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Induced optimism as mental rehearsal to decrease depressive predictive certainty

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ABSTRACT

The present study examined whether practice in making optimistic future-event predictions would result in change in the hopelessness-related cognitions that characterize depression. Individuals ($N = 170$) with low, mild, and moderate-to-severe depressive symptoms were randomly assigned to a condition in which they practiced making optimistic future-event predictions or to a control condition in which they viewed the same stimuli but practiced determining whether a given phrase contained an adjective. Overall, individuals in the induced optimism condition showed increases in optimistic predictions, relative to the control condition, as a result of practice, but only individuals with moderate-to-severe symptoms of depression who practiced making optimistic future-event predictions showed decreases in depressive predictive certainty, relative to the control condition. In addition, they showed gains in efficiency in making optimistic predictions over the practice blocks, as assessed by response time. There was no difference in depressed mood by practice condition. Mental rehearsal might be one way of changing the hopelessness-related cognitions that characterize depression.

1. Introduction

The way that individuals view the future has long been implicated in the experience of depressive symptoms. Individuals who report high levels of depressive symptoms tend to anticipate the future with pessimism (i.e., they predict that negative outcomes will occur and that positive outcomes will not occur) (Alloy & Ahrens, 1987; Andersen & Limpert, 2001), make such pessimistic predictions efficiently (Andersen, Spielman, & Bargh, 1992; Andersen & Limpert, 2001), and hold their pessimistic expectations with certainty (Andersen, 1990). Cognitive models of depression have suggested that such biased views of the future reflect maladaptive schemas about the future (Beck, Rush, Shaw, & Emery, 1979; Andersen et al., 1992; Andersen & Limpert, 2001). Thus, understanding how to modify future-oriented cognitions is an important step in tailoring treatments for depression. The present research sought to examine mental rehearsal in making optimistic future-event predictions as one way to modify the maladaptive future-oriented cognitions that characterize depression.

According to the hopelessness theory of depression, depressive symptoms arise when individuals come to expect that undesired outcomes will occur and that desired outcomes will fail to occur, and that no matter what they do, they are helpless to change these outcomes (Abramson, Metalsky, & Alloy, 1989). Andersen and colleagues have previously conceptualized hopelessness in the form of *depressive predictive certainty* – i.e., the point at which negative future events are treated as certain to occur and positive future events are treated as being certain *not* to occur (Andersen & Lyon, 1987; Andersen, 1990). This goes beyond pessimism, in which individuals expect negative experiences without necessarily believing that these outcomes are definite or unavoidable (O'Connor & Cassidy, 2007). Depressive predictive certainty has previously been found to be positively associated with symptoms of depression (Andersen, 1990), even more so than with anxiety (Miranda & Mennin, 2007), and to predict symptoms of depression over 6-week follow-up periods (Jacobson, Weary, & Edwards, 1999; Miranda, Fontes, & Marroquín, 2008). It has also been found to be associated with suicidal ideation, even beyond simple pessimism

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(Sargalska, Miranda, & Marroquín, 2011), and to mediate the relation between lifetime suicide attempt history and future suicidal ideation (Krajniak, Miranda, & Wheeler, 2013). Andersen and colleagues have suggested that depressive predictive certainty develops through rumination about the future – i.e., through repeated consideration of whether positive or negative outcomes will occur in one's future (Andersen & Limpert, 2001; Andersen et al., 1992). According to this idea, rumination about the future leads individuals to develop biased future-event schemas that enable them to make pessimistic predictions about the future with relative efficiency (Andersen & Limpert, 2001; Andersen et al., 1992). In fact, a recent study found that the tendency to think about whether negative outcomes would occur or whether positive outcomes would not occur in the future – i.e., to engage in pessimistic future-oriented repetitive thought, was positively associated with depressive predictive certainty and symptoms of depression (Miranda, Wheeler, Polanco-Roman, & Marroquín, 2017).

Prior work shows that experimental manipulation is quite successful in improving how people think about future events. For instance, a positive mood induction was successful in increasing depressed adolescents' optimistic future expectancies, in that participants who imagined or remembered happy situations while listening to a cheerful or upbeat melody playing in the background (in order to induce a positive mood) generated more positive and fewer negative outcomes that they believed might happen to them in the future (De Jong-Meyer, Kuczmera, & Tripp, 2007). Other research suggests that imagining positive future outcomes in response to verbal cues increases positive mood and may be one way to change the absence of positive imagery about the future that characterizes dysphoria (Holmes & Mathews, 2010).

