Laughter as a Buffer for Negative Thoughts in Anxiety-Provoking Situations

Kelly Knowles
The University of North Carolina at Chapel Hill
Spring 2013

A thesis presented to the faculty of The University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the Bachelor of Arts degree with Honors in Psychology

Committee Chair: Sara Algoe, Ph.D.
Committee Member: Jon Abramowitz, Ph.D.
Committee Member: Barbara Fredrickson, Ph.D.
Acknowledgements

First, I would like to thank my advisor, Dr. Sara Algoe, for all of her support and guidance. Sara, you have been a fantastic mentor and I could not have asked for a better thesis experience. Brittney Scurry served as a great research assistant in Sara’s lab, and I am thankful for her dedication to my research. I would like to thank my committee members, Dr. Barbara Fredrickson and Dr. Jon Abramowitz, for their advice and comments. Special thanks are due to Jon for letting me join his lab as a sophomore and coaching me through the research process, and for referring me to Sara when I was first interested in completing a thesis on laughter. I would also like to thank Dr. Joe Lowman for getting me so interested in psychology at Carolina. His classes helped me discover what I wanted to do when I grew up, and it was in his Evolutionary Psychology class where I first encountered research on laughter and fell in love with the possibilities. Dr. Lowman also directed me toward Jon’s lab, and I would not have found my way here without him. Finally, I’d like to thank my parents, Barry and Lisa Knowles, without whom I would not have made it through this long process and whose support for my education has endured through 17 years, countless hours of homework, and a few late-night science fair construction projects. Within me they have cultivated a love of learning that I cherish and plan to nurture for the rest of my life.
Abstract

Laughter is a phenomenon that occurs in a variety of contexts and has effects at social, cognitive, and physiological levels. Laughter is linked to positive emotions, which have been theorized to broaden thought-action repertoires and build social and psychological resources; however, few studies have examined the effects of laughter in an experimental manner. In times of anxiety, people could especially benefit from more flexible thoughts and increased social and psychological resources, and laughter may be a useful tool in the psychological arsenal. In this study, I attempt to use laughter as an intervention to reduce anxiety after the induction of an anxious state. I compare the effects of genuine laughter to the effects of another positive state, relaxation, as well as to a forced laughter condition and a control condition without an intervention, on subjective ratings of anxiety and cognitions. Although laughter was not found to affect self-reported ratings of anxiety, it did significantly lessen the degree of negative thoughts regarding the anxiety-provoking situation compared to the other three conditions. Genuine laughter also reduced implicit attentional bias toward social threat compared to the control condition, as measured by an emotional Stroop task. Future research could extend this finding by exploring the utility of laughter in a therapeutic setting with clinically anxious clients, as anxiety disorders are characterized by an attentional bias to perceived threat and inflexible, negative cognitions about situations or objects that are found threatening. Using laughter along with traditional cognitive-behavioral therapy might increase treatment success rates and overall client well-being.

Keywords: laughter, anxiety, attentional bias
Laughter as a Buffer for Negative Thoughts in Anxiety-Provoking Situations

Anxiety disorders are characterized by a misevaluation of and distorted beliefs about the danger of external or internal stimuli (Clark, 1999) and may also be linked with an attentional bias toward perceived threat (Mathews & MacLeod, 1985). Individuals with anxiety disorders are typically treated with cognitive-behavioral therapy in order to address the inappropriate thoughts and behaviors that arise in those with an anxiety disorder. Making clients aware of their bias toward threat and retraining them to focus on less-threatening stimuli is a component of cognitive-behavioral therapy. What cognitive-behavioral therapy lacks is a broader effect on the emotional well-being of those treated, beyond the reduction of anxiety.

In addition to a cognitive understanding of anxiety disorders, recent research suggests that problems with the ability to regulate emotions may also be an underlying factor in anxiety (Kring & Werner, 2004). People who experience social anxiety, which is characterized by increased vigilance toward perceived social threat and increased attention to oneself (Clark & Wells, 1995), especially struggle with emotional reactivity and emotion dysregulation. They fear the disapproval of others in social situations and make negative evaluations of their self-worth. The prevalence of social anxiety in the United States is about 2.8% over a one year period, or 5% over a lifetime (Grant, et al., 2005); however, many people also experience sub-clinical anxiety in social situations on a regular basis. Thirty-three percent of adults in one sample reported excessive anxiety in response to public-speaking (Stein, Walker, & Forde, 1996). Thus, while research on social anxiety is critical for clinical populations, there are also potential wide-ranging benefits for non-clinical populations. For example, according to a study conducted with anxious youth, cognitive-behavioral therapy improved emotion regulation for worry, but not general emotion regulation ability (Suveg, Sood, Comer, & Kendall, 2009). Emotion regulation
techniques emphasize control and appropriate expression of negative emotions but largely ignore the possible impact of increasing feelings and expressions of positive emotions. Expanding the current approach to emotion regulation by focusing on a wider range of emotions could benefit anxious populations.

