



Research paper

## Expressive flexibility and anxiety

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## ABSTRACT

**Background:** The ability to flexibly enhance and suppress emotional expressions plays an important role in emotion regulation and the fostering of social connections. Deficits in expressive flexibility have been linked with posttraumatic stress disorder and prolonged grief reactions. Previous studies have suggested that the ability to respond flexibly in the context of an immediate threat (a nonconscious prime) may be important. In this study we sought to extend this work by examining the impact of individual differences in anxiety on expressive flexibility.

**Methods:** Eighty four participants with high and low trait anxiety viewed blocks of negative images with instructions to enhance or suppress emotional expressions. Across blocks one of three nonconscious primes (threat, safety, neutral) appeared before each image. Observers blind to the study's design rated participants' emotional expressiveness.

**Results:** Repeated Measures Anova's showed that high trait anxiety was associated with lower levels in enhancement ability. Further, low trait anxiety was associated with less emotion in response to the threat prime irrespective of expressive instruction.

**Limitations:** This study was cross-sectional which precludes causal relationships. Participants were drawn from a student population and the generalizability to other populations will need to be established

**Conclusions:** This study identified trait anxiety as factor that may contribute to expressive flexibility deficits. High trait anxiety is a feature of many clinical conditions. Strategies to target expressive flexibility may relevant to a range of anxiety related clinical conditions.

## 1. Introduction

Emotional expressions play an important role in social interactions (Chervonsky & Hunt, 2017; English & Eldesouky, 2020; Gupta & Bonanno, 2011; Keltner, 1995; Van Kleef, 2009). While there has been a long standing debate in the literature about the relative benefits of expressing versus suppressing emotional displays, contemporary research suggests that both may be linked with benefits and harms (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Chervonsky & Hunt, 2017). To make sense of the varied findings, a growing number of theorists have highlighted the importance of context in determining the adaptiveness, or maladaptiveness of emotional displays (Aldao, Sheppes, & Gross, 2015; Bonanno & Burton, 2013; Sheppes et al., 2014; Tamir, 2016). In an early study, Bonanno et al. (2004) asked college students to view aversive images under three conditions: suppressing any emotional expression, enhancing any emotional expression, and simply viewing the images. Bonanno et al found that both enhancement and suppression

ability independently predicted better long-term adjustment following the 9/11 terrorist attack. The sum of these abilities (labelled "expressive flexibility") also predicted reduced long-term distress. Conversely, low ability on both dimensions (or low expressive flexibility) predicted worse long-term functioning (see also Westphal, Seivert, & Bonanno, 2010). Restricted expressive flexibility has since been observed among individuals with Posttraumatic Stress Disorder (PTSD; Rodin et al., 2017) and Prolonged Grief Disorder (PGD; Gupta & Bonanno, 2011), both of which are psychopathologies that develop following potentially stressful life events. It is thought that the ability to appropriately enhance or suppress emotions provides visual feedback within interactions that fosters social connections, elicits social support, or assists with emotion regulation more generally (Gupta & Bonanno, 2011). The phenomenon has also been observed among individuals with substance use disorders, a condition often characterised by poor emotion regulation (Dingle, Neves, Alhadad, & Hides, 2018).

To extend understanding of expressive flexibility, Westphal et al.

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(2010) retested participants from Bonanno et al. (2004) three years after their initial assessment. The authors were interested in examining the temporal stability of expressive flexibility and whether it was more relevant to adjustment when measured in a threat versus neutral context. Social threat was seen as particularly relevant given that emotional expressions are inherently social in nature. Westphal et al., hypothesized that demonstrating greater expressive flexibility under threat may be associated with better adjustment in response to life stressors. To create social threat, Westphal, et al. used a nonconscious priming procedure. Participants were briefly presented with either a social threat prime (“separation”) or a no threat prime (“cognition”) before each image on the expressive flexibility task. Westphal et al. found that expressive flexibility was stable across the three year period for participants in the no threat condition. They also observed the expected positive relationship between expressive flexibility indexed under threat and adjustment. Further, the relationship between expressive flexibility and adjustment was stronger for participants in the social threat condition than the no threat condition. In particular, suppression ability under threat was a better predictor of positive adjustment than enhancement ability under threat. This finding is consistent with research showing that fewer displays of negative emotions in a potentially stressful context are associated with better long-term functioning in bereavement (Bonanno & Keltner, 1997). Interestingly, in a subsequent study, Rodin et al. (2017) investigated expressive flexibility in a sample of US military veterans. They found that a deficit in enhancement ability was more strongly related to the severity of PTSD and depression than suppression ability. By contrast, in another study, individuals suffering from grief-related psychopathology showed relative deficits in both enhancement and suppression ability (Gupta and Bonanno (2011).

