From HAHA to AHA: Rumination, Humor, and Problem Solving

by

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A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Approved November 2018 by the
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ARIZONA STATE UNIVERSITY

May 2019

ABSTRACT

Past research has focused on the important role humor plays in interpersonal relationships; however, researchers have also identified intrapersonal applications of humor, showing that people often use humor to alleviate negative affect, and that humor has generally been found to beneficially influence mental health. The purpose of this study is to examine whether humor-based coping can be utilized as an intrapersonal tool to aid or facilitate creative thinking and problem solving when faced with a distressing situation. The current study posits reduced rumination as the mechanism by which humor facilitates creativity. To measure creativity, a task was devised that had individuals brainstorm under some distress; participants were asked to recall and describe an ongoing, unresolved problem they were facing, followed by a rumination induction, as rumination is characterized by perseverative thoughts that hinder constructive action. After the rumination induction, participants were randomly assigned to a control condition or either of two emotion regulation conditions: positive reappraisal or humor-based reappraisal. Following this, participants were asked to complete an "alternate solutions" task, based on Guilford's Alternate Uses Task, generating solutions for their own unresolved problem. Results of the study showed that the use of humor was indeed related to a decrease in rumination, but that the humor condition did not outperform either control condition on any measure of creativity (performing worse in some cases). Limits of this study and future directions are discussed.

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"Humor has bailed me out of more tight situations than I can think of. If you go with your instincts and keep your humor, creativity follows. With luck, success comes, too."

– Jimmy Buffett

Although we are quick to associate humor with professional comedians, humor can also be described as one of humanity's most versatile tools. Humor as a personality trait is valued cross-culturally, speaking to the diversity with which it can be implemented and the degree to which it is appreciated by others (Buss, 1988). Specifically, it has been found to be one of the most favorably evaluated personality traits in studies on social desirability (Craik, Lampert, & Nelson, 1996). Humor is a critical social tool used to garner friendships, ease tension, and strengthen bonds. Past research has focused heavily on the important role humor plays in interpersonal relationships, as a method of enhancing positive interactions, facilitating self-disclosure and social probing, and defusing tension and conflict (Lefcourt, 2001; Long & Graesser, 1988).

However, researchers have also identified intrapersonal applications of humor, finding that people often use humor to alleviate negative affect, and suggesting that humor has beneficial influences mental health (Strick, et al., 2009). Additionally, humor has been found to facilitate recovery following exposure to stressors (Lefcourt & Martin 1986). However, the mechanisms by which humor accomplishes these benefits have not been examined with as much scrutiny. The purpose of this study is to examine whether humor-based coping can promote creative thinking and problem solving in the face of a stressor. The proposed research will focus on whether individuals can 'harness' the

cognitive flexibility that accompanies and is an essential aspect of humor in order to interrupt ruminative thought patterns, and aid in problem solving.

Rumination

Rumination is defined as the repetitive looping of negative thought, with focus on feelings of distress and possible consequences (Lyubomirsky & Nolen-Hoeksema, 1995). Common examples of ruminative thought content include focus on bad feelings ("I feel so bad today"), negative self-evaluative questions ("why am I like this?", "why do I always do this?"), and fear of consequences from continued bad feelings ("what if I can't get over this?"). The result of these looping negative thoughts tends to be counterproductive. Individuals are unable to take constructive action to solve their problems, and are stuck in an inflexible thought pattern.

Rumination is particularly characteristic of individuals with mixed anxiety and depressive symptoms (Nolen-Hoeksema, 2000). By contributing to a sense of hopelessness about the future, and negative self-evaluation, rumination has been found to maintain and exacerbate depression (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Ruminating individuals not only experience more distress, but their problem solving becomes impaired. When rumination was induced in a group of dysphoric participants, they were more likely to appraise their problems as overwhelming (Nolen-Hoeksema, 2000); they were unable to view their problem as solvable, and thus their motivation to engage in constructive action was reduced. Additionally, a ruminator's social life is highly impacted; social support networks including family, friends, and romantic partners become eroded due to the individual's perseverative focus on negativity, and lack of attempts to problem solve (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

In these moments of distress, when individuals are faced with a problem and fall into ruminative thought patterns, what can be done to interrupt rumination and promote problem-solving? The ideal intervention will first need to reduce the prevalence of negative thoughts. Additionally, cognitive flexibility will need to be introduced into the system, as the rigidity of cognition is a barrier to identifying solutions to one's problems. Finally, the ideal intervention would help people generate viable solutions to their problems. One possible intervention, which may provide each of these benefits, is the use of humor.

The Cognitive Shift Theory of Humor

What is meant by the term "humor?" Many competing theories have attempted to explain why people find things funny. Benign violation theory focuses on the violation of presuppositions or expectations, and the simultaneous view of the situation as nonthreatening (McGraw & Warren, 2010). Incongruity theory posits that humor is the realization of incongruity between a concept and a real object thought to be related to the concept (Mulder & Nijholt, 2002). A third theory of humor, which successfully incorporates elements of both benign violation theory and incongruity theory, is the *Cognitive Shift Theory of Humor*.

Cognitive Shift Theory conceives of humor as a process in which an initial tension (i.e., joke setup) is resolved through a cognitive shift in which the original conceptual framing of a central element is replaced by a conceptual framing that is different, but equally appropriate (i.e., punch line), leading to tension release and felt amusement (Latta, 1999). Like the other two theories, Cognitive Shift Theory emphasizes the unexpected and automatic shift in meaning that accompanies humor, including both

the benign violation of expectation and the resolution of incongruity. Humor in this theory starts from a certain implicit assumption or set of assumptions, which are then abandoned in favor of a new conceptual framework for the situation. For example, consider the following joke:

Why can't you explain puns to kleptomaniacs?

They always take things literally.

