.41 (6.34)</td>
<td>25.05 (6.41)</td>
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<tr>
<td>STAI-T</td>
<td>42.44 (7.88)</td>
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*Note. STAI-S = State-Trait Anxiety Inventory, State version. SLS = Satisfication with Life Scale. STAI-T = State-Trait Anxiety Inventory, Trait version, collected only at Time 1.*
conditions on preattentional bias scores revealed that the conditions did not differ in their attentional bias toward threatening, $F(4, 142) = .05$, $p = .995$, or pleasant, $F(4, 142) = 1.5$, $p = .21$, cues.

A mixed design 5 (condition: Happy, Sad, Neutral, Fear, Mirth) × 2 (time: Pre-Mood Induction, Post-Mood Induction) × 3 (cue valence: Threatening, Pleasant, Neutral) × 2 (cue validity: Valid, Invalid) general linear model (GLM) indicated main effects of validity (participants responded more rapidly in the valid trials) and time (participants responded more quickly after mood induction) (both $p < .0001$). There were no main effects of valence on response times and no main effects of or interactions with mood condition. Entering our measures of concurrent psychological functioning (SLS, STAI-S) as covariates in the GLM above did not change these results.

### Hypothesis Testing

Using an individual-difference approach, our primary research aim was to assess whether our measures of MIAS to threatening and/or pleasant cues would predict changes in state anxiety and life satisfaction over time. Thus, we computed a series of linear regressions separately by mood condition. These regressions assessed whether attentional bias-change scores (post-pre) at Time 1 were associated with psychological functioning (STAI-S, SLS) at Time 2. In these analyses, psychological functioning at Time 2 was the criterion variable; Time 1 psychological functioning was entered as a control variable, and the attentional bias composite score was entered on the second step.

### Do Mood-Induced Attentional Shifts Predict Ill-Being (State Anxiety)?

As predicted, in the Fear condition, a shift in attention toward threatening cues from pre- to postfilm clip at Time 1 was associated with higher STAI-S scores at Time 2, taking into account levels of SLS at Time 1, $β = .05$, $p = .006$, $\Delta R^2 = .17$ (see Figure 3). Interestingly, a shift toward threatening cues in the Happy condition was also associated with higher SLS scores at Time 2, taking into account levels of SLS at Time 1, $β = .04$, $p = .01$, $\Delta R^2 = .15$.

![Figure 2](image-url)  
**Figure 2.** A scatter plot showing the zero-order correlation between shift in attentional bias toward threatening cues from before to after the induction of a fearful mood and an increase in state-anxiety scores 3 weeks later, as measured with the state form of the State-Trait Anxiety Inventory (STAI-S; Time 2 − Time 1).
Higher SLS scores at Time 1 were associated with higher SLS scores at Time 2, $\beta = .70$, $p < .001$. A follow-up $t$ test indicated that there was no mean change in SLS from Time 1 to Time 2, $t(19) = 1.26$, $p = .22$, in the sample as a whole. There were no significant associations between MIAS and well-being 3 weeks later in the Fear, Sad, Neutral, or Mirth mood groups.

**Follow-Up Analyses**

**Biases in attentional engagement versus disengagement.** To reduce our familywise error rate in the above analyses, we used composite measures of attentional bias that collapse across engagement and disengagement of attention to emotional cues. However, previous research has suggested that separating out these two constructs may be informative (e.g., Fox, Russo, Bowles, & Dutton, 2001). We, therefore, repeated our regression analyses for the Fear and Happy conditions, this time separately examining attentional engagement and disengagement processes. Engagement of attention to emotional cues was calculated as RT valid neutral cue—RT valid emotional cue. Difficulty disengaging attention from emotional cues was calculated as RT valid neutral cue—RT invalid neutral cue. Again, the predictor of interest was the shift in engagement (or difficulty disengaging) from before to after mood induction (post-pre).

In the Fear condition, there were no significant associations between shifts in engagement with or difficulty disengaging from threatening cues and change in state anxiety over the 3-week follow-up period, $\beta = .03$, $p = .66$, $\Delta R^2 = .01$ and $\beta = .06$, $p = .10$, $\Delta R^2 = .09$, respectively. In the Happy condition, however, greater difficulty disengaging from threatening cues was predicted to change in state anxiety, $\beta = .07$, $p = .002$, $\Delta R^2 = .21$, and pleasant, $\beta = .06$, $p = .02$, $\Delta R^2 = .14$, cues significantly predicted increases in satisfaction with life over time. Greater engagement of attention to pleasant cues predicted only marginally significant increases in satisfaction with life over time, $\beta = .08$, $p = .08$, $\Delta R^2 = .08$.