These studies highlight the importance of both enhancement and suppression ability for psychological wellbeing, but also, as theory suggests (Bonanno & Burton, 2013), that the relative importance of each ability will tend to vary across contexts and sample characteristics. Westphal et al. (2010) highlighted the relevance of threat for understanding expressive flexibility. However, as the study used a between persons design, it was not possible to determine the extent to which threat influenced an individual’s expressive flexibility ability. To investigate this issue, the current study employed a within person design to examine the impact of threat on expressive flexibility. All participants completed the task under conditions of social threat and no threat. Further, we included a positively valence prime condition in the form of social safety (e.g. “friendly”, “included”). Just as threat is an important context for emotional expression, the ability to appropriately enhance or suppress emotions in a supportive context may also be important for psychological wellbeing: Individuals who are less able to express negative emotions in socially supportive contexts may fail to benefit from available social supports.

Further, in addition to examining the stability of expressive flexibility across threat and nonthreat contexts, we examined the relationship between trait differences in anxiety and threat perception and expressive flexibility. High trait anxiety is conceptualized as a dispositional tendency to overestimate the level of threat in the environment (Spielberger, 1966; Spielberger & Sydeman, 1994). High trait anxiety has been associated with hypervigilance to threat (Longin, Rautureau, Perez-Diaz, Jouvent, & Dubal, 2013; Mogg & Bradley, 1999), biased processing of emotional stimuli (Liu, Wang, & Li, 2018; MacLeod & Cohen, 1993) and impaired downregulation of emotional physiological states (Cho, White, Yang, & Soto, 2019; Efinger, Thuillard, & Dan-Glauser, 2019). Moreover, the inability to regulate emotion, is heavily implicated in the aetiology and maintenance of anxiety disorders (e.g., Cisler et al., 2010; Mennin, 2004) and anxious individuals also tend to overuse suppression strategies (Erskine, Kvilavilashvili, & Kornbrot, 2007). To our knowledge no one has investigated the relationship between high trait anxiety and expressive flexibility. Rodin et al. (2017) found that PTSD severity was linked with reduced expressive flexibility

ability. However, as PTSD is a complex emotional condition, the extent to which anxiety contributed to this result is unclear.

Therefore, to investigate the relationship between threat and expressive flexibility, the current study compared responding between high trait anxiety (HTA) and low trait anxiety (LTA) participants on an expressive flexibility task completed under conditions of social threat, social safety and a neutral context. Due to our interest in examining responding in response to threat we included only aversive images in the task. Overall we expected that HTA participants would show impaired expressive flexibility compared to LTA participants. Based on the findings of Rodin et al (2017) we predicted that this would be more prominent for enhancement ability than suppression ability. Specifically, we expected that both groups would demonstrate an ability to suppress the expression of emotion, but emotional dysregulation associated with HTA would impair their ability to enhance emotion. Based on Westphal et al (2010) we also expected that expressive flexibility would differ across prime contexts. Overall, we expected that relative to the neutral condition, threat would be associated with greater suppression, and safety would be associated with greater enhancement ability. However, we did not have strong hypotheses about the interaction between trait anxiety and prime condition; we expected that differences in threat perception and emotion regulation associated with HTA and LTA may result in different responses to the threat and safety primes.

## 2. Method

### 2.1. Participants

Ninety undergraduate students (25 male and 65 female) from the University of New South Wales participated in this study. Participants were recruited from first year psychology students and the general university student population. In return for participation, participants received either course credit or an AU\$20 payment, respectively. Potential participants first completed a general screening questionnaire which included assessment of current anxiety symptoms (DASS-21) and other questionnaires not relevant to this study. Participants who reported experiencing either no recent anxiety or high levels of recent anxiety on this screening tool were invited to participate in the current study. Data were unavailable for four participants due to equipment failure, and a further two participants were excluded from analysis due to erratic responding on the Expressive Flexibility Task. This resulted in final sample of 84 participants (24 male and 60 female). The mean age of the sample was 19.42 years ( $SD = 2.54$ ). Participants were classified as high trait anxiety (HTA) or low trait anxiety (LTA) based on a median split of STAI-T scores (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The median score for trait anxiety was 41.50 ( $M = 43.57$ ,  $SD = 9.93$ ). This is higher than the mean score reported in a population-based sample of Australian adults aged 18 to 24 ( $M = 40.33$ ,  $SD = 12.32$ ; Crawford, Cayley, Lovibond, Wilson, & Hartley, 2011). Moreover, as