However, cognitive bias modification research suggests that changing mood is not enough to produce change in cognitive bias and increase positive interpretations (Standage, Ashwin, & Fox, 2010). Previous experimental manipulations involving how people think about the future have focused on changing mood, and only one study of which we are aware has focused specifically on modifying biases in the predictions that dysphoric individuals make. In a study that targeted dysphoric individuals' tendency to predict more negative than positive outcomes, Collier and Siegle (2015) found that manipulating the predictions that individuals made about positive or negative statements other people might make about them based on a visual cue reduced the number of negative predictions and increased the positive predictions made by dysphoric individuals. Another study with college undergraduates (not selected for symptoms) found that two manipulations of optimistic orientation – one that involved having students answer five questions about their expected grades, career, and relationships, and another that involved priming via a scrambled sentences task that included words related to optimism – led to increases in generalized and comparative optimism relative to a control condition (Fosnaugh, Geers, & Wellman, 2009). No research of which we are aware, however, has examined shifts in the certainty with which depressed individuals make their pessimistic future-event predictions.

1.1. Overview of the present research

Our study sought to build on previous research designed to change the hopelessness-related cognitive biases that characterize depressive symptoms by shifting the certainty with which depressed individuals make their pessimistic future-event predictions (i.e., depressive predictive certainty). We sought to do so by changing the *procedure* of considering the future with pessimism to one of optimism. The present research tested whether practice in making optimistic future-event predictions would lead to a reduction in depressive predictive certainty, increases in optimistic predictions, and improvement in mood among individuals high in depressive symptoms, relative to practice engaging in a control task (i.e., making a lexical decision). We hypothesized that practice in making optimistic future-event predictions would be associated with increases in fluency in making such predictions, decreases in depressive predictive certainty, increases in optimistic predictions about the future, and improvement in mood (i.e., decreases in dysphoric mood), relative to practice in making a lexical decision, particularly among individuals high in depressive symptoms. We compared individuals high in depressive symptoms to individuals low and mild in depressive symptoms, who were expected to already have more fluency in making optimistic future-event predictions, lower baseline depressive predictive certainty, and thus show less change in depressive predictive certainty, relative to individuals who practiced making a lexical decision.[1]

2. Method

2.1. Study overview

The study design was a 3 × 2 (Depression Level: Low, Mild, Moderate-to-Severe × Practice Condition: Optimism vs. Control) Factorial Design. Participants were pre-selected based on their scores on a depression inventory (see below) and randomly assigned to either practice making optimistic future-event predictions or to a control condition, in which they viewed the exact same stimuli but practiced making a lexical decision, instead. Depressive predictive certainty, optimistic future-event predictions, and mood were measured before and after the practice conditions.

2.2. Participants

Young adults ($N = 170$; 128 female), ages 18 to 33 ($M = 20.0$, $SD = 3.4$), were recruited from an urban, public college in the northeastern United States and were pre-selected to participate based on their depression scores on the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), administered as part of an online pre-screening to college undergraduates who participated in research studies as part of their Introduction to Psychology courses. Individuals were eligible to take part in the present study if they scored in the following ranges on the CES-D: 0–15 (low depressive symptoms; $n = 73$), 16–23 (mild depressive symptoms; $n = 42$), and 24-above (moderate-to-severe depressive symptoms; $n = 55$). The racial/ethnic composition of the sample was 35% Asian ($n = 59$), 32% White ($n = 54$), 15% Hispanic/Latino(a) ($n = 26$), 9% Black ($n = 15$), and 9% other ($n = 16$). Information on socioeconomic status was not collected.

2.3. Materials: stimuli

One hundred forty-four future events (half positive, half

[1] Three separate depression categories were examined, rather than examining depressive symptoms continuously, because previous research suggests that individuals with mild depressive symptoms are distinct from those low and more severe in symptoms. Weary and colleagues suggest that mildly depressed individuals process information more carefully than do individuals with lower or more severe depressive symptoms, due to chronically accessible "causal uncertainty" beliefs (i.e., an uncertainty about their ability to control events that happen in their lives) (Weary & Edwards, 1996; Weary, Tobin, & Edwards, 2010). Thus, we expected that the mildly depressed group might process stimuli differently than the other groups.

negative) were included as stimuli. Stimuli were selected from 352 future events, worded as short phrases (e.g., *get a good grade in class*, *experience a computer problem*), that were pre-tested on a sample 23 college undergraduates, along with a further list of 86 events that were classified by two independent raters (college students), who rated how likely these events would be to happen to an average undergraduate at some point in the future on a scale ranging from −5 ("Not at all likely") to 5 ("Extremely likely"). They also rated the valence of events on a scale from −5 ("Extremely bad/unpleasant") to 5 ("Extremely good/pleasant"). The reliability of the ratings made by the pair of raters was 0.73 for likelihood and 0.83 for valence ratings. Items rated −2 and below for likelihood were considered "Highly unlikely" items (e.g., *win the lottery, be convicted of murder*), while those rated 2 and above were considered "Highly likely" (e.g., *have dinner with a good friend, lose a loved one*). Items with ratings in between were considered "Moderately likely" (e.g., *be satisfied with major life decisions, experience the death of a spouse*). Items with ratings of 1.5 and above were classified as positive and those rated −1.5 and below were classified as negative. Details on stimuli development can be found elsewhere (Miranda & Andersen, 2008).