According to the broaden-and-build theory of positive emotions, emotions such as joy, interest, contentment, pride, love, and amusement enable a person to function more effectively in two steps. First, positive emotions broaden in-the-moment thought-action repertoires, which increase creativity and the flexibility of thoughts (Fredrickson & Branigan, 2005). Second, positive emotions build psychological and social resources over time, beyond the present emotional experience. Positive emotions increase psychological resilience and increase emotional well-being (Fredrickson, 2001). Experiencing positive emotions on a regular basis allows people to go beyond ritualized thinking in the moment and manage future threats with an increased store of social and physiological resources, which allow them to cope with their problems and experience an upward, rather than a downward, spiral (Fredrickson & Joiner, 2002). Although all positive emotions have this effect, I hypothesize that laughter, a marker of the positive emotion of exhilaration (the emotional response to humor, also called amusement or mirth; Ruch, 1990), will have a stronger effect on anxiety than other positive emotions. Laughter affects an individual psychologically, socially, cognitively, and physiologically. As an active behavior that occurs along with positive emotions, laughter might have a greater effect than the experience of positive emotions alone. The present study is designed to address the current lack of experimental evidence that laughter can reduce state anxiety and increase psychological resources for distressed individuals.
Laughter is not only a sign of exhilaration, but it also tends to lead to further exhilaration, especially in social settings. It is important to note that laughter does not always occur as a result of humor; the author of one study found that 80% of conversational laughter occurred outside of humorous contexts (Provine, 2001). From an evolutionary perspective, laughter is a communicative signal. Known as the safety signal hypothesis, laughter developed as an outward display of emotion that lets others know that the intent of the action it accompanies is not aggressive (Preuschoft & van Hooff, 1997). Evidence for an evolutionary theory of laughter can be found in primate studies that examine precursors to laughter among apes, including the open-mouthed, panting “play-face” (Ross, Owren, & Zimmermann, 2009; Preuschoft & van Hooff, 1997). Laughing people are rated by others as more likeable (Reysen, 2006), and thus a person who laughs often builds social resources. Shared laughter, laughter that occurs between two or more individuals in a social situation, is tied to factors like social support and group cohesion. Although the social effects and benefits of laughter are important, in this study, I attempt to isolate the phenomena of laughter in the individual, in order to examine its cognitive and emotional effects without confounding these effects with those of social support. People usually laugh in a social context, but laughter can be studied experimentally in individuals, not just in pairs or groups, and it has been induced in the laboratory in an individual context (Petridis, Martinez, & Pantic, in press).

It is worthwhile to examine the specific mechanisms of laughter, instead of studying laughter as an incidental side effect of a positive emotion. Laughter has effects on physiology, cognition, behavior, and social interactions. Although laughter is a social tool, its effects are not merely communicative or conciliatory. It has been hypothesized that when people laugh, they temporarily distance themselves from distress in a form of mild dissociation (Keltner &
Bonanno, 1997). Perhaps they might be able to break the cycle of negative thoughts by moving themselves away from a distressing memory, event, or pattern of thoughts. This psychological benefit of laughter has some support from a study that found a negative correlation between genuine laughter and perceived suffering after the loss of a loved one (Keltner & Bonanno, 1997). However, further experimental research using a broader sample is needed to examine the connection between laughter and reduced distress. Instead of looking at overall patterns of humor preference or trait cheerfulness, laughter must be examined on-line in stressful situations in order to pinpoint specific effects.

One other important factor to consider is that only genuine laughter, which is accompanied by positive emotions, is thought to produce the psychological effects described above. Different researchers have used different manners of distinguishing genuine from forced laughter, although there is typically much overlap. Keltner and Bonanno (1997) found a significant correlation only between Duchenne laughter (which involves orbicularis oculi muscle movement), reduced distress, and increased positive emotions. Other research suggests that voicing and tonality are characteristics of genuine laughter, as laughs with these characteristics more readily elicit positive affective responses in listeners (Bachorowski & Owren, 2001). Keltner and Bonanno compared Duchenne and non-Duchenne laughter in their study, but the correlational nature of their work means that genuine laughter and positive emotions might not be factors that contribute to a reduction of distress. Experimental evidence is needed to demonstrate conclusively that genuine laughter reduces distress more effectively than forced laughter.
Present Study

In this study, I aim to look at the effects of laughter on an individual, specifically in its ability to buffer the emotional and cognitive effects of anxiety. After inducing a social stressor, I will compare the pre- and post-stressor anxiety levels of four groups: a group that experiences genuine laughter, a group that engages in forced laughter, a group that experiences relaxation (a more passive positive emotion), and a control group. I hypothesize that participants who engage in genuine laughter will experience a greater decrease in self-ratings of anxiety than participants who laugh without a humorous stimulus, engage in relaxation, or experience no intervention condition.

In order to see changes in anxiety over time, I will induce anxiety in the laboratory in a non-clinical population sample, using a speech preparation task. In previous experiments, a speech preparation task has significantly increased baseline anxiety ratings and physiological responses, even in non-clinically anxious participants (Mauss, Wilhelm, & Gross, 2003). After this task, I will assess differences in attentional bias among the groups. In a typical response pattern, participants show slower response times for words related to social anxiety compared with other words, which indicates increased attention toward anxiety-related words. However, I hypothesize that participants who engage in genuine laughter will show a smaller difference in reaction time between social anxiety words and control words than participants in the other three conditions.

