

Running head: INFLEXIBLE NEGATIVE INTERPRETATIONS AND EMOTION  
REGULATION

**When negative interpretations persist, positive emotions don't! Inflexible negative interpretations encourage depression and social anxiety by dampening positive emotions**

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### **Abstract**

Research on emotion regulation difficulties has been instrumental in understanding hallmark features of depression and social anxiety. Yet, the cognitive mechanisms that give rise to maladaptive patterns of emotion regulation strategy use remain underspecified. This investigation examined the association of negative interpretation inflexibility and interpretation biases with the use of common emotion regulation strategies in response to negative and positive emotional experiences (repetitive negative thinking, positive reappraisal, and dampening). Study 1 ( $N=250$ ) found that inflexibility in revising negative interpretations in response to disconfirmatory positive information was related to the dampening of positive emotions, but not to repetitive negative thinking or positive reappraisal. Importantly, dampening mediated the relation between inflexible negative interpretations and symptoms of both depression and social anxiety. This mediation model was further supported by the data from Study 2 ( $N=294$ ). Across both studies, negative interpretation bias was related to repetitive negative thinking and dampening, whereas positive interpretation bias was related to positive reappraisal. Collectively, these results suggest that both interpretation inflexibility and interpretation biases may contribute to difficulties in emotion regulation related to depression and social anxiety.

*Keywords:* Depression; Social Anxiety; Interpretation Inflexibility; Interpretation Bias; Emotion Regulation, Bias Against Disconfirmatory Evidence (BADE).

## INTRODUCTION

The identification of mechanisms involved in depression and social anxiety is an integral part of efforts to improve existing prevention and treatment strategies for these burdensome disorders (Kessler & Bromet, 2013; Stein & Stein, 2008). Theoretical models advocate that individual differences in emotion regulation are important determinants of the emotional disturbances that characterize depression and anxiety (Hofmann, Sawyer, Fang, & Asnaani, 2012; Joormann, 2010; Morrison & Heimberg, 2013). Emotion regulation refers to a range of automatic and strategic processes that influence the frequency, intensity, and duration of emotional experiences (Gross, 2014). A plethora of studies have tied depression and (social) anxiety to the use of specific emotion regulation strategies in response to both negative and positive emotions (Campbell-Sills, Ellard, & Barlow, 2014; Dryman & Heimberg, 2018; Joormann & Stanton, 2016; Liu & Thompson, 2017).

In response to negative emotions or distress, depressed and anxious individuals habitually engage in repetitive negative thinking and use positive reappraisal less frequently (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Kivity & Huppert, 2018; Visted, Vøllestad, Nielsen, & Schanche, 2018). Repetitive negative thinking refers to a transdiagnostic process of persistent thinking about negative topics (e.g., past distress, future threats) that is difficult to control (Ehring et al., 2011; Mahoney, McEvoy, & Moulds, 2012; Watkins, 2008). Repetitive negative thinking is related to exacerbated negative mood (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), heightened emotional reactivity (Ruscio, Seitchik, Gentes, Jones, & Hallion, 2011), and impaired stress recovery (Watkins, 2008). Positive reappraisal has been defined as cognitively reframing the meaning of a distressing event in a more positive manner to minimize its emotional impact (Garnefski & Kraaij, 2007; Gross, 2014). Decreased use of positive reappraisal may prevent depressed and anxious individuals from obtaining beneficial

outcomes associated with this strategy, such as increased positive and decreased negative emotions (Gross & John, 2003) and better stress recovery (Jamieson, Nock, & Mendes, 2012).

In response to positive emotions, depressed and anxious individuals are more likely than control individuals to dampen their emotional experiences (Eisner, Johnson, & Carver, 2009; Feldman, Joormann, & Johnson, 2008; Raes, Smets, Nelis, & Schoofs, 2012; Werner-Seidler, Banks, Dunn, & Moulds, 2013). Dampening involves a repetitive style of thought (e.g., “my streak of luck is going to end soon”, “good things won’t last”) that serves to reduce the intensity and duration of positive emotions (Feldman et al., 2008). The tendency to respond to positive emotions with dampening predicts future depressive symptom levels (Raes et al., 2012) and is uniquely related to anxiety and depression symptoms when controlling for repetitive negative thinking (McEvoy et al., 2018). Considered together, these studies provide accumulating evidence that patterns of emotion regulation strategy use may contribute to emotion dysregulation in individuals with depression and anxiety.

Despite this scientific progress, the mechanisms that give rise to this maladaptive pattern of emotion regulation strategy use remain underspecified. Cognitive theories of depression and anxiety posit that biases in interpreting ambiguous emotional situations are important determinants of the emotional disturbances observed in these internalizing disorders (Everaert, Podina, & Koster, 2017; Hirsch, Meeten, Krahé, & Reeder, 2016). Research indicates that depressed individuals develop more negative and fewer positive interpretations to explain ambiguous information (Everaert, Podina, et al., 2017). Furthermore, studies have shown that socially anxious individuals report fewer positive interpretations at the time when ambiguity is first encountered and report more negative interpretations when elaborating on ambiguous information (Amir, Prouvost, & Kuckertz, 2012; Beard & Amir, 2009; Hirsch et al., 2016; Moser, Hajcak, Huppert, Foa, & Simons, 2008). Importantly, biased interpretation of ambiguity has been linked to the decreased use of positive reappraisal (Everaert, Grahek, et al., 2017) and

increased engagement in repetitive negative thinking (Badra et al., 2017; Everaert, Grahek, et al., 2017; Mor, Hertel, Ngo, Shachar, & Redak, 2014; Wisco, Gilbert, & Marroquin, 2014).

Notwithstanding the putative pathogenic role of interpretation bias, investigators are increasingly emphasizing that bias toward negative or positive interpretations may not be consistently (mal)adaptive. For example, even biased negative interpretations may motivate people to adjust their behavior to meet situational demands. Consistently drawing positive interpretations may lead people to ignore important negative features of situations, such as problems at work or difficulties in romantic relationships. Whether negative or positive interpretations promote (mal)adaptive behavior hinges on the fluctuating demands of the context in which these interpretations are made (Everaert, Bronstein, Cannon, & Joormann, 2018; Kashdan & Rottenberg, 2010; Mehu & Scherer, 2015; Stange, Alloy, & Fresco, 2017). Recent models propose that the inflexibility with which negative interpretations are formed and maintained may determine the misfit between interpretations and changing situational demands, thereby dysregulating negative emotions and encouraging maladaptive emotion regulation strategies in psychopathology (Mehu & Scherer, 2015).

Interpretation inflexibility refers to the impaired integration of initial understandings of a situation with information that subsequently becomes available. Interpretation inflexibility therefore hampers the revision of initial interpretations in the face of disconfirmatory evidence (Bronstein & Cannon, 2018). Recent empirical work suggests that the interpretation of unfolding situations in depression and social anxiety is marked by inflexibility (Everaert et al., 2018). In that study, an emotional variant of the Bias Against Disconfirmatory Evidence (BADE) task was developed to disentangle interpretation bias and inflexibility. The results demonstrated that both depression and social anxiety symptoms were related to reduced revision of *negative* interpretations in the face of disconfirmatory positive information (even when their associations with interpretation bias were considered). Indeed, it seems plausible

that inflexibility in revising negative interpretations may maintain negative emotions in evolving situations that might otherwise evoke experiences (e.g., of positive emotion) that relieve internalizing symptoms (Mehu & Scherer, 2015). This context-insensitive elicitation of negative emotions and interpretations may determine the (in)sensitivity of emotion regulation strategy implementation to changing contexts. Accordingly, the inflexibility with which negative interpretations are formed and maintained in the face of disconfirmatory positive information may facilitate engagement in repetitive negative thinking and dampening, but may interfere with the use of positive reappraisal.

### **The present investigation**

Despite the intuitive appeal of the inflexibility account, research has not yet examined whether inflexible negative interpretations of ambiguous information are associated with emotion regulation difficulties that have been previously linked to depression and anxiety. This investigation focused on depression and social anxiety because of the high comorbidity between these disorders (Adams, Balbuena, Meng, & Asmundson, 2016), their overlapping emotional information-processing biases (Everaert, Podina, et al., 2017; Hirsch et al., 2016; Morrison & Heimberg, 2013), and the social nature of the stimuli presented in the belief revision task used in the present studies.