2.4. Induced optimism vs. control condition

The experimental manipulation consisted of two conditions – an induced optimism condition ($n = 83$), in which individuals were induced to practice making optimistic future-event predictions – based on manipulation of the likelihood of occurrence of given positive and negative events – and a control condition ($n = 87$), in which individuals viewed the same stimuli but practiced determining if each phrase presented contained an adjective. The computer-based program, run using Empirisoft DirectRT software (v2006; Jarvis, 2006), was designed to present seventy-two positive and seventy-two negative future events, with the majority of positive phrases (40) pre-configured as "highly likely" to occur (e.g., *have dinner with a good friend*) and the majority of negative phrases (40) pre-rated as "highly unlikely" to occur (e.g., *be convicted of murder*) (Miranda & Andersen, 2008). Forty-eight of the remaining items were "moderately likely" to occur: half were positive (e.g., *be satisfied with major life decisions*) and half were negative (e.g., *experience the death of a spouse*). Eight positive events were "highly unlikely" to happen (e.g., *win the lottery*) and eight negative items were "highly likely" to happen (e.g., *lose a loved one*), to decrease the obviousness of the manipulation. Events were presented one at a time on a computer screen, and participants were asked to either decide whether they believed the event would happen to them *at some time in the future* (experimental condition) or to determine whether the phrase contained an adjective (control condition). To remind participants of the procedure in which they should engage, phrases were preceded either by the prompt, "*Likely to happen to you?*" (experimental condition) or "*Contains an adjective?*" (control condition). Participants were asked to respond as quickly and as accurately as possible by pressing keys corresponding to *yes* or *no* on the computer keyboard.

All participants practiced these procedures across four blocks of trials. Each block consisted of 36 phrases for a total of 144 items.[2] The induced optimism condition was set up so that participants would endorse positive future outcomes that had a high likelihood of occurrence and deny negative future outcomes that had a low likelihood of occurrence (Note that participants in this condition were never instructed to try to make optimistic future-event predictions). Individuals in the lexical-decision condition viewed the same phrases but, rather than considering them as possible future events, were asked to decide if each phrase presented contained an adjective (thus practicing a different mental procedure).

2.5. Measures before and after the experimental manipulation

2.5.1. Future events questionnaire (FEQ; Miranda & Mennin, 2007)

Participants completed the FEQ to assess optimistic future-event predictions and depressive predictive certainty before and after they completed their practice condition. The FEQ consists of 17 positive (e.g., "*be admired by people*") and 17 negative (e.g., "*regret a major life decision*") future events previously estimated to have a moderate likelihood of occurrence. The items were selected from previous studies on future-event predictions (e.g., Andersen & Limpert, 2001; Miranda & Andersen, 2008). Participants were asked to decide whether or not each event was likely to happen to them in the future by circling "yes" or "no" and to rate how certain they were of their "yes" or "no" prediction using a Likert scale ranging from 1 (*not at all certain*) to 5 (*as certain as one can be*). In the present study, *depressive predictive certainty* was calculated as the number of times participants responded "yes" to negative or "no" to positive future events with the highest degree of certainty (rating of "5") – i.e., as the number of times they were completely certain when making pessimistic future-event anticipations. FEQ responses were also used to generate *optimistic predictions* scores, calculated as the number of times individuals responded "yes" to a positive future event or "no" to a negative future event. The FEQ has an internal consistency reliability of 0.65–0.70 for yes/no responses and of 0.87–0.91 for certainty ratings (Miranda & Mennin, 2007; Miranda et al., 2008; Sargalska et al., 2011).

2.5.2. Mood

Change in mood was assessed via the Profile of Mood States-Revised (POMS-R; McNair, Lorr, & Doppleman, 1992), a 65-item self-report mood scale in which participants rate the degree to which they are feeling each emotion using a Likert scale of 1 (*not at all*) to 4 (*extremely*). A total score on the *depression-dejection* scale, which consists of 15 items, is computed by summing the items on the scale.

2.6. Procedure

After providing informed consent, participants completed the FEQ to assess for level of depressive predictive certainty and optimistic predictions and the POMS-R to assess mood before the experimental manipulation. Participants (within each depression category) were randomly assigned to either the induced optimism condition described above, in which they practiced making optimistic future-event predictions, or to the control condition, in which they were presented with the same stimuli and asked to make a lexical decision. Participants were presented with the same breakdown of positive and negative phrases across 4 blocks of trials. After completion of the study, participants were debriefed, given a list of mental health treatment resources, and granted research credit. The materials and procedure used in this study received full Institutional Review Board approval.

3. Results

3.1. Baseline depressive predictive certainty, optimistic predictions, and mood

There were no statistically significant differences between the experimental and control conditions in baseline depressive

[2] Due to a program anomaly, participants were presented with 32 randomly selected stimuli per block.