**Are mood-induced attentional shifts equivalent to trait anxiety?** Based on previous studies demonstrating strong associations between trait anxiety and attentional biases to emotional information, might MIASs in the present context represent a proxy for trait anxiety? If that were true, MIAS should be correlated with trait anxiety. However, we did not observe any significant correlations between trait anxiety and our measures of MIAS within the Fear and Happy conditions. The only exception was a trend toward a significant correlation between trait anxiety and shift toward threatening faces following the Happy film clip, $r(29) = .35$, $p = .06$.

Moreover, if MIASs in the present context represent a proxy for trait anxiety, MIAS should no longer predict change in anxiety or satisfaction with life at Time 2 when controlling for trait anxiety at Time 1. However, a follow-up regression in the Fear condition indicated that entering Time 1 trait anxiety (STAI-T) along with Time 1 STAI-S on the first step did not eliminate the association between attention to threatening cues at Time 1 and higher STAI-S scores at Time 2, $\beta = .06$, $p = .08$, $\Delta R^2 = .09$, although it did reduce this association to a trend-level effect.

Similarly, follow-up regressions in the Happy condition indicated that entering Time 1 trait anxiety (STAI-T) along with Time 1 SLS on the first step did not eliminate the association between attention to emotional cues at Time 1 and higher SLS scores at Time 2, pleasant $\beta = .06$, $p = .005$, $\Delta R^2 = .19$, and threatening, $\beta = .05$, $p = .003$, $\Delta R^2 = .20$, respectively.

**Mood-Induced Attentional Shifts and Concurrent and Future Psychological Functioning**

Finally, whereas our primary focus in this article was on whether MIAS would predict changes in psychological functioning over time, we next examined whether MIAS would be associated with concurrent and/or future levels of psychological functioning. To this end, we followed up our significant findings in the Fear and Happy condition by conducting Pearson correlations between MIAS and concurrent and follow-up measures of psychological functioning (STAI-S, SLS). In the Fear condition, there was no association between a shift in attention toward threatening cues from pre- to postfilm clip at Time 1 and concurrent levels of state anxiety, $r(25) = - .01$, $p = .97$. However, there was a trend-level association with follow-up levels of state anxiety, $r(25) = .37$, $p = .065$. In the Happy condition, there was no association between a shift in attention toward threatening cues from pre- to postfilm clip at Time 1 and either concurrent, $r(28) = - .08$, $p = .68$, or follow-up, $r(19) = .33$, $p = .16$, levels of satisfaction with life. Also, in the Happy condition, there was no association between a shift in attention toward pleasant cues from pre- to postfilm clip at Time 1 and either concurrent, $r(28) = - .08$, $p = .68$, or follow-up, $r(19) = .28$, $p = .23$, levels of satisfaction with life.

**Discussion**

Collectively, our results suggest that, in a sample of college students not preselected for extreme scores on clinical measures, naturalistic mood-induced shifts in attention to threatening and
positive information are associated with individual variation in ill-
and well-being over time. Namely, a shift in attention to threaten-
ing cues after fear mood induction was associated with increases in
state anxiety. In addition, a shift in attention to emotional cues
(threatening and pleasant) following happy mood induction was
associated with increases in satisfaction with life. These results
were obtained in the absence of mean changes in anxiety and life
satisfaction over the brief, 3-week follow-up period. We discuss
these results, in turn, below.

**Links to Existing Literature**

As predicted, shifting attention toward threatening stimuli after
fear induction was associated with small elevations in state anxie-
ty. This extends previous work on experimentally induced
changes in attentional bias (e.g., Clarke et al., 2008; Schmidt et al.,
2009) and work examining differential changes in attentional bias
based on an interaction of state and trait anxiety (e.g., Rutherford
et al., 2004). These data add the important observation that natu-
ralistic individual differences in MIASs are associated with indi-
vidual differences in change in state anxiety over time. It is notable
that there were no MIASs in the sample as a whole. In keeping
with Yiend’s (2010) observations, it may be that the threatening
and pleasant faces cues were not sufficiently intense or short
enough in duration to encourage attentional bias or that the mood
inductions were not sufficiently potent to lower the threshold for
detection of emotional information in this unselected sample.