The present studies employed a recently developed task that requires the revision of emotion-laden interpretations of scenarios that prominently feature social concerns (Everaert et al., 2018). Using this task, the present studies examined the relation between inflexibility in negative interpretations and the use of widely investigated emotion regulation strategies that have been previously associated with depression and social anxiety. In particular, this study focused on repetitive negative thinking, positive reappraisal, and dampening of positive emotions. In accordance with psychological (in)flexibility perspectives on psychopathology (e.g., Mehu & Scherer, 2015; Stange et al., 2017), it was hypothesized that negative

interpretation inflexibility would be related to more frequent use of repetitive negative thinking and dampening as well as less frequent use of positive reappraisal (Hypothesis 1). Furthermore, as predicted by cognitive models of emotion (dys)regulation (Hofmann et al., 2012; Joormann, 2010; Mehu & Scherer, 2015), it was expected that the use of emotion regulation strategies would mediate the relation between cognitive factors (here: negative interpretation inflexibility) and symptoms of depression and social anxiety (Hypothesis 2). Lastly, the present studies also attempted to replicate previous findings regarding the relation between negative interpretation inflexibility and symptoms of depression and social anxiety. In line with prior work (Everaert et al., 2018), it was hypothesized that greater inflexibility in revising negative interpretations would be associated with more severe depression and social anxiety symptoms (Hypothesis 3).

Testing these hypotheses using the recently developed emotional BADE task (Everaert et al., 2018) allowed this study to disentangle biased and inflexible emotional interpretations with respect to their relations with internalizing symptoms and emotion regulation strategy use. In light of prior research, it was expected that interpretation biases would be related to emotion regulation strategy use (Badra et al., 2017; Everaert, Grahek, et al., 2017; Mor et al., 2014; Wisco et al., 2014) as well as symptoms of depression and social anxiety (Everaert et al., 2018; Everaert, Podina, et al., 2017; Hirsch et al., 2016).<sup>1</sup> By examining these hypotheses, the present study was expected to shed light on the cognitive mechanisms that may give rise to maladaptive profiles of emotion regulation strategy use in individuals with psychopathology.

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<sup>1</sup> No specific predictions were formulated regarding the relation between social anxiety and *positive* interpretation bias. Prior work suggests that an attenuated positive bias in social anxiety occurs in tasks that measure interpretations online (i.e., at the time when ambiguity is encountered) but not offline (i.e., at later elaborate stages of interpretation; for a review, see Hirsch et al., 2016). The emotional BADE task used in this study adopts features of online and offline interpretation tasks. Our prior study did not find a relation between positive interpretation bias and social anxiety (Everaert et al., 2018). Therefore, the current set of studies serves to further explore whether an attenuated positive interpretation bias would be evident in socially anxious individuals' behavior on the emotional BADE task.

## STUDY 1

### Method

#### Participants and sampling strategy

Participants were recruited via Amazon's Mechanical Turk (MTurk). MTurk provides an online crowdsourcing platform with access to large and diverse samples that are suitable for clinical research collecting mental health data (Chandler & Shapiro, 2016). Participation in this study was restricted to MTurk users who were 18 years or older and living in the United States.

In keeping with the Research Domain Criteria (Insel et al., 2010), this study employed a dimensional approach that considered varying degrees of emotion regulation strategy use and negative interpretation inflexibility along the continuum of depression and social anxiety symptom severity. A stratified sampling approach was employed to represent the full spectrum of depression and social anxiety severity in the sample. Sampling began by having 500 MTurk participants complete the Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) and the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987). Sum scores for the BDI-II ( $M=16.18$ ,  $SD=13.01$ , range=0-55) and LSAS ( $M=52.30$ ,  $SD=31.85$ , range: 0-138) were computed and recoded into four groups according to established cutoffs (Beck et al., 1996; Liebowitz, 1987). For the BDI-II, groups reflected minimal (range: 0-13), mild (range: 14-19), moderate (range: 20-28), and severe (range: 29-63) symptom levels. For the LSAS, groups reflected symptom levels at which social anxiety was unlikely (range: 0-30), probable (range: 31-60), very probable (range: 61-90), and highly probable (range: 90-144). From each of the eight groups, 50 individuals were randomly contacted, yielding a final sample of 250 individuals. In this study, a considerable portion of the participants reported elevated levels of depression ( $n=126$  with BDI-II total score  $\geq 14$ ) and social anxiety ( $n=184$  with LSAS total score  $> 9$ ) according to established cutoffs (Beck, Epstein, Brown, & Steer, 1988; Beck et al., 1996). Supplement 1 presents demographic information for the final sample.



**Data quality measures**

Following recommendations for research using crowdsourced samples (Chandler & Shapiro, 2016), several steps were taken to ensure high data quality. Only MTurk workers with a history of providing good-quality responses (i.e., an acceptance ratio of  $\geq 96\%$ ) were allowed to participate. Moreover, two reading check questions were presented during the survey to discriminate attentive from inattentive MTurk workers. These questions were presented at irregular intervals and participants were required to correctly answer both. Data from participants failing to correctly answer both these questions were not counted toward recruitment quotas. With these quality requirements, research has demonstrated that MTurk data are comparable to those collected in the laboratory (Chandler & Shapiro, 2016). Finally, the data were screened for repeating latitude and longitude coordinates to further ensure that responses were valid and unique.

**Interpretation inflexibility**

The emotional variant of the Bias Against Disconfirmatory Evidence (BADE) task was utilized to measure interpretation bias and inflexibility (Everaert et al., 2018). The emotional BADE task was created by modifying a paradigm that has been used for over a decade to study the extent to which interpretations are revised in consideration of evidence against them in individuals with psychosis (Sanford, Veckenstedt, Moritz, Balzan, & Woodward, 2014; Woodward, Moritz, Cuttler, & Whitman, 2006) and in the general population (Bronstein & Cannon, 2017, 2018; Woodward, Buchy, Moritz, & Liotti, 2007). This paradigm was modified to better capture the challenges that individuals with social anxiety or depression may encounter when revising emotion-laden interpretations. During the emotional BADE task, 24 self-referential scenarios containing three statements were presented to participants. Each statement provided additional information about an unfolding ambiguous interpersonal situation relevant to themes of social failure and rejection, which likely reflect concerns relevant to depression

and social anxiety (Clark, Beck, & Alford, 1999; Rapee & Heimberg, 1997). For example, the three statements of the scenario “On a trip” read: “You are on a day out with old friends but the outing comes to an abrupt end” (Statement 1), “Everyone’s mood has dropped” (Statement 2), “After finding shelter from the heavy showers, your old friends thank you for bringing the group back together” (Statement 3). Scenario development was guided by ambiguous scenarios utilized in prior research on interpretation biases in anxiety and depression (cf. Everaert et al., 2018).

After viewing each statement, participants rated the plausibility of four different interpretations of the information acquired thus far in that scenario using a 21-point rating scale ranging from ‘poor’ (a score of 1) to ‘excellent’ (a score of 21). Interpretations were presented in randomized order after each statement. Across scenarios, the interpretations were grouped into three categories: Absurd, Lure, and True interpretations (in accordance with Everaert et al., 2018): One Absurd interpretation (e.g., “You and your old friends suddenly fall asleep”), which was consistently implausible, was presented in each scenario. Two Lure interpretations – Lure-A and Lure-B (Lure interpretations were arbitrarily sorted into these categories) – were presented in each scenario. These interpretations were initially most plausible but became less plausible after the third statement (e.g., “Your old friends decide to leave and do something else”). One True interpretation (e.g., “Your old friends think you are a fun person to spend time with”) was also presented in each scenario. True interpretations were initially less plausible than the Lure interpretations but became the most plausible after the third statement. Thus, the emotional BADE task requires participants to revise their beliefs about the most plausible interpretation for a given scenario by integrating the disconfirmatory information provided by each of the latter two statements.