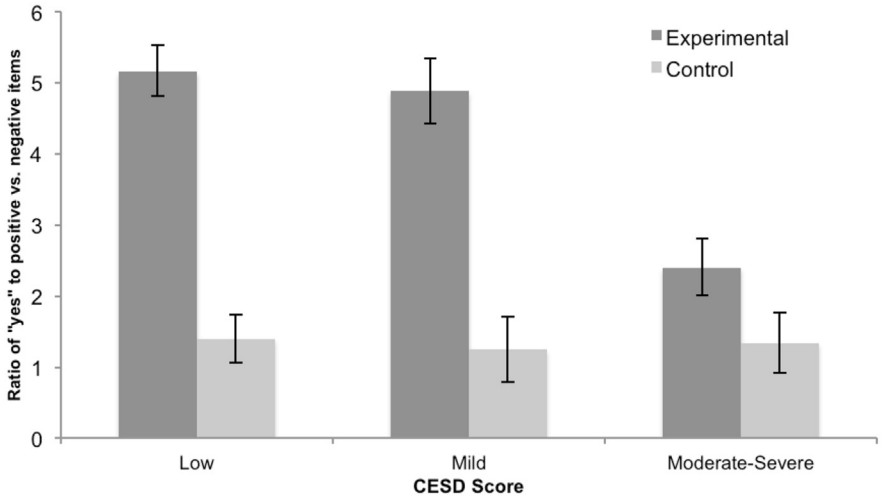

Fig. 1. Average ratio of yes to positive vs. negative items over 4 practice blocks, by group and practice condition. Error bars represent standard errors.

predictive certainty (FEQ), optimistic predictions (FEQ), or dysphoric mood (POMS-R). Pre-manipulation (baseline) depressive predictive certainty, $F(2,164) = 11.59$, $p < 0.01$, dysphoric mood, $F(2,164) = 27.30$, $p < 0.01$, and optimistic predictions, $F(2,164) = 30.79$, $p < 0.01$, varied by depression category, with moderately-to-highly depressed individuals showing higher levels of depressive predictive certainty ($M_{\text{Depcert}} = 3.51$, $SD = 3.97$), $t(164) = 4.59$, $p < 0.008$, dysphoric mood ($M_{Mood} = 30.93$, $SD = 14.89$), $t(164) = 7.19$, $p < 0.008$, and lower baseline optimistic predictions ($M_{Opt} = 16.53$, $SD = 6.68$), $t(164) = 7.81$, $p < 0.008$, relative to non-depressed individuals ($M_{\text{Depcert}} = 1.22$, $SD = 2.14$; $M_{Mood} = 18.84$, $SD = 3.92$; $M_{Opt} = 24.03$, $SD = 4.50$). Individuals in the mildly depressed group did not show statistically significant differences in optimistic predictions, $M_{Opt} = 21.55$, $SD = 4.70$, depressive predictive certainty, $M_{\text{Depcert}} = 1.48$, $SD = 1.70$, or dysphoric mood, $M_{Mood} = 21.21$, $SD = 6.15$, than individuals in the non-depressed group. Note that Bonferroni corrections were made to p-values, such that statistically significant comparisons were those with $p < 0.008$ (0.05/6).

3.2. Manipulation check: responses to positive and negative events in practice blocks

Our manipulation of optimistic future-event predictions should have led participants to respond *yes* more often to positive than to negative events, and we did not expect this to be the case in the control condition. To check the effectiveness of this manipulation, we examined the ratio of *yes* responses participants made to positive versus negative future events, in a 3 × 2 (Depression Group: Low, Mild, Moderate-to-Severe × Practice Condition: Optimistic Future-Event Predictions vs. Lexical Decision) factorial design ANOVA. As predicted, the analysis yielded a reliable main effect of practice condition, such that participants in the experimental condition more often responded yes to positive than to negative events ($M_{\text{ratio}} = 4.16$, $SD = 3.18$), compared to the control condition ($M_{\text{ratio}} = 1.35$, $SD = 0.63$), $F(1,163) = 70.68$, $p < 0.01$. This main effect was qualified by a 2-way interaction among practice condition and depression group, $F(2,163) = 7.15$, $p < 0.01$, with the high depression group having a lower ratio of responses yes to positive versus negative events in the experimental condition ($M_{\text{ratio}} = 2.40$, $SD = 1.20$), $t\ (163) = 5.10$, $p < 0.01$, whereas the mild depression group showed no difference from the low depression group ($M_{\text{ratio}} = 4.88$, $SD = 3.21$, vs. $M_{\text{ratio}} = 5.16$, $SD = 3.71$), $t < 1$. In the control condition, there was no difference in the ratio of yes responses to positive and negative items by depression group. Our manipulation was thus effective (see Fig. 1).