In this case the initial tension is created by the question posed. It leaves the audience for the joke considering what information they know about puns, or kleptomaniacs, that could answer this question. The punch line resolves this tension by presenting two competing but equally appropriate resolutions to the question within a single statement, with the shift in meaning relying on two distinct but equally relevant meanings of the word "take" in this context. In the first meaning, the answer is that you cannot explain puns to someone who takes the pun at face value (takes literally). The second meaning emphasizes the kleptomaniacal tendency to steal things (literally take). This shift in meaning requires that the audience have access to both conceptual frames and be able to switch from one to the other in an instant; if one frame is not understood or known, this results in a lack of a shift and the individual not "getting" the humor or finding it funny. If in the example someone was unfamiliar with the definition of kleptomania, then they would not be able to shift to the other meaning of "take things literally".

Cognitive Shift Theory suggests that humor may prime cognitive flexibility in general, beyond the actual humor stimulus. Cognitive flexibility is defined as a person's ability to abandon one cognitive strategy in favor of another, based on a change in task

demands (Scott, 1962). Thus, cognitive flexibility is the opposite of perseveration - the tendency to loop on the same thought, behavior, or strategy even when it is not paying off (Dreisbach & Goschke, 2004). Humor requires the ability to carry multiple conceptual frameworks in the mind at once, and the mental flexibility to shift between them. Evidence already suggests that experimentally induced positive affect reduces perseveration in a cognitive set-switching paradigm (Dreisbach & Goschke, 2004). In this study, participants were trained to respond to target stimuli of one color while ignoring stimuli of a different color, and then assigned to a switching condition. In one condition, participants had to respond to a new color, while distractors appeared of the previously learned target color. In this task people tend to perseverate on the original color, leading to false-positive responses to that color, but a previous positive affect manipulation essentially eliminated this perseveration. In another study which asked participants to categorize cards, subjects in a positive mood condition were able to identify a greater variety of both similarities and differences between stimuli, demonstrating flexibility in categorization (Isen, Daubman, & Nowicki, 1987). More work is needed to determine whether the increase in cognitive flexibility is due to positive affect in general, or whether the process of humor may distinctly prime flexibility, as suggested by Cognitive Shift Theory.

Humor and Creativity

In promoting cognitive flexibility, humor should also facilitate creativity. Creativity is commonly defined as the ability to produce work that is both novel and appropriate; it requires flexibility, divergent thinking, and often the combination of elements that are remotely conceptually associated (Mednick, 1962). Previous research

suggests a link between pleasant affective states and creative problem solving. Chermahini and Hommel (2012) found that completing a task requiring divergent thinking - Guilford's (1967) Alternate Uses Task, which asks participants to generate as many uses as possible for a simple object under time constraint - improved subsequent mood. Importantly, experimental work also suggests an effect in the opposite direction. In a study involving word associations, positive mood was related to more unusual first-associates to neutral words, and associations to positive words appeared to be more diverse than to neutral (Isen, Mitzi, Johnson, Mertz, & Robinson, 1985). Positive affect induced by watching a few minutes of a comedy film improved performance on two tasks that require creative ingenuity: Dunker and Lee's (1945) candle task and Mednick, Mednick, and Mednick's (1964) Remote Association test (Isen, Daubman, & Nowicki, 1987). These tasks examine divergent and convergent thinking. The candle task is particularly interesting because it requires that people generate an unconventional use of a common object (a box) in order to solve the problem (attach a candle to the wall). After viewing the comedy film, subjects were better able to "think outside of the box" about the box in the candle task. While these studies are billed as establishing a link between positive affect and creativity, many (though by no means all) of these studies used a humor stimulus to evoke "positive affect." This raises the question of whether there is something special about humor and amusement that promote creative thinking, above and beyond the influence of general positive affect.

Humor, Coping, and Problem-Solving

Humor-based coping has long been recognized as an effective strategy for dealing with negative life circumstances (Martin & Lefcourt, 1983; Vaillant, 2000). Humor has

been found to reduce the impact of stress (Martin & Lefcourt, 1983). Anecdotal evidence from POW's suggests that they used humor to build relationships and fight back against their captors in the only way they could (Henman, 2001). Further studies have found that the more adaptive types of humor (affiliative and self-enhancing humor) are associated with beneficial effects such as greater self-esteem, lower depression and anxiety levels, and more positive self-competency judgments (Kuiper et al., 2006).

Humor-based coping is a form of cognitive reappraisal which entails changing the perceived meaning of an event to alter its emotional impact (Gross, 1998). People vary in how they respond to the same stimulus; the theft of a piece of jewelry could be inconsequential to one person and devastating to another, depending on the value placed on the item and extent of loss appraised by each individual. These appraisals subsequently influence the emotions felt. Cognitive reappraisal as a means to regulate emotions is linked to several benefits including more positive and less negative affect, enhanced social connectedness, and higher well-being (Gross, 1998; English, John, Srivastava, & Gross, 2012; Gross & John, 2003). Reappraisal encompasses several subtypes, each of which has a distinct suite of effects (Shiota & Levenson, 2012). As a reappraisal strategy, humor shares some features with positive reframing (finding a benefit in the situation) in terms of the positive-valence feelings that accompany it, as well as with detached reappraisal (think about the situation in an objective way) in terms of the psychological distance that humor can create between the subject and the situation. However, we proposed that humor-based reappraisal is unique, and should offer benefits distinct from these other two forms of reappraisal. Humor may not be positive or paint the situation in a positive light, nor does it necessarily create distance between the

individual and the situation; in order to joke about the situation, a person must directly think about aspects of their issue in new ways. We hypothesize that, because of the cognitive shift people need to make to find humor in their situation, humorous reappraisal will have the distinct effect of interrupting rumination and facilitating creative problem solving.

In one of the first studies to directly connect the humorous coping and emotion regulation literatures, Samson & Gross (2012) directly examined the effects of humor-based coping on emotional responses to a set of negatively valenced images. Participants were first asked to view 30 negative pictures and rate their emotional responses. In the second phase, they were instructed to reappraise the images by either (a) simply viewing the images again, (b) using positive humor ("sympathetic, tolerant, and benevolent amusement"), or (c) using negative humor ("hostile, superior, mocking way to create emotional distance"), and provide ratings for their emotional responses. Findings indicated that when successfully implemented, positive humor coping was the more effective strategy to down-regulate negative and up-regulate positive emotions in the short-term.