Regardless, people who shifted attention toward threatening
cues when we induced fear in the laboratory were more likely to
experience small increases in state anxiety over the 3 weeks that
followed. On the other hand, people who shifted attention away
from threatening cues when we induced fear in the laboratory were
more likely to experience small decreases in state anxiety. In the
sample as a whole, there was no systematic change in state anxiety
over time. For this reason, an individual-difference approach was
necessary to cull out the intriguing association between MIAS and
increased later anxiety. Importantly, relations between MIAS and
changes in state anxiety over time were still present even when
controlling for levels of trait anxiety, though controlling for trait
anxiety did reduce the effect to a strong trend. Thus, MIASs were
not simply serving as a proxy for trait anxiety.

Shifts in attentional bias toward both threatening and pleasant
cues after happy mood induction were associated with small in-
creases in well-being over time. This result is reminiscent of Tamir
and Robinson’s (2007) finding that induction of positive moods
resulted in attentional bias toward rewarding words, and
Wadlinger and Isaacowitz’s (2006) finding that inducing a positive
mood increased attention to peripheral positive and neutral images.
Our results, however, take the important next step of determining
that these kinds of attentional biases for positive information have
functional consequences. Notably, neither of these studies reported
a relationship between the positive mood inductions and bias
toward negative stimuli. This may be because the methods and
stimuli were quite different from the present study. For example,
whereas the previous studies only assessed attentional bias after
the mood induction, we assessed attentional bias both before and
after. This allowed us to isolate mood-induced shift in attentional
bias, which may have increased our sensitivity. Notably, although
we observed that MIASs toward threat after happy mood induction
were modestly correlated (at a trend level) with concurrent trait
anxiety, including trait anxiety as a predictor, did not eliminate the
relationship between concurrent MIAS and increases in later well-
being. Thus, it appears that these may be unrelated effects.

Our finding that shifts in attention to potentially salient (threat-
ening and pleasant) cues after the induction of happy mood were
associated with higher levels of well-being over a follow-up period
of 3 weeks is consistent with Fredrickson’s broaden-and-build
theory of positive emotion (Fredrickson, 1998, 2001). This theory
suggests that in contrast to negative emotions, which are associated
with specific thought-action repertoires, positive emotions gener-
ally broaden cognition. This allows for creative exploration and the
building of resources required for well-being and resilience. Inter-
preted in light of this theory, broadening one’s attention to both
threatening and pleasant stimuli in one’s environment may allow
for the detection of resources and information that may be import-
for well-being.

Despite similar effects on mood as measured by the POMS-SF,
we did not find a relationship between shifts in attentional bias and
well-being following mirth mood induction. The mirth film clip
consisted of a series of skits from Saturday Night Live 25th
Anniversary Special. As such, the type of humor portrayed was
largely disparagement humor, in which one or more of the char-
acters were being ridiculed or mocked in some way. It may well be
that this type of belittling humor does not lead to the type of
positive affect linked to the broadening of cognition and the
building of resources (such as contentment).

Previous research has suggested that separately considering
processes related to engagement and disengagement of attention to
emotional cues may be informative (e.g., Fox et al., 2001). Indeed,
when in a happy mood, participants who exhibited greater diffi-
culty disengaging from emotional cues experienced increased sat-
isfaction with life 3 weeks later. Although the effect for engage-
ment of attention to pleasant cues showed a trend in a similar
direction, this was only marginally significant. Surprisingly, nei-
ther increased attentional engagement with nor difficulty disen-
gaging from threatening cues when in a fearful mood predicted
increased later anxiety when considered separately. The associa-
tion only held when we collapsed across these two, theoretically
separable attentional processes. Several recent reviews have sug-
gested that attentional bias toward threat may be found for both
forms of attention (Cisler et al., 2009; Yiend, 2010), but another
notes inconsistent findings when using cue durations similar to
ours (Ouimet, Gawronski, & Dozois, 2009). We had no a priori
predictions about the relative importance of attentional engage-
ment or disengagement processes for predicting changes in later
state anxiety and satisfaction with life. It remains to be seen
whether this distinction will be important in future studies, perhaps
using different cue durations.

Although MIAS successfully predicted changes in state anxiety
and life satisfaction over time, we were surprised not to find
similar associations between MIAS and concurrent levels of these
constructs. Indeed, any time period before the MIAS task at Time 1
might reasonably also have contained emotional events that
would have elicited MIAS and, according to our model, affected
psychological functioning at Time 1. In this context, it is important
to note that our concurrent measures of psychological functioning
were collected at the end of the 2-hr study session at Time 1.
Speculatively, it could be that participant fatigue after this rather
long period of time impacted individual differences in concurrent psychological functioning that might otherwise have been associated with MIAS. Future work may be benefited by collecting concurrent measures of psychological functioning at the beginning of the study session.