**Table 1**  
Participant characteristics

	Low Anxiety	High Anxiety	Total
	n = 42	n = 42	N = 84
Female	69.0%	73.8%	71.4%
Age	20.02 (3.24)	18.83 (1.36)	19.42 (2.54)*
Racial Background			
White	40.5%	40.5%	40.5%
Asian	59.5%	59.5%	59.5%
STAI-Y	35.88 (4.54)	51.26 (6.80)	43.57 (9.64)**
DASS-21	4.16 (4.29)	7.85 (7.76)	6.01 (6.51)*
Anxiety			
Depression	2.52 (2.52)	7.41 (7.82)	4.96 (6.27)**
Stress	6.32 (4.67)	12.31 (7.53)	9.27 (6.94)**

Note: Standard deviations appear in parentheses. \*  $p < .05$ , \*\*  $p < .001$ ; STAI-Y = Trait anxiety score of the State-Trait Anxiety Inventory, DASS-21 = Depression Anxiety and Stress Scale.

can be seen in Table 1, the mean STAI-T of the HTA group was approximately one standard deviation above the population mean, indicating that participants in the HTA group were above average in terms of trait anxiety.

### 3. Materials

#### 3.1. Self-report measures

**Depression Anxiety Stress Scales.** (DASS-21; Lovibond & Lovibond, 1995) The DASS-21 is a 21-item self-report questionnaire that assesses symptoms of depression, anxiety, and stress experienced over the previous week. Respondents indicate how much a statement applied to them on a 4-point scale (from 0 = “never” to 3 = “almost always”). Scores on each scale are doubled to give a score out of 42. Scores on this measure were used to identify potential participants with high and low levels of anxiety.

**State-Trait Anxiety Inventory – Trait (STAI-Y Trait; Spielberger et al., 1983)** The STAI-Y trait is a widely used 20-item self-report measure that assesses trait anxiety. Respondents indicated how they generally felt on a 4-point frequency scale (from 1 = “almost never” to 4 = “almost always”). Scores on this measure were used to categorize participants into the high and low anxiety groups according to a median split.

**Expressive flexibility task (EFT).** The EFT was adapted from (Westphal et al., 2010). The task comprised 18 blocks each containing five emotionally negative images (90 experimental trials) taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). Image blocks were matched for valence and intensity. Prior to each block, participants were shown one of three instructions sets, 1) *enhance* their emotional expression to the images so that a “person viewing you on a monitor will be able to guess from your facial expression what you are feeling”, (2) *suppress* their emotional expression so that a “person viewing you on a monitor will not be able to guess what you are feeling”, or (3) “simply view the images and behave as you would naturally do”. Before each image, a social threat word, social safety word, or nonword appeared in the centre of the screen for 28ms. Threat (*alone, rejected, hostile, isolated, and disliked*) and safety (*accepted, belong, friendly, included and liked*) words were selected from Cacioppo et al., 2015. The nonwords were jumbled letter versions of the social words.

Each trial consisted on a fixation cross (500ms), a prime (32ms), backward pattern masking “XXXX” (500ms), negative image (10000 ms). At the end of each block, participants rated the extent to which they had experienced any negative (e.g., anger, revulsion, sadness, distress) or positive emotions (e.g., happiness, joy, amusement, interest) during the block using likert-type scales (1 (not at all) to 7 (extreme)). Order of blocks, prime category for the block, and images within each block were randomized, as was the order of the subjective rating scales. The EFT was administered on a standard desktop computer, and participants were videorecorded using a webcam attached on top of the computer monitor.

**Scoring:** A researcher who was blind to the aims and hypotheses of the study viewed the video recordings and rated participants’ emotional expressions during each block of images using the same 7-point Likert rating scale used by participants. A second rater who was also blind to the aims and hypotheses rated 25% of the videos. Inter-rater reliability was consistent with previous studies ( $r = .91$ ).