Although Samson & Gross (2012) directly examine the benefits of humorous coping in the face of negative stimuli, one limitation is that they do not provide a mechanism by which this benefit is conferred. This limitation is addressed in the current study by investigating reduced rumination as the mechanism by which humor makes people feel better. Additionally, by pitting humor-based coping against positive reframing in this study we can address whether it is just the positive feelings induced by humor

which result in better outcomes, or whether there is something specific to humor, above and beyond positive affect, that leads to desirable outcomes.

The Current Study

The current study aims to extend findings from previous literature by investigating a particular mechanism by which humor might help people overcome stressful situations. We propose that humor promotes cognitive flexibility in the face of a stressor, interrupting rumination, and allowing the individual to think creatively about possible ways to solve their problem. Little research has addressed the specific mechanisms by which humor improves mood and confers other, established benefits for well-being. The current study attempts to expand theory on emotion regulation by examining not only the mechanisms of humor's effects on mood, but also downstream consequences for problem-solving. Humor is a universal and cross-cultural phenomenon. Enhanced understanding of the ways in which humor may function as an adaptive resource would have strong implications for interventions to promote psychological health, education, and performance in other stressful contexts in which cognitive flexibility is desired.

Method

Participants

Participants were recruited online using the ASU Psychology Subject Research Pool and received one hour of course credit for completing the study. 217 participants (107 women) with a mean age of 18.91 years (*SD* = 2.23) came into the lab to complete the study on laptops. We collected a total sample of N = 217 participants (we randomly assigned 70 to positive reappraisal, 73 to humorous reappraisal, and 74 to control) after

removing those who failed attention checks, did not complete the study, were not fluent in English, or wrote about past resolved problems. This sample size provides greater than 90% power to detect main effects of emotion regulation condition in pairwise comparisons with an effect size of eta squared = .05, assuming alpha = .05 (Calculated in GPower - ANOVA).

Procedure

Negative affect and rumination induction. Participants first underwent a negative affect induction in which they recalled an ongoing, unresolved problem they were facing and were asked to write as much about this situation as possible. Specific questions were embedded in the instructions ("please describe who or what is involved, when this issue began, how long it has been of concern, where the problem primarily takes place, and why it is a problem") which encouraged participants to provide plenty of details about the stressor and promote their memory of the event. This task provided participants with the problem to reappraise in the latter half of the study. Problems were required to be unresolved so that participants could consider all possible ways to sort out the issue. Participants were excluded from analyses if they wrote about a problem that they had in the past that was already resolved, or that no longer had a possible solution. Problems varied in subject matter but fell primarily in the categories of relationships, friendships, roommates, family, work, school, health, money, and mental health.

Participants had five minutes to write about their problem and were automatically advanced to the next portion of the study once the time limit was up. This was followed by a rumination induction during which participants read a list of instructions that stimulated rumination about the stressor. Adapted from Nolen-Hoeksema and Morrow's

(1993) study on the effects of rumination versus distraction on naturally occurring depressed mood, we presented participants four waves of statements to read intended to encourage or facilitate rumination. Statements were presented 10 at a time for 45 seconds each. These statements asked participants to focus their attention on thoughts that were symptom-focused, emotion-focused, and self-focused. Examples include asking participants to think about "the physical sensations you feel in your body", "your character and who you strive to be", "the possible consequences of your current mental state", etc. Instructions for this task were as follows: "For the next few minutes, try your best to focus your attention on each of the ideas on the following pages. Read each item slowly and silently to yourself. As you read the items, use your imagination and concentration to focus your mind on each of the ideas. Spend a few moments visualizing and concentrating on each item. Please continue until the time is up and you are automatically advanced to the next task."

Reappraisal task. Participants were then randomly assigned to one of three emotion regulation conditions, during which they were prompted to think about their problem in a different way and write about said problem for three minutes in the instructed manner. The reappraisal conditions consisted of a control condition (continue to write about your problem) or either of two emotion regulation conditions: a positive reappraisal condition (adopt a positive outlook) or a humor-based reappraisal condition (adopt a humorous outlook). Participants were automatically advanced to the next task after the three-minute time limit was up. Instructions for each emotion regulation condition were as follows:

1) Control – We would like you to write about your problem again. This time, while you are writing about your problem please focus on the feelings felt about the situation. As you write, please try to think about the different emotions surrounding your experience. Please answer the original questions (describe who or what is involved, when this issue began, how long it has been of concern, where the problem takes place, and why it is a problem), but please try to think and write about what each aspect of the problem made you think and feel.
2) Positive Reframing – We would like you to write about your problem again. This time, while you are writing about your problem please try to adopt a positive attitude. As you write, please try to think about positive aspects of your experience. Please answer the original questions (describe who or what is involved, when this issue began, how long it has been of concern, where the problem takes place, and why it is a problem), but please try to think and write about your issue in such a way that you feel less negative emotion (highlight the silver linings of your problem, look at the glass half full).
3) Humor – We would like you to write about your problem again. This time, while you are writing about your problem please try to adopt a humorous attitude. As you write, please try to find humor in, poke fun at, or make jokes about the problem. Please answer the original questions (describe who or what is involved, when this issue began, how long it has been of concern, where the problem takes place, and why it is a problem), but please try to think and write about your issue in such a way that would amuse someone who is reading your

description (as if you are writing/performing a comedy stand-up routine for an audience).

After the emotion regulation task, participants experienced a two-minute break during which they were instructed to sit quietly with their thoughts, followed by a measure of state rumination adapted from McCullough et al. (2007) to assess the extent to which individuals were still ruminating about their problem during the two-minute break.

Alternate solutions task. Following this, participants were asked to complete an "alternate solutions" task based on Guilford's Alternate Uses Task, brainstorming solutions for their own unresolved problem. The Alternate Uses Task asks participants to think of as many uses as possible for a simple object, like a pencil or stapler, under some time constraint. This test typically targets divergent thinking, asking for as many responses or ideas as possible. Asking participants to brainstorm as many solutions to their original problem in the same fashion as the Alternate Uses Task is ideal for gauging not only creativity, but also the extent to which the participant was still hindered by rumination after the randomly assigned reappraisal task.