Method

Participants

115 participants from the Psychology 101 Participant Pool at the University of North Carolina at Chapel Hill were recruited to participate in this study. Participants were excluded
during recruitment if they were under 18 for consent purposes. Participants were also excluded during recruitment if they were pregnant or had a known heart condition, to reduce aberrant physiological data. Data from one participant, who withdrew during the experiment, was excluded. Nine other participants were excluded due to procedural error, including problems with following directions, skipping parts of the experiment crucial to the planned analyses, and computer problems. This exclusion left a remainder of 105 participants with usable data. Of these participants, 70.5% were female, 33.3% were non-white, and 7.6% were Hispanic or Latino/a.

Apparatus

Several physiological measures were collected continuously throughout the experiment, although they were not used in the final analysis. Continuous noninvasive blood pressure was monitored with the CNAP Monitor 500, using a cuff placed on the upper left arm and a double-finger cuff on the index and middle fingers of the left hand. All other measurements were collected using a BioNex chassis, accessories, and software. Respiratory measurement was conducted using MindWare BioNex pl500 Respiration Belt with Pulse Lock. An electrocardiogram was measured using three MindWare ECG electrodes placed on the torso according to machine instructions. Galvanic skin conductance was measured using MindWare GSR electrodes placed on the palm of the participant’s right hand.

Participants were videotaped via two cameras, one aimed at their face to monitor facial expression and the other aimed at their hands and computer screen. The experimenter used this second video feed in order to monitor participant progress through the experiment and intervene if necessary in order to provide clarifying instructions, in an attempt to minimize procedural errors. Videos were collected using Noldus Observer XT software.
Procedure

The experiment consisted of a single laboratory session that lasted between 45 and 60 minutes. After setup of the above apparatus, the experimenter brought the participant into the laboratory. The experimenter then showed the equipment to the participant and briefly explained the overall procedure, informing participants that they would be completing tasks and answering questionnaires on a computer, while physiological measures were taken throughout the experiment. Participants consented to the study and agreed to be videotaped. After answering any questions, the experimenter began to set up the equipment with the participant according to the description above.

Initial questionnaires and baseline measurements. In the first section of the experiment, participants were left alone to fill out questionnaires assessing trait characteristics, including measures of anxiety, cheerfulness, resilience, and personality factors. When participants reached a stop sign in the questionnaire, they signaled at the camera that they were finished. At that time, the experimenter re-entered the participant room. The experimenter instructed the participant to “relax and clear your mind” for five minutes, in order to establish baseline physiological measures. Participants were given a pair of headphones to wear during this time to block out excessive background noise. After leaving the participant to sit and relax for five minutes, the experimenter again entered the participant room and gave the participant instructions to continue with the survey, following all directions as given in audio instructions played over headphones. Headphones were also used to prevent the experimenter from knowing to which condition the participant was assigned.

Performance task. Participants listened to an audio file containing instructions to prepare and give a speech entitled “Why are you a good friend?” Participants had two minutes
to mentally prepare a five minute speech on this topic, and were told they would be videotaped and evaluated based on their clarity, coherence, and persuasiveness. The audio file allowed for two minutes of silent preparation, then instructed participants to continue with the survey to receive further instructions. This speech paradigm was taken from Tugade and Fredrickson (2004) and was designed to increase participant anxiety. While participants received these instructions and prepared their speeches, the experimenter observed their behavior via the camera feed in the other room.

**Experimental manipulation.** The next set of instructions in the survey explained that participants would complete another task before giving their speeches. They were randomly assigned to one of four conditions. The survey software randomly assigned participants to groups without experimenter knowledge. Excluding those participants eliminated for procedural errors, the genuine laughter group consisted of 25 participants, the forced laughter group consisted of 23 participants, the relaxation group consisted of 32 participants, and the control group consisted of 25 participants.

In the genuine laughter condition, participants were told that they would watch a brief video clip and should allow themselves to fully experience whatever emotions they had during the clip and respond naturally. Then they advanced the survey to a video clip, which was a shortened version of the Skype Laughter Chain video found on YouTube, which contains footage of people of all ages laughing in reaction to others’ laughter, some with rather odd or uncontrollable laughs. This stimulus produced laughter in individual participants in a previous study. According to a manipulation check at the end of the survey, 58.3% of participants in this condition reported genuine laughter during this video clip.
In the forced laughter condition, participants received a similar set of instructions, but they were told that during the video clip they were going to mimic the sound of the experimenter’s voice. A recording of the experimenter repeating the syllable “HA” at random intervals was inserted into the video clip viewed in the genuine laughter condition, with the original sound removed. This was done to mimic the physical movements of natural laughter without inducing positive emotion. 34.8% of participants self-reported producing at least one genuine laugh during the video clip.

In the relaxation condition, participants were instructed that they would be watching a video clip during which they were instructed to “relax and clear your mind.” Participants then viewed a video that was a slideshow of various sunset pictures, with a light piano melody playing in the background. In this condition, as in all the above conditions, the video clip was two minutes long.

In the control condition, participants were simply instructed to sit quietly and wait for further instructions. These participants did not view a video and simply sat with two minutes of silence playing on their headphones. This condition was created to control for any physiological or anxiety state changes that might occur simply with the passage of time after the anxiety-inducing speech task. After two minutes had passed, participants were instructed to return to the survey and continue.