Expressive flexibility was indexed by enhancement ability and suppressive ability (Westphal et al., 2010). Enhancement ability was calculated by subtracting mean expression scores in the view condition from mean expression scores in the enhance condition. Suppressive ability was calculated by subtracting mean scores in the suppress condition from mean scores in the view condition.

#### 3.2. Procedure

On arrival, participants completed an informed consent procedure, followed by the questionnaire measures and the WAIS-IV Digit Span task (Wechsler et al., 2008). They were then given the following instructions for the EFT. They were told they would be taking part in an emotional communication task in which they would be shown blocks of emotional images and would be asked to rate how they felt while viewing the images. They then viewed a practice block of neutral images. At the completion of the practice block they rated the extent to which they had experienced any negative and positive emotions while viewing the images on the 1 - 7 (not at all - extremely) scale. Next, they were told that they would be video recorded during the task and that a person who did not know any of the specifics about the task would view the video and would be trying to guess what they were feeling. The instructions for the enhance, suppress and view blocks were then presented on the screen. Participants then proceeded to complete the EFT. Following this, they completed several short tasks not relevant to the aims of this study. They were then debriefed and thanked for their participation. This study was approved by the UNSW Human Research Ethics Advisory Panel for Psychology (HREAP-C 2595).

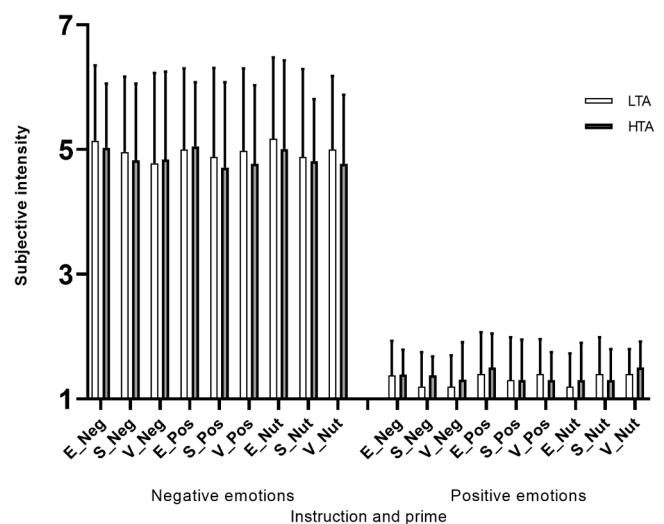
### 4. Results

#### 4.1. Participant Characteristics

Participant characteristics are presented in Table 1. As expected the high trait anxiety group (HTA) had a significantly higher anxiety than the low trait anxiety group (LTA) ( $t(71.55) = -12.18, p = .000$  [95%CI = -17.90 - -12.86]). The HTA group also scored higher on indices of recent anxiety ( $t(63.93) = -2.69, p = .009$  [95%CI = -6.42 - -0.96]), depression ( $t(49.41) = -3.85, p = .000$  [95%CI = -7.43 - -2.33]), and stress symptoms ( $t(68.51) = -4.44, p = .000$  [95%CI = -8.80 - -3.34]) and lower on digit span measure of working memory ( $t(82) = -2.48, p = .015$  [95%CI = 0.57 - 5.14]). Participants in the LTA group were significantly older than those in the HTA group ( $t(82) = 2.19, p = .031$ ).

#### 4.2. Subjective ratings of emotions

Figure 1 presents participants’ mean subjective ratings of positive



**Figure 1.** Mean subjective emotion ratings for EFT instruction and prime conditions for high and low trait anxiety.

Note: E = Enhance instruction, S = Suppress instruction, V = View condition; Neg = Negative (Threat) prime, Pos = Positive (Safety) prime, Nut = Neutral prime, LTA = Low trait anxiety, HTA = High trait anxiety. Values range from 1 = Not at all to 7 = Extremely.

and negative emotions. As can be seen, the EFT was successful in generating negative emotions. Further, consistent with previous studies, participants reported little or no positive emotion. We report only the results for negative subjective emotions here. To examine differences in subjective levels of negative emotion experienced during the EFT using we conducted a 2 (Group: LTA, HTA) x 3 (Condition: Enhance, Suppress, View) x 3 (Prime: Threat, Safety, Neutral) repeated-measures ANOVA. This revealed a significant main effect for Condition ( $F(2, 164) = 7.01, p = .001, \eta = .08$ ). Follow-up testing indicated that, overall, participants reported significantly more intense negative emotion in the Enhance condition ( $M = 5.07, SD = 1.07$ ) than either the View ( $M = 4.86, SD = 1.13, t(83) = 3.49, p = .001 [95\%CI = .98 - .33]$ ) or Suppress conditions ( $M = 4.84, SD = 1.13, t(83) = 3.16, p = .002 [95\%CI = .08 - .36]$ ). Ratings in the View and Suppress conditions did not differ ( $p = .840$ ). Prime did not impact subjective ratings ( $p = .779$ ).