Participants were instructed to list as many solutions as possible to the problem they described earlier in the study. Additionally, we explained to participants that we were interested in *all possible solutions* and to list *as many as they could think of* during the allotted time. Full sentences were allowed but not required; solutions were directed to be separated by two equal signs (= =) to aid in differentiating solutions that were not written in complete sentences. Once solutions to the problem were collected, participants filled out the Brief COPE to assess dispositional coping style, the Ruminative Response

Scale to measure trait rumination, and the Humor-Styles Questionnaire to evaluate sense and style of humor. Following this, participants filled out self-report questions relating to the reappraisal task and questions assessing demographic information. Total time required for the study was approximately 45 minutes.

Materials and Measures

State rumination. We measured state rumination about the problem with an eight-item scale that was adapted from McCullough et al. (2007) and inspired by the Intrusiveness subscale of the Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979). Participants rated on a 6-point scale ranging from 0 (not at all true of me) to 5 (extremely true of me) how much they had the following experiences during the two-minute break: "I couldn't stop thinking about my problem"; "Thoughts and feelings about my problem kept running through my head"; "Strong negative feelings about my problem kept bubbling up"; "Images of the problem kept coming back to me"; "I brooded about my problem"; "I found it difficult not to think about the stress that my problem has caused me"; "I found myself playing the events of my problem over and over in my mind"; "Even when I was taking the break, I thought about my problem." State rumination was assessed by averaging a participant's score across these eight items. Scores ranged across all possible levels of state rumination (score of 1 being lowest to score of 6 being highest) with a mean score of 3.53 (SD = 1.38). Cronbach's alpha for this scale was .92.

Coding of alternate solutions task problems and solutions. All responses were coded by a primary coder, with 20 participants coded by a second coder to assess reliability. The primary coder first determined the main problem in each participant's initial description of the unresolved problem they were facing. As participants were free

to write about several problems, we deemed it necessary to discern what the main problem was in order to properly assess relevance of solutions provided in the Alternate Solutions Task. Then total number of responses was measured by counting responses separated by the "= =" symbol as instructed.

Among the alternate solutions task responses, plausible solution attempts were first identified and counted, and then the primary coder scored each plausible solution for potential impact on the problem. Plausible solutions were defined as responses that could plausibly be interpreted as an *attempt* to potentially ameliorate *the problem causing distress*, as distinct from relieving the distress itself. For example, if the core problem provided was "difficulty choosing which major to switch to", the solution "talk to a friend to feel better about it" would not be deemed an attempt to solve the problem. Solutions were also excluded if the time frame of following through with the solution was unreasonable given the scope and time frame of the problem (e.g., given "my friend is sad" as the problem, "become a therapist" is unreasonable as a solution given the amount of time it takes to complete).

Once plausible attempts were designated, the primary coder rated these solutions for potential to impact the problem on a scale from 0 – 4. The score breakdown for plausible attempts was as follows: 0 - no or extremely low probability of impacting the problem in any meaningful way; 1 - low or modest probability that there will be a small impact on the problem; 2 - reasonable possibility of having a medium sized impact on problem; 3 - low or modest probability that there will be a big impact on the problem; 4 - high probability of a big difference/impact on the problem. Scores of all plausible solution attempts fell between the complete range of 0 – 4.

Number of categories was also tallied. The primary coder gave each plausible attempt a letter designation, with attempts that fell under the same category receiving the same letter. For example, if the coder determined that a participant wrote four plausible solutions and the first three solutions all described "seeking advice" from different people (friend, family, teacher), then these would all receive an 'A' while the final solution would receive a 'B'. Number of categories was determined by counting how many unique letters a participant's plausible solutions received. Participants ranged from a minimum of one category to a maximum of eight categories.

Creativity of solutions was assessed via number of total responses provided (M = 9.08, SD = 4.68), number of plausible solution attempts (M = 5.42, SD = 3.0), number of categories of plausible solutions (M = 3.19, SD = 1.38), peak rating of plausible solutions (M = 3.62, however 75% of participants hit the max peak of 4), and elaboration (amount of detail given in plausible responses, operationalized in terms of total number of words for all plausible attempts divided by number of plausible attempts; M = 10.35, SD = 8.19). We chose not to examine originality of responses due to the extremely wide range of problems, each with its own complex contextual factors; originality could only be assessed if everyone had the same exact problem, as is the case for the original Alternate Uses Task. The other measurements relate to creativity in that we are assessing fluency (number of solutions), flexibility (number of categories), and level of detail provided (elaboration), all similar ratings of creativity as in the Alternate Uses Task. In addition to these we examine peak score as a measure of success.

Reliability of coding the *number* of plausible attempts was assessed by calculating a ratio of agreed upon solutions to total responses given. Of 209 answers total, two coders

agreed 166 times providing a 79% agreement. Agreement consisted of approving plausible solutions and mutually deciding to not include implausible solutions.

We assessed the reliability of the *ratings* given to plausible solutions first by focusing on the variables that would be used as DVs in data analyses (average impact score and number of categories provided across each participant's plausible solutions). The intraclass correlation coefficient was calculated using a two-way mixed model with case as a random factor and coder as fixed factor in SPSS. We expected both coders to be consistent throughout their rating system and focused on absolute agreement, as we were interested in how much the coders were in absolute agreement about scores. Variability would thus be assumed to come from the cases and not the coders. The ICC for the single measure of average rating was .62, Cronbach's alpha = .76, demonstrating a high correlation between coder ratings. The ICC for the single measure of number of categories was .73, Cronbach's alpha = .84, demonstrating another high correlation between coder ratings.

Because the first reliability assessment compared average ratings that at times included plausible solutions upon which coders did not agree, we assessed coder reliability for ratings at the item level as well. This analysis was done only on items that both coders agreed were plausible solutions. Again, the intraclass correlation coefficient was calculated using a two-way mixed ANOVA with case as a random factor and coder as fixed factor in SPSS. The ICC for ratings of plausible solutions at the item level was .61, Cronbach's alpha = 0.76. The ICC for number of categories among agreed upon solutions at the item level was .74, Cronbach's alpha = 0.86.