**Stroop task.** The modified emotional Stroop task is used to evaluate attentional biases toward different kinds of threat in anxiety disorders (Mathews & MacLeod, 1985). Using the Stroop task measures residual anxiety in an implicit manner, and thus could result in data that is potentially more accurate than self-report data. In a comparison of generalized anxiety disorder (GAD) with social phobia using this task, one study found that although patients with GAD were
slowed by all emotionally-related words, patients with social phobia were only distracted by words related to giving a speech (Becker, Rinck, Margraf, & Roth, 2001). In the above study, the authors found no main effect for different types of words (positive, negative, GAD-related, or speech-related) among their non-anxious control group. However, the modified Stroop task in this study was administered at a baseline level. In this study, participants are asked to give and prepare a speech before completing the modified Stroop task, in order to detect an increased attentional bias toward speech-related words due to the effect of priming. Although participants in this study were not clinically anxious, a non-anxious group might show a significant attentional bias toward speech-related words, due to the prevalence of the fear of public speaking in the general population.

To access the Stroop task, participants in this study were instructed to open a webpage containing an Inquisit software script with instructions for a modified Stroop task. They were told to identify the colors of words as quickly as possible without trying to read the content of the word. After a practice round, where all stimuli were color words, the experimental round began, which contained a set of 12 words that evoked positive emotions and 12 words related to social anxiety (see Mathews & MacLeod, 1985 for stimuli). The task was programmed so that words were randomly presented and their order differed for each participant. Two participants’ data were eliminated because they did not follow directions and completed the Stroop task using only one hand, instead of two as instructed, for a total of 103 participants with usable data.

**Speech performance.** Next, participants were instructed to give their prepared speech. Participants were reminded that their performance would be videotaped and evaluated. Participants remained seated and spoke toward the camera. After participants were told to begin, the audio file contained five minutes of silence, after which participants were told that their
speech was over, and they should return to the survey. Participants could speak for the entire time if they chose, but some participants did not speak for the entire five minutes and either forcibly advanced the survey without completing the audio file or sat quietly until instructed to continue.

**Manipulation check and demographic information.** Participants answered a final set of questions evaluating their own performance on the speech and their thoughts related to the speech. Several questions were implemented as a manipulation check, asking how important the speech was to them. Participants then answered basic demographic questions and completed the survey. Once the survey was completed, the experimenter stopped video and physiological data recording. Participants were debriefed, and the experimenter removed all equipment.

**Measures**

**Trait anxiety.** The trait portion of the State-Trait Anxiety Inventory (STAI-T, Form Y; Spielberger, 1983) was used to assess trait anxiety characteristics of participants. The STAI-T (Form Y) contains 20 questions that measure participants’ trait anxiety. Sample items include “I worry too much over something that really doesn’t matter” and “I am a steady person.” Participants indicate how they generally feel on a Likert Scale from 1 (almost never) to 4 (almost always). Higher scores mean that the participant is more anxious. Test-retest reliability for the STAI-T ranges from .65 to .75 over a 2-month interval, and internal consistency coefficients range from .86 to .95 (Spielberger, 1983). In this study, the STAI-T had an internal consistency of $\alpha = .90$.

**Personality.** The Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003) measures basic personality dimensions. The TIPI is a set of 10 items, each consisting of one pair of traits. Sample items include “anxious, easily upset” and “sympathetic, warm.”
Participants rate whether the traits apply to them on a Likert scale from 1 (disagree strongly) to 7 (agree strongly). Items 1 and 6 assess Extraversion, Items 2 and 7 assess Agreeableness, Items 3 and 8 assess Conscientiousness, Items 4 and 9 assess Emotional Stability, and Items 5 and 10 assess Openness to Experiences. Items 2, 4, 6, 8, and 10 are reverse-scored. Scores for each of the five traits are averaged, so that each trait has a possible score of 1 to 7. In the initial study, the TIPI had a test-retest reliability of .72 after six weeks (Gosling, Rentfrow, & Swann, 2003).

State anxiety. State anxiety was measured at three time points: baseline (after baseline physiological measurements had been taken for a five-minute period, to allow participants time to adjust to the equipment and laboratory setting), post-induction (after the initial anxiety-inducing task, in which they prepared their speech), and post-intervention (upon completion of the video for the genuine laughter, forced laughter, and relaxation groups, and after the audio file finished for the control group). Participants rated their current anxiety levels on a sliding scale of 0 to 10, from “not at all” to “very much” based on three questions (“I feel anxious;” “I feel worried;” “I feel stressed”). Total anxiety score was computed by adding the three scales together, for a total anxiety score ranging from 0 (no anxiety) to 30 (maximum anxiety). Internal consistency for baseline, post-induction, and post-intervention measures was high, at $\alpha = .86$, .89, and .90, respectively.

Manipulation and engagement checks. After the experimental manipulation, participants answered several questions as a manipulation and engagement check. Participants who had viewed a video (the genuine laughter, forced laughter, and relaxation groups) were asked to rate the emotions evoked by the video they had previously viewed. They rated 8 emotions (interest, amusement, anger, contentment, disgust, fear, sadness, and surprise) based on how much they experienced each one during the video, from a scale of 0 (none) to 8 (most in my
life). Participants also rated the importance of the speech and their focus during the speech from a scale of 1 to 5.