3.3. Response time to practice

We conducted an analysis of response time (RT) to explore whether individuals who were induced to practice making optimistic future-event predictions would show gains in efficiency, as reflected in RTs, over the practice blocks. We compared RTs in the first half (blocks 1–2) and the last half (blocks 3–4) of the practice task for the four response categories (yes to positive future events, yes to negative, no to positive, no to negative). We conducted a Category by Time by Group repeated measures ANOVA with response time as the dependent variable. There was a main effect of Time; response times were faster in the second half ($M = 2196$ ms, $SE = 101$) compared with the first half ($M = 2409$ ms, $SE = 132$); $F(1,62) = 9.53$, $p < .01$, $\eta p^2 = 0.13$ (all analyses using the Greenhouse Geisser correction for violation of sphericity). There was also a main effect of Category, $F(3,186) = 15.95$, $p < .001$, $\eta p^2 = 0.20$; response times to both optimistic items (yes to positive $M = 2032$ ms, $SE = 112$; no to negative $M = 2144$ ms, $SE = 146$) were faster than RTs to the non-optimistic items (no to positive $M = 2457$ ms, $SE = 111$; yes to negative $M = 2575$ ms, $SE = 129$). There was also a significant Group by Category interaction $F(6,186) = 3.62$, $p < .01$, $\eta p^2 = 0.11$. After visualization of the descriptive data, we conducted relevant follow-up within-group paired t-tests. These tests showed that the low and mild depression groups showed identical patterns of faster RTs for optimistic responses (yes to positive and no to negative) compared with RTs for less optimistic responses (no to positive and yes to negative), (all $ts > 2.22$, $ps < 0.006$ Bonferroni corrected threshold) and this pattern persisted even as their overall performance was faster in the second half (see Fig. 2). The high depression group initially showed a less clear trend toward a pattern of faster endorsements of *yes* or *no* to positive relative to *yes* to negative in the first half ($ts > 2.49$, $p < 0.001$ and $p = 0.020$, respectively; Bonferroni corrected threshold of $p < 0.006$), but equivalent RTs across all response types in the second half (all $ts < 0.66$, $ps > 0.51$), consistent with equally efficient responses over time.

To further understand this change in response patterns in the high depression group, and to examine the descriptive data showing that, in this group only, responses to items with negative

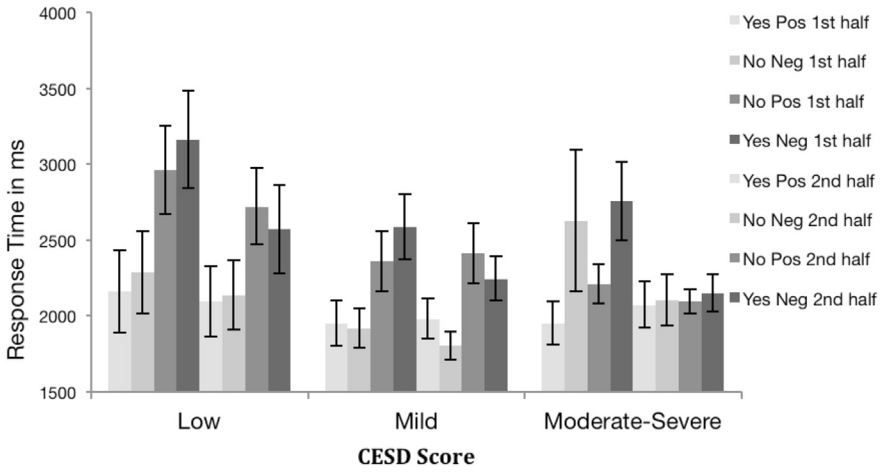

Fig. 2. Response time to making optimistic future event predictions, by depression category, in the first half of the practice trials (blocks 1–2) versus the second half of the practice trials (blocks 3–4). Lighter bars represent optimistic responses (yes to positive, no to negative) and darker bars represent non-optimistic responses (no to positive, yes to negative). Participants in the low and mild depression groups were faster to endorse optimistic items compared with non-optimistic items across both halves of the practice. Participants in the moderate-to-severe depression group were slower to endorse yes or no to negative events in the first half, but showed equivalent response times to all items in the last half, demonstrating the beneficial effect of practice. Note: Because the control task (i.e., lexical decision) utilized different response processes, we do not show response time data for the control condition.

content were slower than to items with positive content in the first half but not the last, we conducted a within group Time (first half, last half) by Valence (positive content, negative content) repeated measures ANOVA. In addition to the main effects of Time, $F(1,23) = 4.68$, $p = 0.041$, $\eta p^2 = 0.17$, and Valence, $F(1,23) = 6.70$, $p = 0.016$, $\eta p^2 = 0.23$, there also was a significant Time × Valence interaction, $F(1,23) = 7.52$, $p = 0.012$, $\eta p^2 = 0.246$. Follow-up t-tests with a Bonferroni corrected threshold of $p < 0.013$ showed that the interaction was driven by slower RTs for negative compared to positive in the first half, $t(24) = 2.73$, $p = 0.011$, $d = 0.33$, and a trend toward faster RTs to negative content in the last half compared to negative content in the first half, $t(24) = 2.58$, $p = 0.016$, $d = 0.36$. There was no difference between RTs to negative and positive content in the last half ($p > 0.56$). To test the possibility that this effect might be driven by habituation to negative content in high depression participants, we conducted the same RM ANOVA in the high depression control group (same stimuli with lexical decision task). The main effect of Valence was significant; high depression control participants were slower to respond to items with negative content across all trials, $F(1,24) = 11.44$, $p = 0.002$, $\eta p^2 = 0.32$. However there was neither a main effect of Time, $F(1,24) = 0.009$, $p = 0.926$, $\eta p^2 = 0.00$, nor a Time × Valence interaction, $F(1,24) = 1.453$, $p = 0.240$, $\eta p^2 = 0.057$.