The emotional BADE task includes 24 scenarios divided equally into two categories. Scenarios from both categories were presented in a randomized order. The first category,

*disconfirming-the-negative* scenarios, contained negative Lure interpretations but ended with a positive (True) interpretation being the most plausible. Disconfirming-the-negative scenarios allow for the investigation of inflexibility in negative interpretations in response to disconfirmatory positive evidence and are of central interest to the goals of this study (cf. Hypotheses 1-3). Given these goals (and hypotheses), this article focuses on the results obtained using the disconfirming-the-negative scenarios. The second category, *disconfirming-the-positive* scenarios, contained positive Lure interpretations but ended with a negative (True) interpretation being the most plausible. Disconfirming-the-positive scenarios allow for the investigation of inflexibility of positive interpretations in response to disconfirmatory evidence. Results regarding these scenarios are presented in Supplement 7.

## **Symptom questionnaires**

### **Depression symptoms**

The Beck Depression Inventory II (BDI-II; Beck et al., 1996) is a widely used 21-item self-report measure of depressive symptom severity during the past two weeks. Item scores are summed to quantify the overall severity of depressive symptoms. The reliability and validity of the BDI-II has been extensively supported in both nonclinical and clinical adult samples (Dozois, Dobson, & Ahnberg, 1998; Joiner, Walker, Pettit, Perez, & Cukrowicz, 2005). The internal consistency of the BDI-II in this study was  $\alpha=.95$ .

### **Social anxiety**

The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) is a self-report measure used to assess social anxiety and avoidance of social situations over the past week. In accordance with prior research using the emotional BADE task (Everaert et al., 2018), this study examined the relationship of total scores on the anxiety subscale of the LSAS with interpretation bias and inflexibility. The LSAS and its subscales have good reliability as well as convergent

and discriminant validity (Fresco et al., 2001; Rytwinski et al., 2009). The internal consistency of the anxiety subscale in this study was  $\alpha=.95$ .

### **Emotion regulation questionnaires**

#### **Dampening**

The Responses to Positive Affect scale (Feldman et al., 2008) was used to measure the use of strategies in response to positive affect. This questionnaire consists of three subscales and 17 items. The 5-item emotion-focused positive rumination subscale measures the tendency to respond to positive affective states with recurrent thoughts about positive affective experiences. The 4-item self-focused positive rumination subscale measures the tendency to respond to positive mood states with recurrent thoughts about positive self-qualities. The 8-item *dampening* subscale assesses the tendency to respond to positive mood states with mental strategies that reduce the intensity and duration of the positive mood. Respondents indicate how well each scale item describes what they might think or do when they feel happy, excited, or enthused. Items are scored on a 4-point scale ranging from 1 ('almost never') to 4 ('almost always'). The Responses to Positive Affect scale has satisfactory to good reliability and validity (Feldman et al., 2008). In this study, the internal consistency was  $\alpha=.85$  for the emotion-focused positive rumination subscale,  $\alpha=.87$  for the dampening subscale, and  $\alpha=.89$  for the self-focused positive rumination subscale. The current study was particularly interested in the dampening subscale, as this emotion regulation strategy has been robustly related to symptoms of depression and social anxiety (cf. Introduction). The results for the positive rumination subscales are reported in Supplement 5.

#### **Repetitive negative thinking**

The Perseverative Thinking Questionnaire (Ehring et al., 2011) is a self-report measure of repetitive negative thinking. Respondents rate all 15 statements in this questionnaire on a five-point scale from 0 ('never') to 4 ('almost always') to describe how they typically think

about negative experiences or problems. A total score was calculated to quantify the habitual use of repetitive negative thinking in response to negative events. The Perseverative Thinking Questionnaire has satisfactory to good validity and reliability (Ehring et al., 2011). In this study, the internal consistency of this questionnaire was  $\alpha=.97$ .

### **Positive reappraisal**

The positive reappraisal subscale of the Cognitive Emotion Regulation Questionnaire (Garnefski, Kraaij, & Spinhoven, 2001) measured the use of positive reappraisal in response to negative events. On each of the 4 items, respondents rate the extent to which they engage in positive reappraisal using a 5-point scale from 1 ('almost never') to 5 ('almost always'). The positive reappraisal scale of the Cognitive Emotion Regulation Questionnaire has high internal consistency as well as convergent and discriminant validity in both nonclinical and clinical samples (Garnefski & Kraaij, 2006, 2007; Garnefski et al., 2001; Ireland, Clough, & Day, 2017). In this study, the internal consistency of the positive reappraisal scale was  $\alpha=.91$ .

### **Procedure**

All participants gave informed consent in accordance with the Yale University Institutional Review Board. Participants completed a survey which began with demographic questions followed by the emotional BADE task. Participants then completed questionnaires measuring psychopathology symptoms (i.e., the Beck Depression Inventory II and the Liebowitz Social Anxiety Scale) and emotion regulation strategy use (i.e., the Perseverative Thinking Questionnaire as well as the subscales of the Cognitive Emotion Regulation Questionnaire and the Responses to Positive Affect scale). The questionnaires were presented in randomized order. Upon completion of the survey, participants were debriefed and received remuneration (4 USD).

### **Data reduction and analysis**

The three emotional BADE components ('negative interpretation inflexibility', 'positive interpretation bias, and 'negative interpretation bias) were extracted from interpretation plausibility ratings. The extraction process began by averaging the interpretation ratings provided after each statement across all scenarios. This procedure was repeated for each interpretation type (Absurd, Lure-A, Lure-B, and True interpretations) contained in disconfirming-the-negative scenarios. Table S2 in the supplement presents the average ratings for the Absurd, Lure, and True interpretations. As in prior research (Bronstein & Cannon, 2017; Everaert et al., 2018), the resulting 12 average ratings were subjected to Principal Component Analysis (PCA) with direct oblimin rotation (i.e., the extracted components were allowed to correlate with one another). PCA is a dimension reduction technique that utilizes the variance-covariance structure of a set of variables to represent the information contained in these variables using a smaller set of new composite dimensions. The results of the PCA are reported in Supplement 3. As in our prior study (Everaert et al., 2018), this procedure yielded three components. The loading patterns of the components were highly similar to the components extracted in prior work (see Table S3) and were thought to capture the same constructs. The first component was 'Negative Interpretation Inflexibility', which reflects the inability to reject implausible negative interpretations and integrate disambiguating positive information. The second and third components were 'Negative Interpretation Bias' and 'Positive Interpretation Bias', which reflected the degree to which the emotional content of the interpretations was endorsed.

To test the study hypotheses, path models were constructed with (a) Negative Interpretation Inflexibility, Negative Interpretation Bias, and Positive Interpretation Bias as exogenous variables, (b) depression and social anxiety symptoms as endogenous variables, and (c) emotion regulation strategy use as a mediator between the exogenous and endogenous

variables. The path model was tested separately for dampening (Model 1), repetitive negative thinking (Model 2), and positive reappraisal (Model 3). Each path model included the direct effect of the exogenous variables (the emotional BADE components) on the endogenous variables (the symptom levels of depression and social anxiety) as well as their indirect effects via emotion regulation strategy use. The overall fit of the models was evaluated using common fit indices: the Root-Mean-Square Error of Approximation (RMSEA), the Confirmatory Fit Index (CFI), and the Tucker-Lewis index (TLI). A well-fitting model has an RMSEA value lower than or equal to 0.06 and values for CFI and TLI that exceed 0.95 (Kline, 2010). Bias-corrected bootstrapped 95% confidence intervals (CIs) were estimated from 5000 re-samples to test the hypothesized effects. Significant effects are indicated by 95% CIs that do not overlap with zero. All path models were fit to the data using the *lavaan* package (Rosseel, 2012) for R (R Core Team, 2018).

Hypothesis 1 was tested by inspecting the coefficients of the paths connecting Negative Interpretation Inflexibility, Negative Interpretation Bias, and Positive Interpretation Bias with the particular emotion regulation strategy under investigation in each model. Hypothesis 2 was tested by examining both the direct and indirect effects of ‘Negative Interpretation Inflexibility’ on depression and social anxiety symptoms via emotion regulation strategy use. Finally, Hypothesis 3 was tested by inspecting the total effects (i.e., the sum of the direct and indirect effects) of Negative Interpretation Inflexibility, Negative Interpretation Bias, and Positive Interpretation Bias on depression and social anxiety symptoms.