**Cognitive measures.** After giving their speeches, participants were asked to describe the overall quality of their speech on a Likert scale from 1 (horrible) to 6 (almost perfect). Their confidence during the speech was also assessed on a Likert scale from 1 (not at all confident) to 5 (completely confident). Finally, participants were asked how frequently they thought about their speech during other portions of the experiment, and to what extent their thoughts were negative and positive (0 = not at all; 10 = extremely). They then described their most negative thought and most positive thought in an open-ended format.

**Results**

**Trait Differences**

Across the four conditions, most of the measures of trait characteristics showed no significant differences. For the STAI score, $M = 40.39$ and $SD = 8.23$ on a scale from 20 to 80; participants had low to moderate trait anxiety on average, as expected for a non-clinical sample. Personality traits, measured using the TIPI on a scale from 2 to 14, had similar means. For extraversion, $M = 9.28$, $SD = 2.92$; agreeableness $M = 10.24$, $SD = 2.25$; conscientiousness $M = 11.16$, $SD = 2.28$; emotional stability $M = 9.69$, $SD = 2.54$; and openness $M = 10.38$, $SD = 2.09$.

After running a one-way ANOVA, it was determined that ratings of openness, measured using the TIPI, differed significantly across groups, $F (104) = 4.01$, $p = .02$. Openness differed significantly between the forced laughter group and the control group, $p = .02$, and there was a marginally significant difference between the genuine laughter and forced laughter groups, $p = .06$. In addition, emotional stability was marginally significantly different between the relaxation group and the control group, $p = .05$. Because openness and emotional stability showed
significant group differences, they were controlled for in the primary analyses. No other traits showed significant differences across groups.

Correlations were calculated between the various trait measures and the primary measure of anxiety, self-reported anxiety at baseline, post-anxiety induction, and post-intervention (Table 1). STAI scores were the most strongly correlated of the trait measures and thus deserved further examination. A hierarchical regression analysis showed a small but significant amount of the variability in each of these anxiety measures was accounted for by STAI score on post-intervention anxiety, the main state anxiety variable of interest, $R^2 = .13, p < .001$. Adding in condition as a second level predictor did not significantly change the model, $\Delta R^2 = .001, p = .78$. Because there were no group differences among STAI scores, they were not examined further.

**Effectiveness of Emotion Induction**

**Speech task.** Overall, the speech task was an effective inducer of anxiety, as measured by self-reported state anxiety levels at baseline, post-anxiety induction, and post-intervention. At baseline, participants had a state anxiety level $M = 7.01, SD = 6.37$. After the anxiety induction, participants had a state anxiety level $M = 11.29, SD = 6.68$. After the intervention, participants had a state anxiety level $M = 7.55, SD = 6.14$. Mean difference between baseline anxiety and post-induction anxiety was significant, $t (103) = -6.83, p < .001$. Mean difference between post-induction anxiety and post-intervention anxiety was significant, $t (102) = 5.69, p < .001$. Mean difference between baseline anxiety and post-intervention anxiety was not significant, $t (102) = - .87, p = .39$. Since post-intervention levels of anxiety did not significantly differ from baseline levels, on average participants returned to the same levels of anxiety at the end of measurement.

**Videos.** Experienced emotions were compared across the three video conditions and one control condition. A one-way ANOVA was used to determine significance between groups, and
Tukey’s HSD was used to determine the direction of significance. There were no significant differences across groups for anger ($M = 1.51$, $SD = 1.12$), disgust ($M = 1.44$, $SD = 1.03$), fear ($M = 1.64$, $SD = 1.39$), or sadness ($M = 1.42$, $SD = .98$), as these emotions were not targeted by the videos. There was also no significant difference across the groups for contentment ($M = 3.84$, $SD = 2.13$), even though the control condition and forced laughter condition were not designed to elicit positive emotions, unlike the genuine laughter and relaxation conditions.

There were significant mean differences in ratings of interest, amusement, and surprise (Table 2). For interest, amusement, and surprise, respectively, $F (103) = 3.99$, $p = .01$; $F (103) = 7.61$, $p < .001$; $F (103) = 5.01$, $p = .003$. Participants rated the video in the genuine laughter condition as significantly more interesting than the video in the relaxation condition, $p = .01$, and marginally more interesting than the video in the forced laughter condition, $p = .08$, and the control condition, $p = .05$. The video in genuine laughter condition was rated significantly more amusing than the video in the relaxation condition, $p = .001$, and the control condition, $p < .001$, but not significantly more amusing than the video in the forced laughter condition, $p = .135$. Finally, the video in the genuine laughter condition was rated as significantly more surprising than the videos in the forced laughter group, $p = .03$, and the relaxation group, $p = .002$.