3.4. Differences in optimistic predictions

We examined change in optimistic predictions before and after the manipulation in a 3 × 2 × 2 (Depression Group: Low, Mild, Moderate-to-Severe × Practice Condition: Optimistic Future-Event Predictions vs. Lexical Decision × Time: pre-manipulation vs. post-manipulation) Mixed Design ANOVA, with time as a repeated measure.[3] There was a statistically significant main effect of time, $F(1,164) = 7.49$, $p < 0.01$, depression group, $F(2,164) = 32.80$, $p < 0.01$, and an interaction between practice condition and time, $F(1,164) = 4.48$, $p < 0.05$. Individuals in the experimental condition showed greater increases in optimistic predictions ($M_{diff} = 0.82$, $SD = 2.58$) relative to the control condition ($M_{diff} = 0.13$, $SD = 1.98$), $F(1, 164) = 4.48$, $p < 0.05$, $d = 0.32$ [95% CI = 0.02–0.63], a small-to-medium effect size, regardless of depression category. Across both time points, individuals in the moderate-to-severe depression group showed lower optimistic predictions ($M = 16.54$) than the low ($M = 24.34$), $t(164) = 8.03$, $p < 0.01$, and mild ($M = 21.99$), $t(164) = 4.90$, $p < 0.01$, depression groups.

3.5. Differences in depressive predictive certainty

We hypothesized an interaction between depression group, practice condition, and time on depressive predictive certainty and tested this hypothesis via a 3 × 2 × 2 (Depression Group: Low, Mild, Moderate-to-Severe × Practice Condition: Optimistic Future-Event Predictions vs. Lexical Decision × Time: pre-manipulation vs. post-manipulation) Mixed Design ANOVA, with time as a repeated measure. There was a statistically significant main effect of time, $F(1,164) = 21.55$, $p < .01$, depression group, $F(2,164) = 10.51$, $p < .01$, and a 3-way interaction among depression group, practice condition, and time, $F(2,164) = 3.19$, $p < .05$. Bonferroni corrections were made to p-values for contrasts to adjust for number of comparisons, such that t-tests were considered statistically significant at a p-value < 0.017 (0.05/3). Among moderately-to-severely depressed individuals, there was a greater decrease in depressive predictive certainty in the Experimental Condition ($M_{diff} = 1.14$, $SD = 1.96$) compared to the Control Condition ($M_{diff} = 0.15$, $SD = 2.09$), $t(164) = 2.51$, $p < 0.017$, $d = 0.68$ [95% CI = 0.14–1.21], a medium-to-large effect size. However, this was not the case for the low-depression group ($M_{diff} = 0.44$, $SD = 0.89$, versus $M_{diff} = 0.10$, $SD = 1.19$), $t = 0.98$, $p = 0.33$, $d = 0.23$ [95% CI = −0.23–0.69], nor for the mild-depression group ($M_{diff} = 0.43$, $SD = 1.12$, versus $M_{diff} = 0.95$, $SD = 1.24$), $t(164) = 1.16$, $p = 0.24$, $d = 0.36$ [95% CI = −0.25–0.96]. Fig. 3 depicts this interaction.

We also computed a score to reflect the proportion of total pessimistic responses about which participants were the most certain (a rating of 5). Change in these proportions was examined in a 3 × 2 × 2 (Depression Group: Low, Mild, Moderate-to-Severe × Practice Condition: Optimistic Future-Event Predictions

[3] Note that in order to compute a pessimistic predictions score, one would simply subtract the total optimistic predictions score from the total number of FEQ items (i.e., 34). Thus, a higher optimistic predictions score would suggest a lower pessimistic predictions score, and vice versa, making a separate analysis of pessimistic predictions unnecessary.