### 4.3. Objective Ratings of Expressive Flexibility

Figure 2 displays the mean objective ratings of negative emotions for the Enhance, View and Suppress conditions for LTA and HTA participants, respectively. As with the subjective ratings, no positive emotion was observed by raters in the video recordings. We report only the negative expression ratings here. A 2 (Group: LTA, HTA) x 3 (Condition: Enhance, Suppress, View) x 3 (Prime: Threat, Safety, Neutral prime) repeated-measures ANOVA indicated a significant main effect for Condition, ( $F(2, 164) = 224.60, p = 0.000, \eta = .73$ ), a significant 2-way interaction for Group x Condition, ( $F(2, 164) = 3.92, p = 0.022, \eta = .05$ ), and a significant 2-way interaction for Group x Prime ( $F(2, 164) = 3.24, p = 0.042, \eta = .04$ ). Follow up testing confirmed that the instructions were successful in manipulating expressiveness: participants showed more emotion in the Enhance condition than the View condition ( $t(83) = 11.65, p = .000, [95\%CI = 1.18 - 1.67]$ ), and more emotion in the View condition than the Suppress condition, ( $t(83) = 10.34, p = .000, [95\%CI = 1.15 - 1.69]$ ). However, these effects were qualified by the Group x Condition interaction, which as predicted indicated that expressiveness differed across instruction conditions for the LTA and HTA groups. We explore this finding in more detail below by examining enhancement and suppressive abilities. Follow up tests exploring the Group x Prime interaction found no differences in responding across prime condition for the HTA group. However, averaged across Condition, participants in the LTA group showed significantly less emotion in the Threat than the Neutral prime ( $t(41) = -2.44, p = .019 [95\%CI = -.35$

- .04].

### 4.4. Expressive Flexibility and Anxiety

To unpack the 2-way Group x Condition interaction described above, we examined differences in enhancement ability and suppressive ability across groups. The groups did not differ on mean expressiveness in the View condition ( $p < .72$ ). However, averaged across prime, expressive ability was lower in the HTA group than the LTA group ( $t(71.36) = 2.96, p = .0044, [95\% CI = .226 - 1.16]$ ). The groups did not differ on suppression ability ( $p = .460$ ). As the HTA group differed significantly from the LTA group in terms of age, and level of recent depression and stress, we explored the relationship between these measures and the flexibility indices. As can be seen in Table 2, STAI-Y trait anxiety severity was correlated with age, past-week levels of anxiety, depression and stress, and working memory. However, only trait anxiety was correlated with indices of flexibility, specifically expressive ability. After controlling for Type 1 error rate ( $< .01$ ), the only remaining significant correlation was between STAI-Y and expressive ability.

## 5. Discussion

The ability to appropriately enhance and suppress the expression of emotions is linked with lower levels of psychopathology and higher wellbeing following life stress (Bonanno et al., 2004; Gupta & Bonanno, 2011; Rodin et al., 2017). In this study we explored within-person differences in expressive flexibility by examining responding under immediate social threat or social safety using a nonconscious priming procedure. We also explored the impact of more stable differences in threat on expressive flexibility by examining responding across individuals with high and low trait anxiety. Overall, high trait anxiety was associated with reduced expressive enhancement ability. When asked to enhance their emotional expression, the HTA group showed less increase in observed emotion than the LTA group. The groups did not differ on observed suppression of emotion. In terms of within person differences, responding was found to be relatively stable across the social threat, social safety, and neutral prime conditions. The exception to this was the finding that the LTA group showed less emotion in response to the threat prime than the neutral prime, regardless of instruction condition. High trait anxiety has been linked with a range of emotional processing, encoding and regulation biases, including attentional orienting to threat (Longin et al., 2013; Mogg & Bradley, 1999), deficits in implicit or automatic emotional processing (Liu et al., 2018) and reduced success in regulating psychophysiological responding (Cho et al., 2019; Efinger et al., 2019). This study extends our understanding of the emotional biases associated with high trait anxiety.