**Engagement check.** Participants were asked to evaluate how focused they were while giving the speech and how important the speech was to them in order to test for levels of participant engagement. Participants who did not give a speech were eliminated from this analysis, leaving valid data from 91 participants.\(^1\) For focus and importance, participants fell around the midpoint of the 5-point scales, $M = 2.59$, $SD = 1$ and $M = 3.36$, $SD = 1.05$, respectively. Across all four groups, no significant differences were found in levels of focus, $F (90) = .32$, $p = .81$, and importance, $F (90) = .35$, $p = .79$.\(^1\)
**Subjective Experience**

**Speech measures.** Participants rated their confidence on the speech around the midpoint of the 5-point scale, $M = 2.25$, $SD = 1.05$. Ratings for overall quality were somewhat below the midpoint of the 6-point scale, $M = 2.36$, $SD = .91$. Participants showed no significant differences across groups in self-reported ratings of their level of confidence before the speech, $F (90) = .64$, $p = .59$, and the overall quality of their speech, $F (90) = 2.01$, $p = .12$.

**State anxiety.** Significance of differences in anxiety measures across conditions was calculated using a hierarchical regression model. Post-intervention anxiety was used as the gauge of the effectiveness of a condition on anxiety, as this anxiety score was conducted directly after the intervention was given. Baseline anxiety was significantly correlated with post-intervention anxiety, $r = .695$, $p < .001$; post-induction anxiety was also significantly correlated with post-intervention anxiety, $r = .847$, $p < .001$. A hierarchical regression analysis was conducted to determine if post-intervention anxiety could be significantly accounted for by condition, above and beyond ratings of baseline anxiety and post-induction anxiety. Group differences for openness and emotional stability were also taken into account in the regression analysis. Post-intervention anxiety was predicted by baseline anxiety, post-induction anxiety, openness, and emotional stability, $R^2 = .75$, $F (101) = 71.63$, $p < .001$. When condition was used as a second-level predictor in the model, $\Delta R^2 < .001$, $\Delta F (101) = .04$, $p = .83$; thus, condition did not significantly influence post-intervention anxiety levels.

This analysis was also repeated after removing outliers, data where reported anxiety at baseline, post-induction, and post-intervention were greater than two standard deviations from the mean (Table 3). Without outliers, post-intervention anxiety was predicted by baseline anxiety, post-induction anxiety, openness, and emotional stability, $R^2 = .64$, $F (93) = 39.54$, $p <$
.001. When condition was used as a second-level predictor in the model, $\Delta R^2 = .002$, $\Delta F(93) = .39, p = .53$; again, condition did not significantly influence post-intervention anxiety levels.

Cognitive Measures

**Implicit.** The emotional Stroop test was used as an implicit cognitive measure of residual anxiety post-intervention. Mean latency, the average time to correctly name the word after it appeared on screen, was calculated for all control words (positively valenced, non-threat words) and for all correct social threat words (Figure 1). A repeated measures ANOVA was used to examine the effect of group on the latency of the two categories of words.\(^2\) The main effect of condition on latency was not significant, $F(1) = .29, p = .59$. There was a marginally significant interaction between word category and group for differences in mean latency between the control words and social threat words, $F(3) = 2.22, p = .09$. The genuine and forced laughter groups showed higher mean latencies for control words than social threat words, while the relaxation and control groups showed higher mean latencies for social threat words than control words (Figure 2). When a planned comparison test was conducted comparing only the genuine laughter group and the control group and excluding participants in the other two conditions, there was a significant difference in the mean difference of social threat and control word latencies, $t(24) = 3.10, p = .005$ (Figure 3). Based on an observation of the pattern of group means, it appears that participants in the genuine laughter group had faster reaction times for social threat words than control words, meaning they did not show an attentional bias toward social threat words; the opposite was found for the control group.

**Explicit.** Participants were also asked to rate their speech-related thoughts as an explicit measure of cognitions. Participants who did not give a speech were excluded from this analysis, leaving data from 91 participants (Table 4). There were no significant differences between the
conditions in the amount of thoughts related to the speech during the intervention period, \( F(90) = 1.32, p = .27 \). Participants also did not have significantly more positive thoughts about the speech in any condition, \( F(82) = .85, p = .47 \). However, participants did experience a significant difference in the degree of negative thoughts about the speech, \( F(81) = 2.86, p = .04 \). A post-hoc test (Tukey’s HSD) was conducted to determine the direction of this effect. The genuine laughter group had marginally less negative thoughts than the forced laughter group, \( p = .07 \), and the control group, \( p = .09 \), but not significantly less negative thoughts than the relaxation group, \( p = .65 \).

Participants were asked after giving their speech to describe their thoughts about the speech. However, they were asked to describe the thoughts they had during the intervention, not during the speech. Because participants were not told that they would not have to give the speech until after the intervention, they were most likely still having the same thoughts during the intervention regarding the speech as others who did ultimately give a speech. Therefore, data collected regarding thoughts about the speech could still be valid even for participants who did not ultimately give a speech. Under this premise, the analysis was repeated to include participants who had not given the speech (Table 5). Group differences for the frequency of speech thoughts were marginally significant, \( F(101) = 2.34, p = .08 \). There were still no significant differences between groups for the extent of positive thoughts, \( F(92) = .70, p = .56 \). Group differences for the extent of negative thoughts remained significant, \( F(90) = 4.10, p = .009 \). The genuine laughter group had significantly less negative thoughts than the forced laughter group, \( p = .02 \), and the control group, \( p = .04 \), but not significantly less negative thoughts than the relaxation group, \( p = .69 \).
Discussion

Although laughter does not appear to have any effects on self-reported levels of anxiety in distressing situations, it does appear to affect cognitions. People who laughed after being presented with a stressful task reported less negative thoughts regarding the stressor than those who did not, though not more so than those in another positive emotion condition, relaxation. They were also not distracted by the social threat cue and were able to name the color of the word in the Stroop task more quickly compared to the control condition, which shows less attentional bias toward threats after laughter. Again, this difference only existed between the genuine laughter condition and the control condition.