Humor styles questionnaire. People differ considerably in their sense of humor. The Humor Styles Questionnaire is designed to assess variation in individual differences in sense of humor (how often people laugh and appreciate jokes/humor) and specific dimensions or styles of humor (Martin, Puhlik-Doris, Larsen, Gray, & Weir, 2003). These dimensions are: benign uses of humor to enhance the self (Self-enhancing) and to enhance one's relationships with others (Affiliative), use of humor to enhance the self at the expense of others (Aggressive), and use of humor to enhance relationships at the expense of the self (Self-defeating). Individual differences regarding propensity to use or appreciate humor may influence how easy it was for those in the humor condition to generate jokes about their problem. This measure was assessed but not used for current analyses to determine later whether sense of humor moderated the relationship between humorous reappraisal and creativity of solutions.

- Self-Enhancing Humor, e.g., “If I am feeling depressed, I can usually cheer myself up with humor.”; Cronbach’s alpha = .76.
- Affiliative Humor, e.g., “I don't have to work very hard at making other people laugh -- I seem to be a naturally humorous person.”; Cronbach’s alpha = .86.
- Aggressive Humor, e.g., “When telling jokes or saying funny things, I am usually not very concerned about how other people are taking it.”; Cronbach’s alpha = .75.
- Self-Defeating , e.g., “I will often get carried away in putting myself down if it makes my family or friends laugh.”; Cronbach’s alpha = .84.

Ruminative response scale (RRS). The RRS is a measure of trait rumination and consists of 22 items describing responses to depressed mood, asking participants to indicate how often they do each (Treynor, Gonzalez, and Nolen-Hoeksema, 2003). Like

the HSQ, RRS was assessed but not used for current analyses to determine in the future whether trait rumination moderates the relationship between humorous coping and creativity of solutions. All items began with the stem "How often do you…?" Response options ranged from 1 (almost never) to 4 (almost always). The RRS includes the following subscales:

- Reflection: Neutrally-valenced items (5) which emphasize contemplation coping as an attempt to overcome problems and difficulties. Cronbach's alpha = .80. Example items include "how often do you analyze recent events to try to understand why you are depressed?" and " how often do you go away by yourself and think about why you feel this way?"
- Brooding: Items (5) emphasizing anxious or gloomy pondering, beyond self-criticism; reflecting what people do when they are moody. Cronbach's alpha = .79. Example items include "how often do you think 'What am I doing to deserve this?' " and "how often do you think about a recent situation, wishing it had gone better?"
- Depression: Items (12) corresponding to the Beck Depression Inventory, reflecting core symptoms of depression. Cronbach's alpha = .91. Example items include "how often do you think about how alone you feel?" and "…think about your feelings of fatigue and achiness?"

Subscales were calculated by averaging items to get a single score for each.

Brief COPE. To assess in the future whether coping strategy moderates the relationship between humorous coping and creativity, we had participants fill out the Brief COPE, but did not use this measure in the current analyses. In the abbreviated

version of the COPE Inventory participants indicate what they generally do to regulate their emotions when they experience a difficult event. Response options ranged from 0 (I don't do this at all) to 3 (I do this a lot). The present study used the following Brief COPE subscales:

- Active coping, e.g., " I take action to try to make the situation better"; Cronbach's alpha = .78
- Planning , e.g., " I try to come up with a strategy about what to do" ; Cronbach's alpha =.72
- Positive reframing, e.g., "I look for something good in what is happening" ; Cronbach's alpha =.82
- Self-distraction, e.g., "I turn to work or other activities to take my mind off of things" ; Cronbach's alpha = .42
- Instrumental support, e.g., " I get help and advice from other people" ; Cronbach's alpha = .89
- Humor, e.g., "I make fun of the situation" ; Cronbach's alpha =.90

Subscales included 2 items which were averaged to get a single score for each.

Demographic Measures. Participants also reported their gender, age, race, and native language. For participants who did not note English as their native language, we asked the number of years spent speaking English; participants who had spent less than eight years speaking English were excluded from analyses. We also had participants fill out self-report measures of difficulty, optimism, enjoyment, and satisfaction regarding the reappraisal condition they were assigned to, not used in the present analyses.

Statistical Analysis

The first step of data analysis used six separate ANOVAs, with regulation condition treated as a between-subjects variable, to examine the effects of regulation condition on creativity of responses, operationalized as (a) number of total responses provided, (b) number of plausible attempts provided, (c) average potential impact score of attempts (d) peak impact score, (e) number of categories for plausible attempts, and (f) elaboration (amount of detail given, i.e. total word count divided by total number) of plausible attempts to solve the problem in the alternate solutions task. Each analysis conducted in SPSS requested two planned comparisons pitting the humor condition against each of the other two conditions, in addition to the omnibus effect of condition.

An additional ANOVA was run examining the impact of regulation condition on rumination, as we hypothesize a decrease in state rumination (specifically in the humor condition) would be the mechanism by which participants produce more creative solutions. In order to examine whether humor-based coping facilitates creative problem solving through reduced rumination, the statistical method employed was a single mediator model. This model assumed that reduced rumination is intermediate in the causal sequence relating humor coping to more creative problem solving. A separate mediation analysis was run to examine the mediated effect on each of the previously mentioned six creativity outcomes: (a) number of total responses provided, (b) number of plausible solution attempts provided, (c) average potential impact score of solutions (d) peak impact score, (e) number of categories for plausible solutions, and (f) elaboration.

We hypothesized that the humor-based coping condition would lead to increased creativity on the Alternate Solutions Task, measured as (a) number of total responses

provided, (b) number of plausible solutions provided, (c) average potential impact score of solutions (d) peak impact score, (e) number of categories for plausible solutions, and (f) elaboration, as compared with the (i) "continue describing" control, and (ii) the positive reappraisal control. We also hypothesize that the humor-based coping reappraisal condition would lead to the largest reduction in rumination, in addition to reduced rumination being the mediator by which emotion regulation condition is related to creativity of solutions.