The finding that enhancement ability was impaired in the HTA group is consistent with Rodin et al. (2017), who found that greater levels of PTSD and depressive symptoms were associated with lower levels of enhancement ability, but not suppression ability, in a sample of combat veterans (see also; Shepherd & Wild, 2014). In our sample, we found higher levels of current depression and stress related symptoms in the HTA compared to the LTA groups, however, neither depression nor stress were significantly correlated with expressive ability. The finding that high trait anxiety was linked with reduced expressive enhancement is somewhat inconsistent with previous investigations of trait anxiety and emotional expression, which have reported no differences in expressivity as a function of anxiety (Efinger et al., 2019; Weinberger, 1979). However, prior studies have typically focussed on indexing natural responding (Weinberger, 1979), or expressiveness in response to down regulation instructions (Efinger et al., 2019). In this study participants were given specific instructions to view, suppress and enhance their emotional expression. Consistent with these prior studies we found no difference between the LTA and HTA groups in the view condition or in suppression ability. Instead, we observed a deficit only in the ability to enhance emotions. Prior studies, have also typically indexed

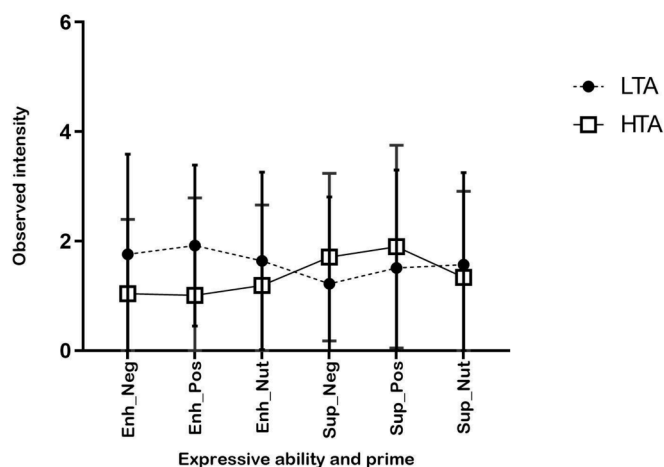


Figure 2. Expressive and Suppressive Ability scores for High and Low Trait Anxiety groups for Negative, Positive and Neutral Primes. Note: Enh = Enhance - View ratings, Sup = View - Suppress ratings; Neg = Negative (threat) prime, Pos = Positive (safety) prime, Nut = Neutral prime, LTA = Low trait anxiety, HTA = High trait anxiety.

**Table 2**  
Pearson product moment correlations with Expressive and Suppressive Abilities

	STAI-Y	EA	SA	Age	DASS anxiety	DASS depress	DASS stress	Digit span
2	-.316*							
3	.123	-.350**						
4	-.305*	.127	.058					
5	.533**	-.225*	-.078	-.196				
6	.579**	-.140	.044	-.191	.631***			
7	.604**	-.134	-.090	-.283*	.689***	.632***		
8	-.287**	.181	.004	-.053	-.159	.083	-.156	

Note: \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ ; EA = Expressive ability; SA = Suppressive ability; STAI-Y = Trait anxiety score of the State-Trait Anxiety Inventory, DASS = Depression Anxiety and Stress Scale scores.

expressivity using facial electromyography (EMG). The current study used observer ratings, as the primary aim was to index the communication of emotion. Overall, participants reported more intense subjective emotion in response to the enhance instruction, however the groups did not differ in this tendency. Future studies may benefit from the addition of facial EMG to allow comparison of observable and psychophysiological expressivity; however, this will require sensors that do not interfere with the ability to communicate or observe emotions.