Because laughter did not decrease the frequency of thoughts about a stressor, the hypothesis that laughter distances a person from psychological distress is not supported. However, laughter differed significantly from the control condition for the measure of attentional bias, while relaxation, the other positive emotion, did not. Therefore, there may still be an added benefit of laughter that goes beyond that of other positive emotions. Laughter appears to function similarly to other positive emotions in acting as a buffer from negative cognitions. Because less attention is directed toward threat during laughter, more cognitive resources are available, which allows for more flexible thinking. This conclusion supports the broadening component of the broaden-and-build theory of positive emotions. People who experience a positive emotion do not dwell on the negative aspects of a stressful situation and are able to think more flexibly, although not necessarily more positively. These people are also less distracted by cues that appear threatening, and instead pay attention to more positive stimuli. In this study, the effect of the broaden-and-build theory on anxiety is emphasized.
Laughter has an effect on the cognitive measures of anxiety, both implicit and explicit, but not on direct measures of anxiety. Why might this be? Self-report data is often unreliable, and many people have difficulty recognizing and differentiating their emotions. Perhaps participants did not want to appear anxious due to social pressure, and thus they reported lower levels of anxiety than they actually experienced. They might have also anticipated the study aims and responded as they thought they should, with their anxiety lessening even after no intervention. Participants were also not directed to think about anything in particular in the control condition, so there might be great variability in the kinds of thoughts participants had. Some participants might have had a more optimistic outlook or a stronger ability to regulate their emotions than expected, meaning they returned to baseline anxiety faster than anticipated.

Another explanation for this outcome is that laughter might affect anxiety, but on a smaller emotional scale or only at a pre-conscious level. Perhaps laughter only has a cognitive, but not a phenomenological, effect. Examining physiological data in the future will help us solve the mystery. If participants did not differ on their physiological responses across conditions, this would be a good indicator that positive emotions and/or laughter only have a cognitive effect. If differences are found between the laughter and relaxation conditions and the control condition, further support for Fredrickson’s undoing hypothesis of positive emotions exists – that positive emotions can “undo” the cardiovascular effects of negative emotions, such as anxiety, by returning heart rate and blood pressure to pre-anxious levels (Fredrickson, Mancuso, Branigan, & Tugade, 2000; Fredrickson & Levenson, 1998). If the laughter group experiences a faster return to baseline physiology than all other groups, including relaxation, we can conclude that laughter has an additional physiological effect that extends beyond the undoing hypothesis of positive emotions; we could also conclude that self-reported measures of anxiety
are less reliable than physiological measures of anxiety, and self-report measures simply failed to pick up the effect of laughter on anxiety in this study.

Future studies might find better methods to test the differences between genuine and forced laughter and between laughter and other positive emotions. Many participants in the forced laughter condition reported instances of genuine laughter during their intervention, although this has not been confirmed with video coding at this time. There are not any existing paradigms that differentiate between “real” and “fake” laughter in an experimental manner, which are needed to explore the differences between the two, if they exist. A better relaxation condition could also be used, perhaps with a mindfulness meditation instead of simple relaxation. A few participants self-reported laughter during the relaxation intervention, perhaps because they found it cheesy. Again, this has yet to be video coded. Additional positive emotion states could be added into the experimental protocol for a more complete comparison of the effects of positive emotions on anxiety.

The data collected in this study are plentiful, and there is great opportunity for future research in the fields of positive emotions, anxiety interventions, and even in this data set. Along with physiological data, behavioral data can be examined. Participants’ speeches can be coded for laughter, smiling, and overall quality, which would inform questions about laughter’s effect on performance in stressful situations, not just on the experience of distress itself. This study could be repeated with more participants or with more rigorous tests of laughter, without relying as much on self-report data, to confirm the cognitive effects of laughter and possibly discover physiological and behavioral effects as well.

Although there is more work to be done, this study was able to discover that laughter does affect cognitive aspects of anxiety, which was previously untested in an experimental
design. Replication of these results and further examination of the data set would open up areas for future study, including an examination of laughter and other positive emotions in those who are clinically anxious. Because the anxiety disorders are characterized by cognitive biases toward threat, and laughter seems to supersede these effects, laughter might be used in a treatment for anxiety as a way to disrupt a cycle of ruminative thinking and distract from biases toward threat. Future experimental studies with a clinically anxious population, and later treatment studies, are promising continuations of research on laughter and anxiety, which until now were unexplored.
References


Footnotes

1 Participants in the first 15 trials of experiment did not give speeches, as this part of the experiment was not yet approved by the IRB. Other participants simply did not follow the instruction to give a speech.