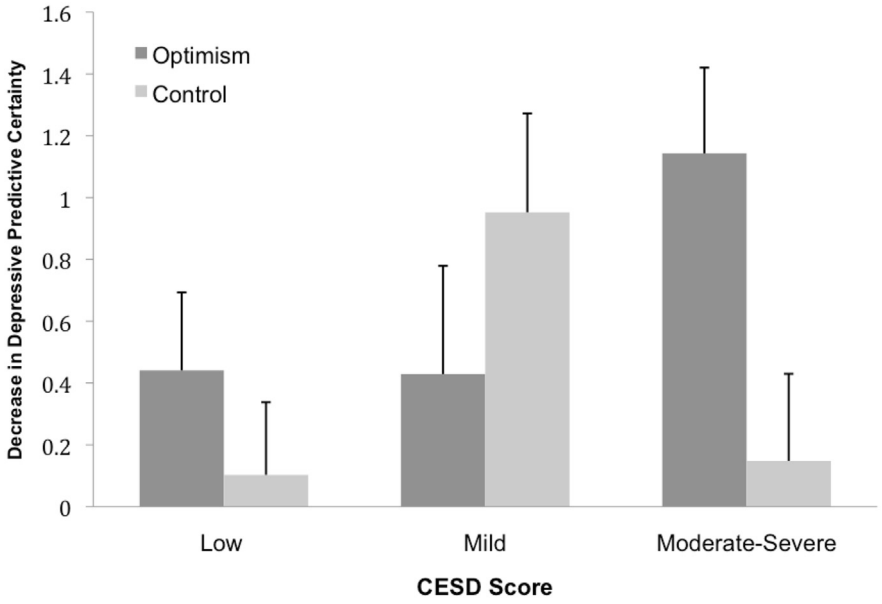

Fig. 3. Change in depressive predictive certainty (baseline minus post-task) by practice condition (induced optimism versus control lexical decision) among individuals with low, mild, and moderate-to-severe symptoms of depression. Error bars represent standard errors.

vs. Lexical Decision × Time: pre-manipulation vs. post-manipulation) Mixed Design ANOVA, with time as a repeated measure. There was a significant main effect of time, $F(1,163) = 13.21$, $p < 0.01$, depression group, $F(2,163) = 4.42$, $p < 0.05$, and an interaction among depression group, practice condition, and time, $F(2,163) = 3.94$, $p < 0.05$. Once again, contrasts were adjusted for number of comparisons, such that *t*-tests were considered statistically significant at a *p*-value < 0.017 (0.05/3). Individuals in the moderate-to-severely depressed group who practiced in the induced optimism condition showed a decrease of about 7% in the proportion of their pessimistic responses about which they were most certain (19.3% pre-manipulation versus 12.5% post-manipulation, on average), while individuals in the corresponding control group showed no such difference (17.8% pre-manipulation versus 17.7% post-manipulation), $t_{diff}(163) = 2.37$, $p < 0.017$. There was no significant change between the induced optimism and control conditions in the other two groups.

3.6. Differences in mood

Finally, we examined differences in dysphoric mood before and after the manipulation in a 3 × 2 × 2 Mixed Design ANOVA. There was no effect of the experimental manipulation on dysphoric mood, as evidenced by no interaction between practice condition and time, $F(1,164) = 1.52$, $p = 0.22$, nor among practice condition, depression category, and time, $F(2,164) = 0.53$, $p = 0.59$. Across both time points and practice conditions, individuals in the moderate-to-severe depression group reported higher dysphoric mood ($M = 30.75$) than did individuals in the low ($M = 18.73$), $t(164) = 6.85$, $p < 0.01$, and mild ($M = 21.81$), $t(164) = 4.44$, $p < 0.01$, depression groups.

4. Discussion

This research sought to examine practice, or mental rehearsal, as a way to reduce the hopelessness-related cognitions that characterize depression. Induced practice in making optimistic future-event predictions led to gains in efficiency, as assessed by response time, and a decrease in depressive predictive certainty among individuals with moderate-to-severe levels of depressive symptoms, relative to a control condition involving exposure to the same stimuli. This was not the case among individuals low or mild in depressive symptoms. Similarly, practice in making optimistic future-event predictions resulted in small increases in optimistic predictions across all conditions. However, there was no difference in dysphoric mood between the experimental and control conditions. Perhaps more sustained practice would be required to enable such change. Alternatively, there is evidence that differential effects of training on mood are primarily seen upon exposure to a stressor, when the newly trained bias is deployed (see, e.g., MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; see also Hallion & Ruscio, 2011, for a review). Future research could examine, for instance, whether practice in making optimistic future-event predictions might buffer against the impact of a stressor on mood.

This experiment provides the first evidence, of which we are aware, that mental rehearsal of the procedure of considering the future with optimism (i.e., predicting that positive events will occur and that negative events will not) may shift the certainty with which individuals reporting high levels of depressive symptoms make pessimistic future-event predictions – i.e., experience depressive predictive certainty. While this procedure led to small increases in optimistic future-event predictions (or decreases in pessimistic predictions) [3] across depression groups, the largest effects were seen in decreased certainty ratings for moderately-to-severely depressed individuals when making pessimistic future-event predictions. This is important, given previous research suggesting that the future-event anticipations that characterize depressive symptoms go beyond simple pessimism (Andersen, 1990; Miranda & Mennin, 2007). As such, treatments for depression that focus on changing how individuals consider their futures should go beyond increasing optimism and decreasing pessimism to address the inevitability (i.e., certainty) with which future suffering is perceived (Abramson et al., 1989; Andersen, 1990).