Individuals with higher levels of anxiety typically report greater use of emotion suppression strategies (Aldao, Nolen-Hoeksema, & Schweitzer, 2010). The finding that the HTA and LTA groups did not differ in terms of suppressive ability warrants discussion. We found no group differences in mean observed emotion in the view condition or mean subjective emotion in either the view or suppress conditions. This suggests that the lack of difference in suppressive emotion was not due to differences in baseline responding or experienced emotions. However, the mean observed emotion in the view condition was below the half way point of the rating scale allowing greater scope to identify differences in enhancement. Future research using dynamic high arousal stimuli, such as short films (Le, Moulds, & Nickerson, 2018) or stimuli with greater personal relevance may be useful for increasing baseline displays of emotion. However, an important feature of the EFT is that it measures regulation ability, rather than frequency of use. Those with high trait anxiety may report greater use of suppression but not be more skilled than those with lower trait anxiety. Bonanno et al. (2004) and Westphal et al. (2010) found that greater suppression ability on the EFT, was associated with better, rather than worse, long-term outcomes when considered simultaneously with enhancement ability. That is, successful adaptation did not depend on one regulatory process, but on the ability to enhance and suppress emotional expressions in accord with situational demands. This is consistent with the idea that there are times when displays of emotion elicit much needed support from others, and there are times when it may be necessary to suppress the display of emotion to facilitate the goals of the interaction. To this ends, the impaired enhancement ability displayed by the HTA group represents a form of inflexibility.

Westphal et al. (2010) found that flexibility in the face of immediate threat was a better predictor of flexibility measured in a neutral condition. However, their study used a between subjects design and so it was unable to determine the degree to which displays of flexibility were sensitive to context. To investigate this question we used a nonconscious priming procedure with social threat and social safety words (Cacioppo, Balogh, & Cacioppo, 2015). Overall, we did not find a strong effect of prime condition on expressive responding. Interestingly, however, LTA participants displayed less emotion in response to the negative prime, irrespective of instruction. In contrast, no differences were observed in responding across conditions in the HTA group. This suggests that expressivity may be sensitive to contextual factors for participants low in anxiety. This finding is consistent with Westphal et al. (2010), who found the relationship between adjustment and suppression was most pronounced when measured under threatening conditions, suggesting reduced displays of emotion in a hostile context may be a sign of adaptive responding. Future studies will be needed to replicate this

finding. We found no effect of the safety prime on responding. Although identified as socially positive (Cacioppo et al., 2015) it is possible that any impact of the prime was negated by the intensity of the negative stimuli that followed. It could also be that the impact of threat and safety primes occurs at different presentation thresholds, that is, there is greater sensitivity to detecting threat. Future studies employing a variety of nonconscious and supraliminal priming methodologies will assist in delineating the boundaries of threat and safety cues on expressive flexibility.

## 6. Limitations

There are a number of additional limitations to the conclusions that can be drawn from this study. We observed a difference in expressive flexibility between HTA and LTA participants using a cross-sectional design. Although our interrater reliability was high, caution is required in generalising the findings, as the majority of videos were coded by one individual. Further, to facilitate the aims of the study we selectively recruited participants who had screened as either high or low on levels of recent anxiety. Future studies examining responding across the full continuum of trait anxiety will assist in furthering understanding of the relationship between anxiety and expressive flexibility across social contexts. Longitudinal studies will facilitate our understanding of the relationship between trait anxiety, expressive flexibility and long term adaptation. It would also be of interest for future research to examine the extent to which deficits observed in this study extend to positive emotional stimuli.

Finally, we note that although the mean level of trait anxiety in the HTA group was one standard deviation higher than the mean level within the Australian population (see Crawford, et al., 2011), all participants were university students who were from predominantly Australian or Asian cultural backgrounds. The extent to which these findings generalise beyond this university population or are stable across the lifespan and cultures requires further investigation.

## 7. Conclusions

The ability to flexibly regulate displays of emotions has been linked with a number of important mental health outcomes. Deficits in expressive flexibility have been identified in participants with PTSD, prolonged grief disorder and substance use disorders. These are complex multifaceted conditions and are differentially associated with deficits in enhancement and suppression, respectively. This study identified trait anxiety as a factor that may contribute to impaired expressive flexibility. Undergraduate students with high trait anxiety showed a reduced ability to enhance their expression of emotion. Compared to low trait anxiety participants, they also appeared less sensitive to implicit social threats. Given the importance of expressive flexibility in assisting with emotion regulation and fostering social connections, this reduced flexibility has implications for understanding emotional deficits across a range of anxiety based conditions.

## Author statement

## Contributors

All authors contributed intellectually to the design of the study. In addition, Sophia Tran undertook data collection. Fiona Maccallum conducted the data analysis and prepared the manuscript for publication. George Bonanno contributed to the interpretation of the results and preparation of the manuscript. All authors approved the final version of the manuscript.

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## Declaration of Competing Interest

The authors have no conflicts of interest to declare

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