## **Results**

### **Descriptive statistics and correlational analysis**

Correlations among depressive symptoms (BDI-II), social anxiety levels (LSAS anxiety), and emotion regulation strategies are presented in Supplement 4. As a result of the stratified sampling approach, participants’ BDI-II scores represented almost the full spectrum

of symptom severity ( $M=15.63$ ,  $SD=12.58$ ): 123 respondents reported minimal (range: 0–13), 40 reported mild (range: 14–19), 44 reported moderate (range: 20–28), and 42 reported severe (range: 29–54) symptoms. The BDI-II data of one participant were missing. Significant variation was also found in participants' scores on the anxiety subscale of the LSAS ( $M=27.38$ ,  $SD=16.26$ ). Regarding total scores on the LSAS, 66 respondents reported symptom levels at which social anxiety is unlikely (range: 0-30), 83 reported probable social anxiety (range: 31-60), 63 reported very probable social anxiety (range: 61-90), and 38 reported highly probable levels of social anxiety (range: 90-132).

In line with prior research on emotion regulation difficulties in psychopathology, depressive symptoms and social anxiety levels were significantly correlated with the use of the emotion regulation strategies investigated in this study. As shown in Supplement 4, depressive symptoms and social anxiety were positively correlated with the use of repetitive negative thinking as well as the use of dampening. As expected, the use of positive reappraisal was negatively related to both depressive symptoms and social anxiety. Supplement 4 presents zero-order correlations between the emotional BADE components and other variables of interest examined here-in.

### **Path analysis models**

Excellent model fits were found for all three path models (CFIs=1, TLIs=1, RMSEAs=0). Figure 1 depicts the fitted models and standardized path coefficients for each model.

#### **Model 1: Dampening as a mediating variable**

In support of Hypothesis 1, path coefficients (see also Figure 1A) revealed that dampening was significantly associated with Negative Interpretation Inflexibility ( $\beta=.19$ ,  $SE=.06$ ,  $p=.001$ ), Negative Interpretation Bias ( $\beta=.15$ ,  $SE=.06$ ,  $p=.018$ ), and Positive Interpretation Bias ( $\beta=-.16$ ,  $SE=.07$ ,  $p=.017$ ). As predicted, greater use of dampening was



associated with higher levels of both negative interpretation inflexibility and negative interpretation bias as well as lower levels of positive interpretation bias.

In line with the hypothesized mediation model (cf. Hypothesis 2), the results provided evidence for the indirect effects of Negative Interpretation Inflexibility on depressive symptoms (coefficient: 1.18, 95%-CI[0.45, 1.91],  $p=.001$ ) and on social anxiety scores (coefficient: 2.17, 95%-CI[0.69, 3.66],  $p=.004$ ) via dampening. The direct effects of Negative Interpretation Inflexibility on depressive symptoms (coefficient: 0.91, 95%-CI[-0.56, 2.37],  $p=.226$ ) and social anxiety levels (coefficient: 2.38, 95%-CI[-1.12, 5.88],  $p=.183$ ) were not statistically different from zero. It is notable that alternative mediation models were not supported by the data (see Supplement 6). This suggests that the hypothesized model is the most tenable model.

Consistent with findings from our previous study (Everaert et al., 2018) and Hypothesis 3, the total effects of Negative Interpretation Inflexibility on depressive symptom severity (coefficient: 2.09, 95%-CI[0.55, 3.63],  $p=.008$ ) and on social anxiety levels (coefficient: 4.55, 95%-CI[0.75, 8.35],  $p=.019$ ) were statistically significant. The results further demonstrated a significant total effect of Positive Interpretation Bias on depressive symptoms (coefficient: -2.50, 95%-CI[-4.09, -0.90],  $p=.002$ ), but not on social anxiety (coefficient: -2.10, 95%-CI[-5.91, 1.70],  $p=.279$ ). The total effect of Negative Interpretation Bias on social anxiety (coefficient: 5.14, 95%-CI[1.11, 9.16],  $p=.012$ ), but not on depressive symptoms (coefficient: 0.79, 95%-CI[-0.72, 2.31],  $p=.306$ ), was statistically significant.

### **Model 2: Repetitive negative thinking as a mediating variable**

With respect to Hypothesis 1, the results showed that repetitive negative thinking was related to Negative Interpretation Bias ( $\beta=.14$ ,  $SE=.06$ ,  $p=.018$ ). Higher levels of negative interpretation bias were related to greater engagement in repetitive negative thinking. Neither Negative Interpretation Inflexibility ( $\beta=.10$ ,  $SE=.06$ ,  $p=.102$ ) nor Positive Interpretation Bias

( $\beta=-.09$ ,  $SE=.07$ ,  $p=.187$ ) was related to repetitive negative thinking. These observations provide partial support for the first hypothesis.

In line with this pattern of relations, the results showed that the indirect effect of Negative Interpretation Inflexibility on depressive symptoms via repetitive negative thinking was not statistically different from zero (coefficient: 0.72, 95%-CI[-0.15, 1.60],  $p=.105$ ). Similarly, no evidence was found for an indirect effect of Negative Interpretation Inflexibility on social anxiety scores via repetitive negative thinking (coefficient: 1.31, 95%-CI[-0.32, 2.94],  $p=.115$ ). A trend toward statistical significance (i.e.,  $.100 < p < .050$ ) was found for the direct effects of Negative Interpretation Inflexibility on depressive symptoms (coefficient: 1.36, 95%-CI[-0.08, 2.80],  $p=.063$ ) and on social anxiety (coefficient: 3.24, 95%-CI[-0.15, 6.63],  $p=0.061$ ). Taken together, these findings do not support the hypothesized mediation model for repetitive negative thinking (cf. Hypothesis 2).

Regarding Hypothesis 3, the total effects of Negative Interpretation Inflexibility on depressive symptoms (coefficient: 2.09, 95%-CI[0.51, 3.66],  $p=.009$ ) and on social anxiety (coefficient: 4.55, 95%-CI[0.73, 8.37],  $p=.019$ ) were again significant. The total effect of Positive Interpretation Bias on depressive symptoms (coefficient: -2.50, 95%-CI[-4.07, -0.92],  $p=.002$ ), but not on social anxiety (coefficient: -2.10, 95%-CI[-5.93, 1.73],  $p=.282$ ), was significant. Finally, the total effect of Negative Interpretation Bias on social anxiety (coefficient: 5.14, 95%-CI[1.05, 9.22],  $p=.014$ ), but not depression symptoms (coefficient: 0.79, 95%-CI[-0.71, 2.30],  $p=.302$ ), was statistically significant.

### **Model 3: Positive reappraisal as a mediating variable**

When examining Hypothesis 1, the results showed that positive reappraisal was related to Positive Interpretation Bias ( $\beta=.19$ ,  $SE=.06$ ,  $p=.001$ ). Higher levels of positive interpretation bias were related to greater use of positive reappraisal. Negative Interpretation Inflexibility ( $\beta=-$

.06,  $SE=.05$ ,  $p=.274$ ) and Negative Interpretation Bias ( $\beta=-.03$ ,  $SE=.06$ ,  $p=.593$ ) were not related to positive reappraisal use.

Indeed, the indirect effects of Negative Interpretation Inflexibility on depressive symptoms (coefficient: 0.31, 95%-CI[-0.25, 0.88],  $p=.275$ ) and on social anxiety (coefficient: 0.66, 95%-CI[-0.52, 1.83],  $p=.273$ ) via positive reappraisal were not statistically different from zero. Instead, the direct effects of Negative Interpretation Inflexibility on depressive symptoms (coefficient: 1.77, 95%-CI[0.42, 3.12],  $p=.010$ ) and social anxiety levels (coefficient: 3.89, 95%-CI[0.27, 7.52],  $p=.035$ ) were significant. These findings indicate that the data did not support the hypothesized mediation model for positive reappraisal (cf. Hypothesis 2).