Results

All analyses were run using SPSS, version 25. Statistics regarding main effects and contrasts for the key study variables are presented in Table 1. An analysis of variance was conducted to examine the omnibus main effect of reappraisal condition on state rumination, measured after the participants took the two-minute break. We hypothesized that those in the humor condition would display the lowest amount of rumination as compared to the positive reframing and control conditions. Results showed that the omnibus main effect of reappraisal condition on state rumination was significant, $F(2, 214) = 3.38$, $p = .036$. To directly test our hypothesis, the planned comparison between the humor condition and the control revealed a significant difference in level of rumination, $p = .010$. As predicted, rumination in the control condition ($M = 3.95$, $SD = 1.12$) was higher than in the humor condition ($M = 3.41$, $SD = 1.28$). However, we did not find a statistically significant difference between the positive reframing condition ($M = 3.68$, $SD = 1.29$) and the humor condition, $p = .200$.

State rumination was highly correlated with gender ($r = .207$, $p = .003$), and an ANOVA run with gender as a fixed effect predicting rumination revealed that the

omnibus main effect of gender on state rumination was also significant, $F(1, 213) = 6.30$, $p<.001$. For this reason, we ran an additional ANOVA which included gender as a fixed effect to determine the effect of reappraisal condition on state rumination with gender accounted for. The results showed that the main effect of gender was significant, $F(1, 213) = 11.80$, $p = .001$, whereas the main effect of reappraisal condition in this model was no longer significant, $F(2, 214) = 2.20$, $p = .114$. However, the pairwise contrast between the humor condition and the control condition in this model still revealed a significant difference in state rumination, $p = .040$. As predicted, rumination in the control condition ($M = 3.95$, $SD = 1.12$) was higher than in the humor condition ($M = 3.43$, $SD = 1.28$). There was not a statistically significant difference between the positive reframing condition ($M = 3.64$, $SD = 1.27$) and the humor condition in this model, $p = .481$.

Analysis of variance was used to examine the omnibus main effect of reappraisal condition (control, positive reframing, humor) on (a) number of total responses provided, (b) number of plausible solution attempts provided, (c) average impact score of plausible solutions (d) peak impact score, (e) number of categories for plausible solutions, and (f) elaboration. We hypothesized that those in the humor condition would experience increased cognitive flexibility and thus provide more creative and better solutions than both (i) control and (ii) positive reframing. To test this hypothesis, we ran pairwise contrasts pitting humor against the other two reappraisal conditions for each outcome variable.

Results showed that the omnibus main effect of reappraisal condition on both (a) total responses provided and (b) number of plausible solution attempts was not

significant, F(2, 214) = 1.26, p = .286 and F(2, 214) = .52, p = .593 respectively. For (a) total responses provided, our contrasts revealed no significant difference between humor and control (p = .156) and no significant difference between humor and positive reframing (p = .196). For (b) total plausible attempts provided, pairwise contrasts revealed no significant difference between humor and control (p = .374) and no significant difference between humor and positive reframing (p = .990). Contrary to our hypotheses, across conditions, participants gave similar numbers of solutions and plausible solutions to their problems. We ran both models again with gender as a second fixed factor. Neither model was significant, (a) F(5, 208) = .88, p = .498, and (b) F(5, 208) = 1.40, p = .228; Moreover, there was no change in significance of the main effect of reappraisal condition on either dependent variable. For (b) total plausible attempts, there was a significant main effect of gender, F(1, 213) = 5.92, p = .016; women provided more solutions rated as plausible attempts than men did (M_{women} = 5.93, *SD* = 2.96; M_{men} = 4.88, *SD* = 2.95). Planned contrasts of this model revealed no significant difference between humor and either of the other two reappraisal conditions for both (a) total responses and (b) number of attempts.

There was a main effect of reappraisal condition on (c) average impact score of plausible solutions which approached significance, F (2, 214) = 2.77, p = .074. Contrary to our hypothesis, our planned contrast revealed that humor-based coping (*M* = 2.26, *SD* = .08) resulted in a significantly *lower* average score on plausible solutions than the control condition (*M* = 2.50, *SD* = .08), p = .034. There was no significant difference between humor-based coping and the positive reframing condition (M = 2.30, *SD* = .08), although the difference was in the predicted direction (p = .780). We ran the model again

with gender as a second fixed factor. This overall model was not significant, F(5, 208) = 1.74, p = .128, and the main effect of reappraisal condition was not significant, F(2, 214) = 2.26, p = .107. Planned contrasts in this model revealed a significant difference between humor and control (p = .047) and no significant difference between humor and positive reframing (p = .196) for (c) average impact score of plausible attempts.

We also found that the effect of reappraisal condition on (d) peak impact score for plausible solutions approached significance, F (2, 214) = 2.46, p = .088. Contrary to our hypothesis, a planned contrast revealed that humor-based coping (*M* = 3.51, *SD* = .09) resulted in a significantly *lower* average peak score on plausible solutions than the control condition (*M* = 3.79, *SD* = .10), p = .038; there was no significant difference between humor and the positive reframing condition (*M* = 3.56, *SD* = .10). Again, we ran the model with gender as an additional fixed factor; this model was significant, F(5, 208) = 2.27, p = .05, and there was a significant main effect of gender, F(1, 213) = 5.23, p = .023; across groups, women reached a higher peak impact score for solutions rated as plausible attempts than men did (M_{women} = 3.75, *SD* = .688; M_{men} = 3.47, *SD* = .873). However, the main effect of reappraisal condition was not significant, F(2, 214) = 1.85, p = .159. Planned contrasts in this model revealed a difference between humor and control which approached significance (p = .070) and no significant difference between humor and positive reframing (p = .734) for (d) peak impact score of plausible attempts.