Speculation About the Mechanism That Links MIAS to Changes in Ill- and Well-Being

What might be the mechanism that explains the relations between mood-induced shifts in attention to emotional information at one point in time and ill- or well-being 3 weeks later? Although speculative, we believe that small mood-induced shifts in attention in the laboratory may be representative of similar shifts that occur in response to mood-eliciting events in everyday life. Used on a routine basis, these patterns of mood-induced attentional shifts may accumulate in such a way that they cause changes in psychological functioning (e.g., anxiety or satisfaction with life). Of course, our correlational results do not permit us to do more than speculate about causal inferences, and as noted earlier, it is unusual that these effects were only present when examining changes over time. In future work, it would be useful to measure the frequency of mood states and life events experienced during the follow-up period, perhaps using experience-sampling methodology. If what we are suggesting is true, then people who have more frequent mood-eliciting events in between the laboratory and follow-up assessments should experience greater changes in ill- or well-being. Nevertheless, even if mood-induced attentional shifts toward emotional information do accumulate in ways that cause changes in ill- and/or well-being, this would surely represent only one of many causal psychological pathways. Individuals may vary over time in state measures based on any number of contributing factors (e.g., life stress, health, rest, and personality). If the results of this study are replicated, future research would need to explicate the causal mechanisms.

Theoretical and Clinical Implications

Gross (1998) has suggested, as part of his process model of emotion regulation, that deployment of attention is one of several processes that can be used in the service of regulating emotion experience, expression, and physiology. Evidence for this notion comes from experiments suggesting that directing attention to emotional versus neutral information in unpleasant photos influences emotion experience and expressive behavior (Urry, 2010) and the late positive potential, a neural index of emotional arousal (Dunning & Hajcak, 2009; Hajcak, Dunning, & Foti, 2009). Based on these observations, it may well be that the mood-induced attentional shifts we measured might have had an immediate emotion-regulatory effect in the laboratory. Unfortunately, we did not collect ratings of mood after the postmood induction spatial cueing task, which would have allowed us to assess that in this study.

In addition to possibly having immediate regulatory effects on mood state, the associations we observed between mood-induced attentional shifts and later anxiety and well-being are highly consistent with the attentional training literature. Experiments show, for example, that one can train an attentional bias to threat over time, and this produces elevated anxiety in response to a laboratory stressor (MacLeod et al., 2002). Moreover, anxious people who are trained over time to avoid attending to threat experience reduced levels of anxiety over time (e.g., Schmidt et al., 2009; See et al., 2009). Based on the present data, it is possible that attentional training paradigms might produce stronger effects on later psychological functioning, if training were to take place in the context of mood induction. That is, training attention away from threat when one is afraid/anxious may best discourage later anxiety. Similarly, training attention toward both threatening and happy cues when in a happy mood may best encourage later satisfaction with life. This possibility remains to be tested in future work.

Additional Limitations and Directions for Future Research

We have made an important, novel contribution by showing that naturalistic mood-induced shifts in attention to emotional information predict changes in ill- and well-being over a 3-week follow-up period. That being said, there were some notable limitations to the current study. First, because we did not conduct diagnostic interviews, we cannot say to what extent diagnosable psychopathology accounts for the findings we obtained. Second, our design did not allow us to assess whether MIAS predicted changes in trait anxiety over time which, given the past history of work on state/trait interactions, may have been very informative. Third, given the between-subjects design for the mood induction, we also had a relatively small sample size. This may have hindered our ability to detect significant differences between mood conditions and limited the generalizability of our findings. Fourth, we used only one negative facial expression (angry/threatening) as a cue in the spatial cueing task. We may have observed different effects if we had used other negative facial expressions (e.g., fearful, sad). Finally, our findings were generally limited to associations between MIAS to threatening and/or pleasant cues and change in ill-and well-being over the 3-week follow-up period. The lack of associations between MIAS to threatening and/or pleasant cues and concurrent or follow-up psychological functioning indicates a need for replication and further exploration of the relationships between MIAS, state anxiety, and life satisfaction.

Conclusions

In sum, this intriguing pattern of results contributes to the theories of vulnerability to emotional disorders and promotion of well-being by suggesting that, in addition to experimentally induced changes in attentional bias, naturalistically adopted attentional bias may contribute to changes in psychological functioning over time. People who show biased attention to threatening information as a function of fearful mood experience increases in state anxiety over time. By contrast, people who show biased attention to positive (and threatening) information as a function of happy mood experience increases in satisfaction with life. It would be important in future experimental and individual-difference work to further specify the extent to which subtle changes in attention to emotional information in the environment as a function of mood state, particularly happy and fearful moods, are important determinants of ill- and well-being (and vice versa).
References

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