2 Openness and Emotional Stability were analyzed as covariates in this model to account for group differences. However, their effects were not significant: for openness, $F = .46, p = .50$; for emotional stability, $F = .005, p = .94$. Because controlling for openness and emotional stability in the primary analyses did not alter conclusions about the results, they will not be discussed further.
Table 1

*Trait and State Anxiety Correlations*

<table>
<thead>
<tr>
<th>Anxiety</th>
<th>STAI</th>
<th>Extraversion</th>
<th>Agreeableness</th>
<th>Conscientiousness</th>
<th>Emotional Stability</th>
<th>Openness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>.38**</td>
<td>-.01</td>
<td>-.13</td>
<td>-.06</td>
<td>-.32**</td>
<td>.06</td>
</tr>
<tr>
<td>Post-induction</td>
<td>.30**</td>
<td>-.02</td>
<td>.04</td>
<td>-.01</td>
<td>-.23*</td>
<td>-.10</td>
</tr>
<tr>
<td>Post-intervention</td>
<td>.36**</td>
<td>-.05</td>
<td>.03</td>
<td>.01</td>
<td>-.18</td>
<td>-.04</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01
Table 2

*Experienced Emotions by Condition (Significant Differences Only)*

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Genuine Laughter $M (SD)$</th>
<th>Forced Laughter $M (SD)$</th>
<th>Relaxation $M (SD)$</th>
<th>Control $M (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td>5.20 (1.94)</td>
<td>3.74 (2.01)</td>
<td>3.41 (1.86)</td>
<td>3.67 (2.50)</td>
</tr>
<tr>
<td>Amusement</td>
<td>5.96 (1.77)</td>
<td>4.70 (2.29)</td>
<td>3.84 (1.63)</td>
<td>3.50 (2.38)</td>
</tr>
<tr>
<td>Surprise</td>
<td>3.88 (2.09)</td>
<td>2.35 (1.70)</td>
<td>2.03 (1.62)</td>
<td>2.67 (2.06)</td>
</tr>
</tbody>
</table>
Table 3

*Self-Reported Anxiety by Condition (Outliers Removed)*

<table>
<thead>
<tr>
<th>Anxiety</th>
<th>Genuine Laughter $M (SD)$</th>
<th>Forced Laughter $M (SD)$</th>
<th>Relaxation $M (SD)$</th>
<th>Control $M (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>5.52 (4.70)</td>
<td>6.53 (4.22)</td>
<td>5.90 (4.20)</td>
<td>4.26 (3.39)</td>
</tr>
<tr>
<td>Post-induction</td>
<td>9.22 (6.42)</td>
<td>11.21 (4.09)</td>
<td>10.10 (5.98)</td>
<td>10.26 (5.28)</td>
</tr>
<tr>
<td>Post-intervention</td>
<td>5.43 (4.91)</td>
<td>7.37 (4.88)</td>
<td>6.38 (4.58)</td>
<td>6.52 (4.31)</td>
</tr>
</tbody>
</table>
Table 4

*Speech-Related Thoughts by Condition (Only Participants Who Gave Speech)*

<table>
<thead>
<tr>
<th>Speech Thoughts</th>
<th>Genuine Laughter $M$ (SD)</th>
<th>Forced Laughter $M$ (SD)</th>
<th>Relaxation $M$ (SD)</th>
<th>Control $M$ (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2.64 (1.05)</td>
<td>2.33 (0.84)</td>
<td>2.82 (1.06)</td>
<td>2.91 (1.00)</td>
</tr>
<tr>
<td>Positive</td>
<td>6.15 (2.56)</td>
<td>5.93 (2.76)</td>
<td>4.92 (2.82)</td>
<td>5.74 (2.93)</td>
</tr>
<tr>
<td>Negative</td>
<td>3.40 (2.21)</td>
<td>5.47 (2.20)</td>
<td>4.25 (2.31)</td>
<td>5.17 (2.81)</td>
</tr>
</tbody>
</table>
Table 5

*Speech-Related Thoughts by Condition (All Participants without Procedural Errors)*

<table>
<thead>
<tr>
<th>Speech Thoughts</th>
<th>Genuine Laughter $M \ (SD)$</th>
<th>Forced Laughter $M \ (SD)$</th>
<th>Relaxation $M \ (SD)$</th>
<th>Control $M \ (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2.63 (1.01)</td>
<td>2.23 (0.97)</td>
<td>2.94 (1.15)</td>
<td>2.88 (0.97)</td>
</tr>
<tr>
<td>Positive</td>
<td>6.22 (2.50)</td>
<td>5.75 (2.77)</td>
<td>5.14 (2.74)</td>
<td>5.76 (2.82)</td>
</tr>
<tr>
<td>Negative</td>
<td>3.32 (2.17)</td>
<td>5.75 (2.41)</td>
<td>4.14 (2.26)</td>
<td>5.24 (2.83)</td>
</tr>
</tbody>
</table>
Figure 1

*Stroop Latency by Word Category and Condition*

[Bar chart showing latency (ms) for Genuine Laughter, Forced Laughter, Relaxation, and Control conditions. The chart distinguishes between control words and social threat words.]
Figure 2

Interaction of Word Category and Condition
Figure 3

*Difference Latency (Social Threat Latency – Control Latency) by Condition*

![Graph showing latency difference by condition](image-url)