As for Models 1 and 2, the total effects of Negative Interpretation Inflexibility on depressive symptoms (coefficient: 2.09, 95%-CI[0.53, 3.64],  $p=.009$ ) and on social anxiety (coefficient: 4.55, 95%-CI[0.71, 8.39],  $p=.020$ ) were significant. The total effect of Positive Interpretation Bias on depressive symptoms (coefficient: -2.50, 95%-CI[-4.09, -0.90],  $p=.002$ ), but not on social anxiety (coefficient: -2.10, 95%-CI[-5.98, 1.78],  $p=.288$ ), was significant. The total effect of Negative Interpretation Bias on social anxiety (coefficient: 5.14, 95%-CI[1.01, 9.26],  $p=.015$ ), but not on depressive symptoms (coefficient: 0.79, 95%-CI[-0.70, 2.29],  $p=.299$ ), was statistically significant.

### **Interim Discussion**

The results of this study extended previous research by revealing that greater inflexibility of negative interpretations was associated with higher levels of dampening of positive emotions. Dampening of positive emotions mediated the relation between negative interpretation inflexibility and symptoms of both depression and social anxiety. Surprisingly, inflexibility in revising negative interpretations was not related to repetitive negative thinking or positive reappraisal in response to negative emotions. This pattern of results provides partial support for Hypothesis 1, which stated that negative interpretation inflexibility would be related

to emotion regulation strategy use. Support was also found for the mediation model proposed by Hypothesis 2 when considering dampening of positive emotions. Importantly, the relation between negative interpretation inflexibility and dampening remained significant when interpretation biases were included in the path model. As expected, the use of dampening was related to a stronger negative and weaker positive interpretation bias. Moreover, repetitive negative thinking was related to a negative interpretation bias and positive reappraisal was related to a positive interpretation bias. In summary, these findings indicate that negative interpretation inflexibility and interpretation biases may be involved in the use of emotion regulation strategies in response to negative and positive emotional experiences.

Replicating earlier observations (Everaert et al., 2018), the results further showed that inflexibility in revising negative interpretations was associated with both depression symptom severity and social anxiety levels (cf. the total effects). In accordance with prior work (Everaert et al., 2018; Hirsch et al., 2016), negative (but not positive) interpretation bias was associated with social anxiety symptom levels. However, in a departure from previous research (Everaert et al., 2018), depression symptom levels were related (negatively) to positive, but not negative, interpretation bias.

Because Study 1 examined multiple outcomes in relation to individuals' interpretations (which may increase the risk of Type I error), Study 2 was designed to directly replicate the relations observed among negative interpretation inflexibility, dampening of positive emotions, and symptoms of both depression and social anxiety. For this second study, it was again hypothesized that negative interpretation inflexibility would be associated with greater levels of dampening, which in turn would be related to symptoms of both depression and social anxiety. The importance of this replication effort is underscored by concerns about reproducibility of psychological science (Open Science Collaboration, 2015).

## STUDY 2

### Method

#### Participants and sampling strategy

This replication study was part of a larger project that also examined analytic reasoning and interpretation flexibility in relation to paranoid ideation (Bronstein, Everaert, Castro, Joormann, & Cannon, 2019). A sample of 294 individuals was recruited via Amazon's Mechanical Turk (MTurk). Only individuals who were 18 years or older, lived in the United States, and had a history of providing good-quality responses (i.e., an acceptance ratio of  $\geq 96\%$ ) were allowed to participate.

Participants were sampled in two waves completed within weeks of one another. In line with prior work (Everaert et al., 2018), a gradual oversampling strategy was employed to capture sufficient variation in psychopathology symptoms. In the first wave, participants were unselected. In the second wave, MTurk participants first completed a screening to determine eligibility for the study. A total of 300 individuals completed the Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996), the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987), and the Green et al. Paranoid Thought Scales (Green et al., 2008). Sum scores for the BDI-II ( $M=20.53$ ,  $SD=13.69$ , range=0-63), LSAS ( $M=56.70$ ,  $SD=35.23$ , range: 0-144), and Green et al. Paranoid Thought Scales ( $M=32.16$ ,  $SD=17.74$ , range=15-80) were computed, and participants within the highest quantile on each questionnaire were invited to participate in the second wave of the study.<sup>2</sup> The obtained range of depression and social anxiety levels (see the descriptive statistics section) enabled this study to investigate differences in interpretation inflexibility and emotion regulation strategy use that were putatively related to depression

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<sup>2</sup> All participants who reported high BDI-II or LSAS scores (even when reporting elevated GPTS scores) were included in the analyses.

and/or social anxiety. This approach accords with the Research Domain Criteria (Insel et al., 2010). Table S1 provides demographic information for the final sample.

### **Materials and procedure**

The test battery involved an extensive survey that was completed over three consecutive days to limit participant fatigue. Participants completed the Beck Depression Inventory – II (BDI-II; Beck et al., 1996), LSAS (Liebowitz, 1987), and the Responses to Positive Affect scale (Feldman et al., 2008) on the first day (questionnaires were presented in randomized order). See the Method section describing Study 1 for a detailed description of these questionnaires. As in Study 1, this second study focused on the dampening subscale of the Responses to Positive Affect scale (Feldman et al., 2008). Supplement 5 presents the results for the other subscales of this questionnaire. The emotional BADE task (Everaert et al., 2018) was completed over the three days with eight scenarios presented during each test session. As in Study 1, the disconfirming-the-negative scenarios from the emotional BADE task were considered to address the study aims regarding the role of inflexibility in negative interpretations in response to disconfirmatory evidence. The results regarding the disconfirming-the-positive scenarios are reported in Supplement 7. All participants gave informed consent in accordance with the Yale University Institutional Review Board. Upon completion of the study, participants were debriefed and received remuneration (4.5 USD).

### **Data reduction and analysis**

The data-analytic plan was similar to that in Study 1. Principal Component Analysis (PCA) was first used to extract the emotional BADE components of ‘negative interpretation inflexibility’, ‘positive interpretation bias’, and ‘negative interpretation bias’ from the interpretation ratings of the disconfirming-the-negative scenarios (see Table S2 in the supplement for average interpretation ratings). The interpretation ratings from the 12 disconfirming-the-negative scenarios were aggregated across the three days of the study. The

results of this PCA are detailed in Supplement 3. As described in Supplement 3, this PCA (with direct oblimin rotation) of interpretation plausibility data produced three components that had similar loading patterns to the components extracted in prior work (see Table S3). The components were therefore thought to capture the same constructs. In particular, the first component reflected a reduced ability to reject implausible negative interpretations and integrate disambiguating information and was labeled ‘Negative Interpretation Inflexibility’. The two other components reflected the degree to which the negative or positive content of the interpretations was endorsed and were labeled ‘Negative Interpretation Bias’ and ‘Positive Interpretation Bias’, respectively.

To test the study hypotheses, path models were constructed in a manner identical to that employed in Study 1. The model included (a) Negative Interpretation Inflexibility, Negative Interpretation Bias, and Positive Interpretation Bias as exogenous variables, (b) depression and social anxiety symptoms as endogenous variables, and (c) dampening of positive emotions as a potential mediator of the relations between the exogenous and endogenous variables. The path model included the direct effect of the emotional BADE components on depression and social anxiety symptom levels as well as their indirect effects via dampening. The model fit was again evaluated using the Root-Mean-Square Error of Approximation (RMSEA), the Confirmatory Fit Index (CFI), and the Tucker-Lewis index (TLI). Bias-corrected bootstrapped 95% confidence intervals (CIs) were estimated from 5000 re-samples to test the hypothesized effects. Significant effects are indicated by 95% CIs that do not overlap with zero. The path model was fit to the data using the *lavaan* package (Rosseel, 2012) for R (R Core Team, 2018).