The shifts in depressive predictive certainty among moderately-to-severely depressed individuals in this study were also supported by exploratory analyses of changes in response time when making future-event predictions during the induced optimism practice

task. The first half (i.e., first two blocks) of the practice trials reflected prior habitual responses, i.e., faster optimistic predictions among low and mildly depressed groups, and slower "no-to-negative" events predictions in the moderately-to-severely depressed group. The response times in the moderately to severely depressed group in the second half (i.e., third and fourth blocks) of the practice trials, however, support the effectiveness of the practice: Initially, participants in this condition responded with their habitual non-optimistic pattern, but as predicted, over the course of their practice trials, they began to consider equally the more optimistic responses. The shift to an equivalent response time across all response types only for those in the moderately-to-severely depressed group provides some support for the relevance of more deliberate consideration of every item rather than continuation of habitual and less optimistic future predictions. The effect cannot be attributed to habituation following initial capture by negative content, as the high depression control group did not show similar habituation when viewing identical negative stimuli. Further, response times were much longer than the latency required for disengagement following attentional capture, suggesting that even if capture played a role, it could not fully account for the differences in RT across categories, which instead is more consistent with deliberative processes. In general, this finding is consistent with prior literature showing greater implicit negativity in future event thinking in depression (Kosnes, Whelan, O'Donovan, & McHugh, 2013; see also; Andersen et al., 1992), cognitive inflexibility in dysphoria (e.g., Owens & Derakshan, 2013), and evidence supporting the notion that inducing optimistic future cognitions can be an effective technique for effortful changes in response patterns (Lee et al., 2015).

4.1. Strengths and limitations

This is the first study of which we are aware to demonstrate that an experimental manipulation involving practice in making optimistic future-event predictions reduces depressive predictive certainty among individuals endorsing moderate-to-severe levels of depression. Given that participants in the control condition viewed the same exact stimuli and that participants in both conditions viewed an equal number of positive and negative phrases, it is clear that what varied between conditions was the mental procedure that participants practiced. Differences between conditions can thus be attributed to mental practice as a procedure rather than to the valence of the viewed stimuli. Despite these strengths, some study limitations should be noted. First, although participants were pre-selected for level of depression, the sample consisted of college undergraduates and was not a clinical sample. Future research is necessary to replicate these findings with a treatment-seeking sample of depressed individuals from the community. Second, practice was limited to one study session, rather than a series of sessions, as would occur in treatment. Future research should examine whether individuals induced to practice making optimistic future-event predictions over time would continue to show changes in depressive predictive certainty, and whether these changes would result in symptom relief. Third, no particular point in time was specified for the future-event predictions participants made. There is evidence that whether an event is expected to happen in the near versus distant future may impact the importance given to the likelihood and desirability of a future event (Trope & Liberman, 2010). Future research should examine optimistic future-event predictions made within a particular time frame (e.g., within the next week, next month, next year, etc.). Fourth, it is possible that it wasn't the act of making future-event predictions that led to shifts in depressive predictive certainty, relative to the control condition. The difference between the groups could result from engaging in self-relevant processing of the stimuli. One might find similar effects if individuals were to decide whether events had happened to them in the past. Similarly, the effect could have been due to general (but not self-relevant) future-relevant processing (e.g. rating whether events would happen to someone else might have a similar effect). A third possible alternative explanation for the effect might be that it wasn't necessarily practice of the mental procedure of making future-event predictions that had an effect, but that it was simply practice in making a "yes" response to a positive item and a "no" response to a negative item. A control condition involving induction of such a response bias but in which individuals would not make future-event predictions would be necessary to rule out this possibility. Additional research is thus needed to rule out alternative explanations. Finally, the effects of practice were observed on a measure that asked participants to make optimistic future-event predictions similar to those they had made in the experimental condition. Future research should examine transfer tasks that are not so closely related to the practice condition in order to more conclusively demonstrate that practice in making optimistic future-event predictions does, indeed, lead to shifts in hopelessness-related cognitions.

4.2. Conclusion

This is the first study of which we are aware to examine whether engaging in mental rehearsal that involves primarily predicting the occurrence of positive future outcomes and the non-occurrence of negative future outcomes results in shifts in the hopelessness-related thinking that characterizes high levels of depression. While further study is necessary to replicate and extend these findings over multiple study sessions, the present study has implications for treatment. For instance, treatments that seek to target pessimistic certainty might encourage highly depressed individuals to practice considering the likelihood of the occurrence of everyday, highly likely positive outcomes, while also focusing on the non-occurrence of highly unlikely negative outcomes. Corresponding increases in optimistic future-event predictions and decreases in depressive predictive certainty, while not resulting in immediate mood shifts, might promote such mood shifts over time. At the same time, future research is necessary to determine whether the cognitive changes that may result from interventions such as this one may also be sustained over time, and whether there are factors that might help maintain these effects, even independently of mood.

Conflict of interest

The authors have no conflicts of interest to declare.

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