Our analyses revealed that the omnibus main effect of reappraisal condition on both (e) number of categories given and (f) elaboration was not significant, F(2, 214) = .81, p = .445 and F(2, 214) = .26, p = .770 respectively. For (e) number of categories, our contrasts revealed no significant difference between humor and control (p = .237) and no

significant difference between humor and positive reframing (p = .875). For (f) elaboration, pairwise contrasts revealed no significant difference between humor and control (p = .529) and no significant difference between humor and positive reframing (p = .540). Contrary to our hypotheses, across conditions, participants produced similar numbers of categories and similar levels of detail in plausible solutions. As before, we ran both models again with gender as a second fixed factor. Neither model was significant, (e) F(5, 208) = 1.38, p = .232, and (f) F(5, 208) = .67, p = .644; Moreover, there was no change in significance of the main effect of condition on either dependent variable. For (e) number of categories, there was a significant main effect of gender, F(1, 213) = 4.65, p = .032; women provided more categories of solutions than men did (M_{women} = 3.38, *SD* = 1.36; M_{men} = 2.95, *SD* = 1.36). Planned contrasts of this model including gender revealed no significant difference between humor and control (p = .742) and no significant difference between humor and positive reframing (p = .630). Contrasts also revealed no significant difference between humor and control (p = .376) and no significant difference between humor and positive reframing (p = .989) for (f) elaboration.

Next, six separate mediation analyses were conducted to assess the extent to which state rumination mediated the effect of reappraisal condition on each of the outcome variables. These models assumed that reduced rumination was intermediate in the causal sequence relating humor coping to more creative problem solving. Path analysis was used to determine the pathways by which the reappraisal condition and level of rumination interacted to influence creativity outcomes on the Alternate Solutions Task. The predictor variable of interest was reappraisal condition and contrast codes were

first set up to orthogonally compare the difference between humor vs. control and humor vs. positive reappraisal. We hypothesized that humor would outperform both control and positive reappraisal on i) rumination level (lowest) and ii) all creativity outcomes. Mediation analyses employed the joint significance approach advocated by MacKinnon et al., (2002). Because mediation effects can occur in the absence of significant direct effects of the independent variable on the dependent variable (Rucker et al., 2011), mediation analyses were conducted regardless of the outcomes of earlier ANOVAs. The mediation analyses revealed no significant mediated effect for any outcome variable except elaboration and only when comparing humor to the control condition.

In this mediation model, the contrast which pit humorous reappraisal against control was not significantly related to elaboration scores, although this relationship approached significance (c_1=-2.17, s_c=1.17, t_c (216) = -1.85, p = .064). This contrast (C_1) of humor vs. control was, however, significantly related to our proposed mediator, average rumination (a_1= .177, s_a= .06, t_a(216) = 3.0, p=.003). Average rumination was significantly related to elaboration, controlling for reappraisal condition in our first path (C_1) (b= -1.19, s_b= .44, t_b(216) = -2.70, p=.007). The adjusted effect of reappraisal condition was statistically significant, (c'= -2.38, $s_{c'}$=1.17, $t_{c'}$ (216) =-2.04, p = .042) and we found that there was a drop to c' = -2.38 from c= -2.17.

For $\hat{a}_1$ = .177 (SE = 0.059) and $\hat{b}$ = -1.19 (SE = 0.44), the indirect effect estimate is -0.211 (SE = 0.108). The distribution of the product of coefficients method 95% CI is [-0.455, -0.037]. This reveals a statistically significant mediated effect of reappraisal condition on elaboration through average rumination; decreased rumination was correlated with increased level of detail in plausible solutions.

Discussion

The current study was designed to explore one mechanism by which humor may lead to positive outcomes. Humor has long been considered a highly adaptive way to cope with negative or stressful events (Lefcourt & Martin 1986). However, the mechanism by which humor benefits individuals in stressful situations is rarely explored. One possible mechanism by which humor grants benefits in these cases is the reduction of ruminative thoughts. We did find that reappraisal condition was significantly related to state rumination in the expected direction; individuals in the humor condition reported significantly less rumination as compared to the control condition, and less than in the positive reappraisal condition as well although this effect was not significant. This effect was not moderated by gender, although women tended to report significantly higher levels of state rumination as compared to men, another common finding in the rumination literature (Nolen-Hoeksema & Jackson, 2001). These findings partially support the hypothesis that one mechanism by which humor makes individuals feel better and confers other benefits is the reduction or interruption of ruminative thought patterns.

We further hypothesized that this decrease in rumination would facilitate greater flexibility in thinking, and thus more creative responses to the Alternate Solutions Task. This hypothesis was not supported by our findings. Our findings suggest that the use of humor-based coping in the face of a stressful situation may not necessarily outperform other reappraisal strategies in terms of facilitating creative problem-solving. Overall, we found that participants performed consistently on the Alternate Solutions Task across the different reappraisal conditions (control, positive reframing, humor). Outcome variables for which the effect of reappraisal condition was significant (average score, peak score)

revealed an unexpected advantage for the control condition. Past literature tends to subscribe to the finding that positive affect leads to better responses on various tests of creative ingenuity (Isen et. al., 1985; Isen et. al., 1987). Our study pit two reappraisal strategies that incline individuals to be more positive in the face of a stressor, and yet we found that the control condition was equivalent to or outperformed both positive and humorous reappraisal on our measures of creativity. This suggests that our task, which first evoked stress and rumination before asking people to solve their problems, may have constrained the level of creativity we were able to measure in participants. Positive affect may lead to more creativity, but the effect may not be present when the positive affect is used to reappraise a negative or stressful situation.

Intriguingly, although our mediation analyses returned almost no significant results, we did find one significant mediated effect: reduced rumination was found to be intermediate in a causal sequence relating humor coping to one measure of creativity, elaboration of plausible attempts. Individuals in the humor condition ruminated the least and this resulted in more words per solution as compared to the control and positive reframing conditions. When considering how rumination is characterized by inflexible cognition, with a sort of "stickiness" which keeps people perseverating on their issue, level of elaboration in responses may be functioning as an additional measure of rumination. It would be interesting to consider the effect of humor in other brainstorming tasks for which level of detail would directly relate to better performance on said task. This effect may also be beneficial in therapy settings. If patients are tasked with journaling and end up writing more, therapists may have more data to examine and more opportunities to pinpoint an issue.