## Results

### Descriptive statistics and correlational analysis

Participants’ BDI-II scores covered almost the full range of depressive symptom severity ( $M=13.05$ ,  $SD=12.65$ ): 167 respondents reported minimal (range: 0–13), 40 reported

mild (range: 14–19), 47 reported moderate (range: 20–28), and 40 reported severe (range: 29–52) symptoms. Significant variation was also found in participants' scores on the anxiety subscale of the LSAS ( $M=24.15$ ,  $SD=17.59$ , range: 0-66). Regarding the total scores on the LSAS, 112 respondents reported levels at which social anxiety is unlikely (range: 0-30), 68 reported probable social anxiety (range: 31-60), 80 reported very probable social anxiety (range: 61-90), and 35 reported highly probable levels of social anxiety (range: 90-133). The correlation between the BDI-II and LSAS anxiety scores was large,  $\rho(294)=.66$ ,  $p<.001$  (see Supplement 4 for zero-order correlations between the emotional BADE components and the other study variables).

### **Path analysis model**

Figure 2 depicts the tested path model. The path model had an excellent fit with the data (CFIs=1, TLIs=1, RMSEAs=0). Consistent with Hypothesis 1, path coefficients showed that dampening was significantly associated with Negative Interpretation Inflexibility ( $\beta=.29$ ,  $SE=.06$ ,  $p<.001$ ) and marginal significantly related to Negative Interpretation Bias ( $\beta=.12$ ,  $SE=.07$ ,  $p=.077$ ). In contrast with the results from Study 1, no evidence was found for a relation between Negative Interpretation Inflexibility and Positive Interpretation Bias ( $\beta=-.04$ ,  $SE=.07$ ,  $p=.539$ ).

Replicating the observations from Study 1 and providing further support for Hypothesis 2, the results of the bootstrapping procedure revealed that the indirect effect of Negative Interpretation Inflexibility on depression symptom scores via dampening was positive and statistically different from zero (indirect effect coefficient: 2.38, 95%-CI[1.34, 3.43],  $p<.001$ ). The direct effect (coefficient: 1.16, 95%-CI[-0.21, 2.52],  $p=.092$ ) was only trending toward significance. Similarly, the indirect effect of Negative Interpretation Inflexibility on social anxiety (LSAS) scores via dampening was positive and different from zero (indirect effect coefficient: 2.65, 95%-CI[1.36, 3.94],  $p<.001$ ). The corresponding direct effect (coefficient:



3.04, 95%-CI[0.75, 5.33],  $p=.009$ ) was significant. These results provide support for the hypothesis that the dampening of positive emotions mediates the relation between negative interpretation inflexibility and symptoms of depression.

As in Study 1, alternative mediation models were tested (see Supplement 6). Some support was found for a model with dampening mediating the relation between depressive symptoms and negative interpretation inflexibility, as well as for a model with negative interpretation inflexibility mediating the relation between dampening and social anxiety symptoms. However, these alternative mediation models were not consistently supported by the data across Studies 1 and 2. The hypothesized mediation model was the only model that received consistent empirical support from the two independent studies, indicating that the hypothesized model is the most plausible.

Providing support for the third hypothesis, the total effects of Negative Interpretation Inflexibility on depressive symptom severity (coefficient: 3.54, 95%-CI[1.86, 5.22],  $p<.001$ ) and on social anxiety levels (coefficient: 5.69, 95%-CI[3.47, 7.91],  $p<.001$ ) were significant. For Positive Interpretation Bias, the results demonstrated a significant total effect on social anxiety (coefficient: -3.75, 95%-CI[-6.02, -1.47],  $p=.002$ ), but not on depressive symptoms (coefficient: -1.21, 95%-CI[-2.96, 0.54],  $p=.176$ ). The total effect of Negative Interpretation Bias on social anxiety (coefficient: 3.16, 95%-CI[1.07, 5.25],  $p=.003$ ) and on depression symptoms (coefficient: 2.05, 95%-CI[0.53, 3.56],  $p=.008$ ) was statistically significant.

### **Interim Discussion**

Replicating the observations of Study 1, the results of Study 2 showed that inflexibility in revising negative interpretations was associated with higher levels of dampening of positive emotions (cf. Hypothesis 1) as well as more severe symptoms of depression and social anxiety (cf. Hypothesis 3). In addition, the data provided support for a mediation model in which the dampening of positive emotions intervenes in the relation between negative interpretation

inflexibility and symptoms of depression and social anxiety. This finding provides further support for Hypothesis 2.

In line with our prior work (Everaert et al., 2018), the results of this second study revealed that a negative (but not positive) interpretation bias was related to depression symptoms. Furthermore, as in Study 1, social anxiety levels were related to negative interpretation bias. However, in contrast with Study 1 and earlier work (Everaert et al., 2018), Study 2 observed that social anxiety levels were also negatively related to a positive interpretation bias. Finally, replicating the results of Study 1, a negative interpretation bias was related to the dampening of positive emotions. However, in a departure from Study 1, no evidence was found for a negative relation between dampening and positive interpretation bias.

### **GENERAL DISCUSSION**

The present investigation examined whether inflexible negative interpretations of ambiguous information may promote the maladaptive use of emotion regulation strategies that have been previously related to symptoms of depression and anxiety. Two studies demonstrated that inflexibility of negative interpretations is reliably and uniquely associated with the dampening of positive emotions. In line with Hypothesis 2, this finding suggests that individuals with difficulties adjusting negative interpretations when positive information is presented are more likely to respond to positive emotions by diminishing their intensity and duration. Interestingly, both studies revealed that dampening of positive emotions mediated the relation between negative interpretation inflexibility and symptoms of depression as well as social anxiety. In line with cognitive models of emotion (dys)regulation (Hofmann et al., 2012; Joormann, 2010; Mehu & Scherer, 2015) and Hypothesis 3, the data supported a model in which negative interpretation inflexibility is related to greater dampening, which in turn is associated with higher symptom levels of both depression and social anxiety. This observation is consistent with prior research linking the dampening of positive emotions to depression (Feldman et al.,

2008; Raes et al., 2012; Werner-Seidler et al., 2013) and (social) anxiety (Eisner et al., 2009; McEvoy et al., 2018). Importantly, this observation extends this prior work by identifying (for the first time) a cognitive mechanism (negative interpretation inflexibility) that may set the stage for the use of this emotion regulation strategy in the context of psychopathology.

Furthermore, as expected, both studies found that interpretation bias was linked to dampening of positive emotions. In particular, more negative interpretations of ambiguous situations were consistently linked to more frequent use of dampening strategies. Indeed, dampening may be a mechanism through which initial negative interpretations persist as individuals disqualify disconfirmatory positive information (Kube, Rief, Gollwitzer, Gärtner, & Glombiewski, 2018). Collectively, these findings suggest that both negative interpretation inflexibility and negative interpretation bias are involved in emotion regulation difficulties in response to positive emotions. Through this suggestion, the present studies significantly extend earlier research, which has mainly focused on the relation between interpretation of ambiguity and the use of strategies to downregulate negative emotions (Badra et al., 2017; Everaert, Grahek, et al., 2017; Mor et al., 2014; Wisco et al., 2014).

Contrary to Hypotheses 1 and 2, inflexibility in revising negative interpretations in the face of disconfirmatory positive information did not explain a significant portion of the variability in the use of repetitive negative thinking or positive reappraisal. Instead, interpretation bias was related to the use of these emotion regulation strategies. In accordance with prior research (Badra et al., 2017; Everaert, Grahek, et al., 2017; Mor et al., 2014; Wisco et al., 2014), negative interpretation bias was related to repetitive negative thinking and positive interpretation bias was related to positive reappraisal. This pattern of findings suggests that engagement in emotion regulation strategies when one experiences negative emotions may be fueled by the presence of negative and positive interpretations, but not by the inflexibility of negative interpretations. Despite this suggestion, future research should clarify whether

negative interpretation inflexibility has a role in repetitive negative thinking or positive reappraisal. It is possible that negative interpretation inflexibility may relate to the efficacy with which these emotion regulation strategies are implemented (despite its lack of relation with the frequency of their use). Indeed, regardless of emotion regulation strategy use, depressed and socially anxious individuals are less effective at using strategies (e.g., positive reappraisal) to downregulate negative emotions (Joormann & Stanton, 2016; Kivity & Huppert, 2018).

The results of this study also replicate prior findings with the recently developed emotional BADE task (Everaert et al., 2018). In line with this initial study and Hypothesis 3 of the current study, the research reported here found that negative interpretation inflexibility was associated with depression and social anxiety symptom levels. In particular, greater inflexibility in revising negative interpretations was associated with higher levels of both depression and social anxiety symptoms. These findings provide further support for the role of inflexible negative interpretations in depression and social anxiety symptoms and underscore the ability of the emotional BADE task to shed light on dynamic features of the interpretation process.

Moreover, the results of this study support the notion that depression and social anxiety are related to interpretation biases (Everaert, Podina, et al., 2017; Hirsch et al., 2016). As in prior research with the emotional BADE task (Everaert et al., 2018), social anxiety levels were consistently related to negative interpretation bias in both studies. More severe levels of social anxiety were linked to a greater negative bias in the interpretation of ambiguous emotional information. However, mixed evidence emerged for the relation between positive interpretation bias and social anxiety. Social anxiety levels were negatively related to a positive interpretation bias in Study 2, whereas Study 1 and earlier work (Everaert et al., 2018) did not provide evidence for this relationship. Similar mixed findings have been reported in the literature, and researchers have suggested that a lack of a positive bias in social anxiety occurs when tasks measure interpretations online (i.e., at the time when ambiguity is initially encountered) but not

offline (i.e., at later reflective or elaborative stages; for a review, see Hirsch et al., 2016). As noted, the emotional BADE task involves features of online and offline interpretation tasks. In providing plausibility ratings for the interpretations, participants may rely on interpretation processes that resemble online (e.g., reporting the first interpretation that comes to mind) and/or offline (e.g., comparing and reflecting on the plausibility of the different interpretations) task demands. It is possible that differential reliance of these processes may account for the current observations.

Furthermore, the results regarding interpretation biases in depression across Studies 1 and 2 were mixed. In Study 1, it was found that depression levels were related to a positive interpretation bias. In Study 2, as in the original study (Everaert et al., 2018), depression symptoms were related to a negative interpretation bias. Similar mixed findings have emerged in prior research on interpretation biases in depression, and meta-analytic evidence suggests that depression may be characterized by both an elevated negative interpretation bias and the lack of a positive interpretation bias (Everaert, Podina, et al., 2017). The current results are consistent with this general pattern of findings reported in the literature, but much remains to be learned about the conditions under which depression manifests in a negative interpretation bias rather than in the lack of a positive interpretation bias.

The present results imply a possible mechanism by which evidence-based cognitive-behavioral therapies for depression and social anxiety might act: through their focus on cognitive restructuring, these therapies may increase the flexibility of negative interpretations. This increased flexibility might limit the impact of biased negative interpretations of ambiguous social situations, discourage dampening of positive emotions when these situations evolve in better-than-expected ways, and may ultimately alleviate symptoms. This possibility could be investigated by examining (individual differences in) trajectories of change in negative interpretation inflexibility during cognitive-behavioral therapy and whether such trajectories

covary with change trajectories of dampening of positive emotions as well as symptoms of depression and anxiety.

Several limitations of this study point to additional future directions. First, the cross-sectional design of this study precludes conclusions regarding the causal direction of the observed relations. This design may also lead to the biased estimation of parameters describing casual pathways that unfold over time (Maxwell & Cole, 2007). Multiwave longitudinal study designs are therefore better suited to address the question of whether interpretation inflexibility is causally linked to the dampening of positive emotions. However, researchers are increasingly advocating a more relaxed approach to cross-sectional mediation analysis in the interest of facilitating scientific progress (see Hayes & Rockwood, 2017). Indeed, by consistently demonstrating that (at least in cross-sectional data) there is a significant amount of variance shared between negative interpretation inflexibility, the dampening of positive emotions, and depression/social anxiety, these studies take an important first step toward identifying potential mechanisms that may link interpretation inflexibility with internalizing symptoms. It is therefore notable that in the present studies, mediation models in which interpretation inflexibility was associated with depression and social anxiety via its effects on emotion regulation strategies were better supported than several alternatives.

Second, when interpreting the path models from Study 2, readers should be mindful of the fact that the emotional BADE task was completed over three consecutive days. Variation in participants' response patterns on the BADE task across study days could then influence the total, direct, and indirect effects described in the path models. Notably, it is unlikely that this variation was influenced by the order in which BADE task scenarios were administered in Study 2; BADE task scenarios were administered in randomized order, and analyses of BADE task responses revealed no substantial differences across study days. Another limitation stems from the administration of portions of the BADE task after administration of measures tapping

constructs hypothesized to be influenced by BADE. This temporal order is the reverse of that implied by the path models tested in this manuscript, which limits the strength of conclusions that may be drawn from Study 2 regarding the putatively causal influence of BADE on depression and social anxiety via the dampening of positive emotions. This limitation could be addressed in a future study by measuring BADE, emotion regulation strategies, and psychopathology (in that order) across consecutive time points.

Third, it is possible that the self-report measures of depressive symptoms, social anxiety levels, and the habitual use of different emotion regulation strategies imperfectly capture the phenomena of interest (e.g., due to response bias). Future studies could use multiple methods (e.g., ecological momentary assessment of emotion regulation strategy use in daily life) and multiple informants (e.g., patient and clinician ratings of symptom levels) to measure single constructs. However, given the extensive psychometric evidence for the reliability and validity of the questionnaires and replication across two studies, it is unlikely that the current results consist primarily of measurement error.

Fourth, both studies observed relatively small effects of negative interpretation inflexibility in relation to depression, social anxiety, and dampening. However, the size of interpretation inflexibility's effects on anxiety and depression reported here-in is similar to that observed in our prior study (Everaert et al., 2018) and is consistent with the size of the effect observed when belief revision difficulties are related to other forms of psychopathology using the original version of the BADE task (Luk, Underhill, & Woodward, 2018). Importantly, the small but significant effects reported here-in are consistently observed in two independent samples of individuals. Although cognitive tasks (such as the BADE task) often have a small (in terms of effect size) relationship with symptoms, the relationship is not necessarily insignificant or evolving due to chance. This is demonstrated by the use of the BADE task in the investigation of delusions in individuals with schizophrenia. Despite the limited overlap in

variance between BADE and psychosis symptoms (~9%), the relationship between BADE and delusions is one of the more consistent in the literature (Luk et al., 2018) and has significant theoretical implications (see Sanford et al., 2014).

Fifth, this study focused on only one facet of the emotion regulation difficulties related to depression and social anxiety: the frequency of emotion regulation strategy use. As noted, future studies should consider negative interpretation inflexibility in relation to emotion regulation ability (the effectiveness with which emotion regulation strategies are implemented). Depression and social anxiety have been linked to a reduced ability to effectively use emotion regulation strategies to downregulate negative (or upregulate positive) emotions (Joormann & Stanton, 2016; Kivity & Huppert, 2018). It seems likely that interpretation inflexibility may hinder emotion regulation ability.

Finally, the general population samples from both studies may limit the generalizability of the aforementioned findings to clinical populations. However, these studies' dimensional approach accords with the Research Domain Criteria (Insel et al., 2010) and is particularly well-suited to cast light on mechanisms related to emotion regulation strategy use along the continuum of symptom severity from normative to clinical levels. Indeed, a substantial portion of the participants in both studies reported severe levels of depression and social anxiety. However, future work could replicate the present findings in clinical samples to substantiate the role of interpretation inflexibility at clinically significant levels of severity.

Despite these limitations, this study advances our understanding of the cognitive mechanisms involved in the use of emotion regulation strategies that have been related to psychopathology in important ways. Using the recently developed emotional Bias Against Disconfirmatory Evidence (BADE) task in two independent studies, this investigation found that inflexibility in revising negative interpretations was related to the use of emotion regulation strategies that dampen positive emotions, as well as to symptoms of depression and social



anxiety. Interestingly, the use of emotion-dampening strategies mediated the relation between negative interpretation inflexibility and both symptom types. Moreover, interpretation biases were related to depression and social anxiety as well as to emotion regulation strategy use. Negative interpretation bias was related to repetitive negative thinking and dampening, while positive interpretation bias was related to positive reappraisal. The findings provide further evidence for the role of interpretation bias and inflexibility in depression and social anxiety and emphasize the utility of these constructs in efforts to promote greater understanding of emotion regulation difficulties.