Other studies have tended to assume mechanisms by which humor facilitates improved mood after a stressor. One strength of this study is that we directly tested reduced rumination as one such mechanism, and found support for this prediction, thus adding to the emotion regulation and humor literatures. Although creativity, as operationalized in our study, was not significantly influenced by reduced rumination, this effect may nonetheless be very useful in other ways.

For this study we were more interested in practical applications of humor, as distinct from the effect of humor leading to people feeling better (e.g., Samson & Gross, 2012), so we chose to focus on creative outcomes instead of affective responses. This resulted in the decision to change the distressing stimulus to be reappraised from the more commonly used unpleasant photos to individuals' own personal problems. Using real-world personal problems as the stimulus also lends a degree of ecological and face validity to the study. In addition, we used a traditional and well-known task in the creativity literature, the Alternate Uses Task, as a model for the task used to measure creativity of participants' responses.

Limitations and Future Directions

Although our study revealed an important new association between humor and ruminative cognition, there were a number of limitations. First, the control condition to which positive reframing and humorous coping were compared may have inadvertently influenced individuals to continue to ruminate. Instructions prompted participants to continue writing about their problem with a focus on their feelings and emotions about the problem. This may have resulted in a boost of rumination in the control condition. Also, the measures of creativity were fairly subjective and depended heavily on coders

reliably implementing the coding system. The level of reliability between coders, while acceptable, was modest enough to suggest that reanalyzing the data more carefully trained coders would be beneficial for reliability, and potentially alter some results.

One might also question the extent to which the alternate solutions task is truly capable of capturing creativity; perhaps creativity is not necessary to solve personal problems? It may be that, as opposed to abstraction, which we predicted as an outcome of humor in this study, concrete thinking is more useful for problem solving. We plan to replicate this study with appropriate adjustments to the control ("continue writing" instead of "write about your feelings and emotions") and coding system to better investigate the impact of humor on creativity. We also plan to design a future study to explore the impact of humorous reappraisal on other aspects of cognition, including abstract thinking.

In this study, we were able to consider whether using real world problems as the stimulus would foster negative or positive humorous coping and whether the results would be the same regardless of valence. Previous work examining positive and negative humor leans towards favoring positive humor; it tends to lead to a greater reduction in negative and increase in positive emotions (Samson & Gross, 2012). Certain personal problems, however, may lend themselves to using negative humor (mocking, sarcasm, aggression) more readily to create a psychological distance or sense of superiority or control such as disagreements between roommates, unpleasant work environment, or family tension. Moreover, future studies will also investigate several other facets of humor besides valence (subject, style, success) as possible moderators of effects on creativity and other outcome variables of interest.

Most research on humor emphasizes that it is widely practiced, sought after, and wonderfully beneficial. The present findings suggest that humor-based coping may not always facilitate solving life's problems in a practical way and may even inhibit generating practical solutions. Given that humor-based coping did appear to lead to a decrease in state rumination, it was surprising that the use of humor actually interfered with problem solving in this study. One possibility is that poking fun at their problem may have led participants to think more abstractly about their situation. In order to find humor in their problem, participants had to consider several aspects of their situation, reflect on how they relate to each other, and ponder which of those could have humorous double meanings or lead to a cognitive shift. In asking people to joke about their problem, we may have knocked them out of a more concrete construal level, and into a more abstract level of perceiving their issue. We asked participants to then give concrete solutions to their specific problems. A mismatch of abstract thinking and concrete solution generation may help explain the present, unexpected results.

If humor is not ideal for thinking about concrete tasks, the next step is to consider what an abstract task would look like and ask of participants. If abstraction means going from low level thinking to higher level associations, there are conceivable advantages to this change of mindset in a therapy setting. Future studies may benefit from exploring the impact of rumination reduction on instrumental behavior, as solution implementation is often interfered with by rumination. Individuals who suffer from OCD could experience downstream benefits from the reduction of rumination through humor. OCD is often treated with Cognitive Behavioral Therapy which works by reducing the emotional impact of negative thought patterns, as well as encouraging individuals to practice

accepting, distancing, and redirecting attention to other content (Tolin et al., 2004). Humor-based coping in this context could be integrated to help alleviate negative affect, increase positive affect, allow for psychological distance through humor, and interrupt the ruminative thought patterns which take hold of an individual afflicted with OCD.

Conclusion

The current study was designed to explore one mechanism by which humor makes individuals feel better – reduced rumination. Rumination can completely hinder problem solving and impede constructive action as people are bogged down by negative thoughts and stuck in a loop of pessimism. We did find that individuals in the humor condition reported significantly less rumination as compared to the other emotion regulation conditions. We hypothesized that this decrease in rumination would have resulted in an increase of creativity, but this was not the case. Although this specific link between reduced rumination and creative thinking was found to be insignificant, future research is needed to examine other possible downstream consequences of reduced rumination. Future studies would also benefit from further exploring the specific mechanisms by which humor-based coping reduces ruminative thought patterns.

Table 1: Main Effects and Contrast Results

DV	ME Condition	H vs. Control	H vs. Positive	Model 2: ME Condition	Model 2: ME Gender	Model 2: H vs. Control	Model 2: H vs. Positive
Rumination	Yes; p = .036	Yes; expected direction, p = .010	No	No	Yes; p = .001	Yes; expected direction, p = .040	No
(A) Total Responses	No	No	No	No	No	No	No
(B) Total Attempts	No	No	No	No	Yes; p = .016	No	No
(C) Average Impact Score	Yes*; p = .074	Yes; unexpected direction, p = .034	No	No	No	Yes; unexpected direction, p = .047	No
(D) Peak Score	Yes*; p = .088	Yes; unexpected direction, p = .038	No	No	Yes; p = .023	Yes*; unexpected direction, p = .070	No
(E) Number of Categories	No	No	No	No	Yes; p = .032	No	No
(F) Elaboration	No	No	No	No	No	No	No

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