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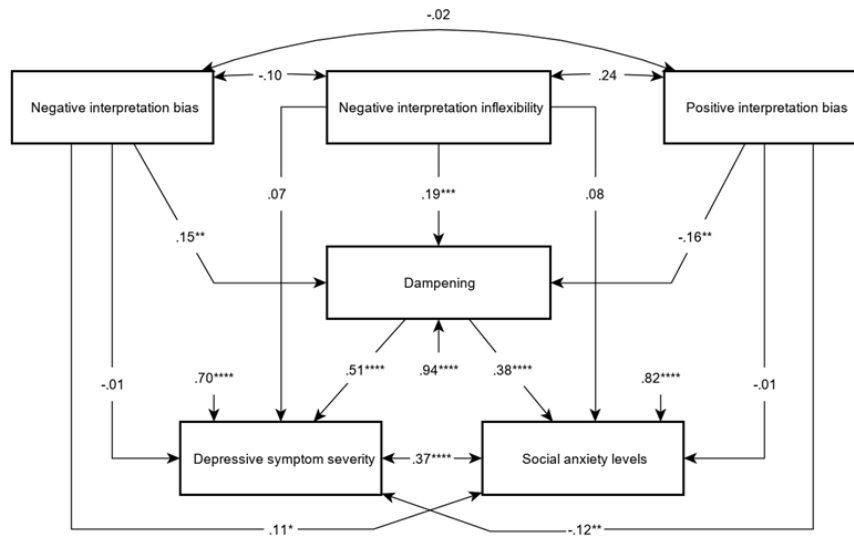
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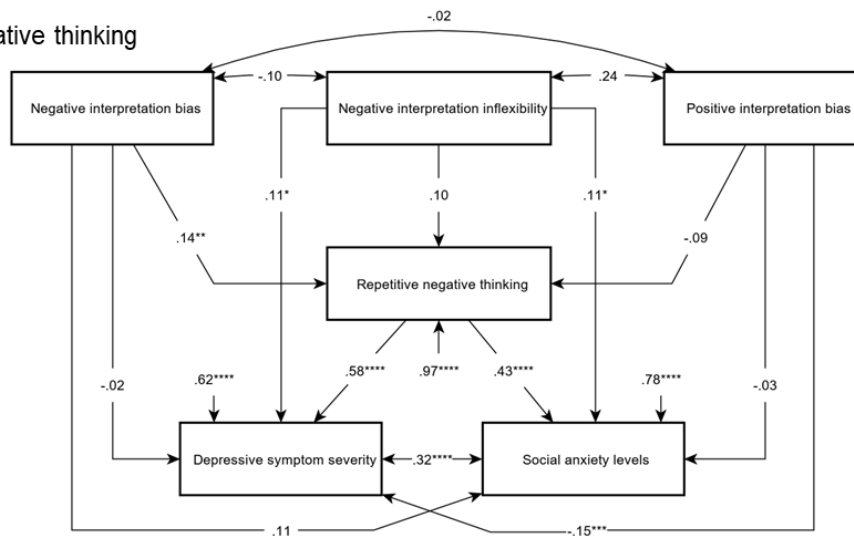
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1A. Model 1:  
Dampening



1B. Model 2:  
Repetitive negative thinking



1C. Model 3:  
Positive reappraisal

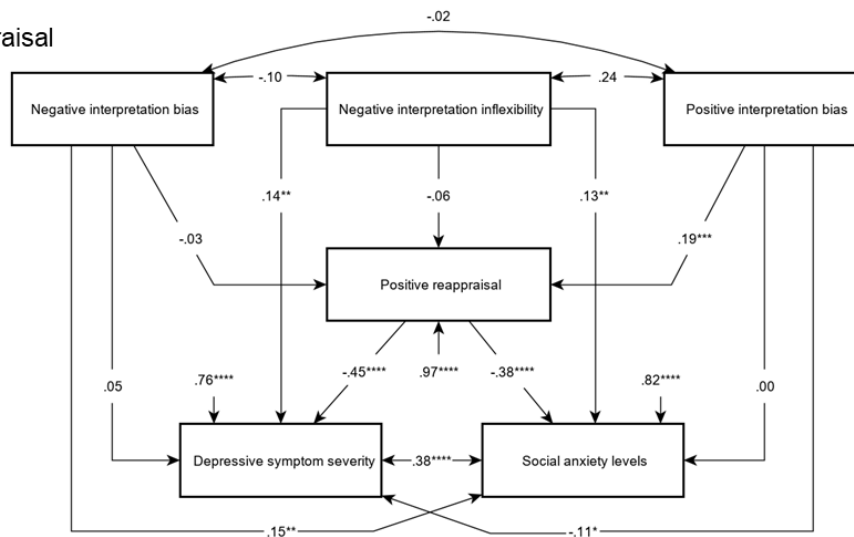


Figure 1. Fitted path models per emotion regulation strategy (Study 1).  
Note: \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ , \*\*\*\* $p < .001$ ; Figures display standardized path coefficients.

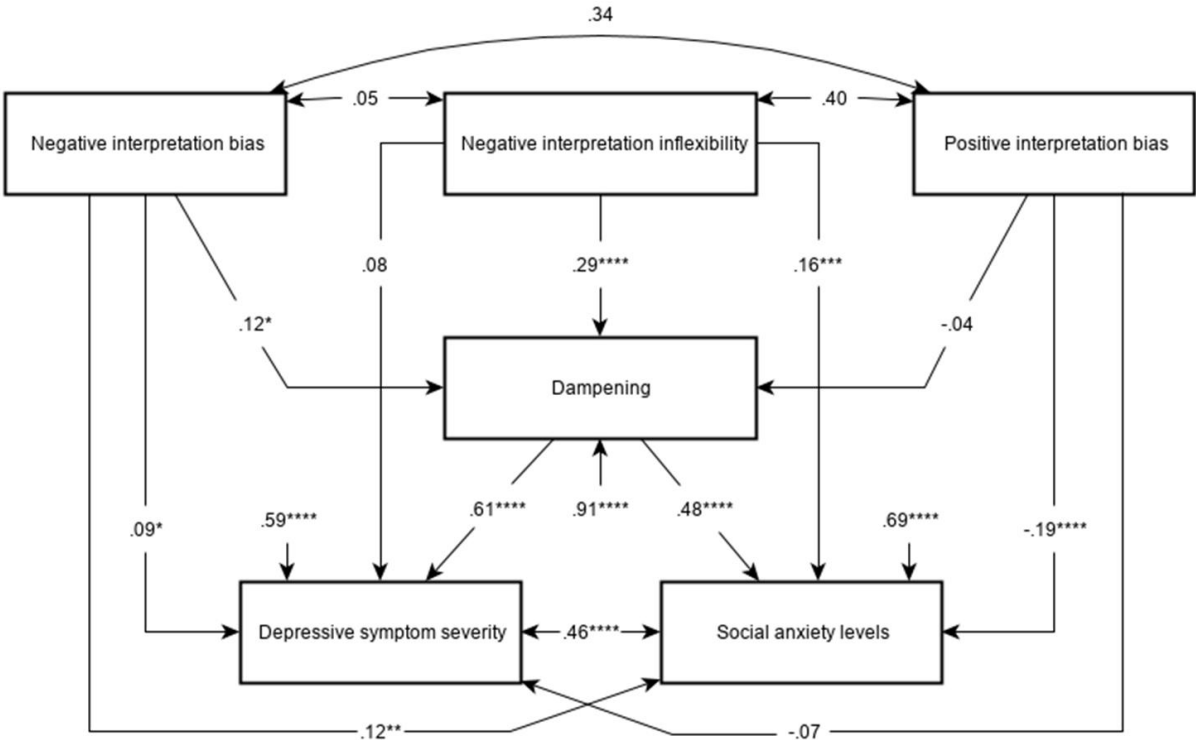


Figure 2. Fitted path model with dampening as a mediating variable (Study 2).  
Note: \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ , \*\*\*\* $p < .001$ ; Figure displays standardized path coefficients.