AFRAID TO FEEL GOOD: IS FEAR OF EMOTION ASSOCIATED WITH CREATIVE PROBLEM SOLVING?

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This paper is dedicated to my family, without whom none of this would have been possible.

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ABSTRACT

Previous literature indicates that increased positive affect leads to greater creative problem solving ability. However, high fear of positive emotion (FOPE) individuals may not capitalize on positive mood inducing situations either because they resist the induction of positive mood or have their positive feelings blunted by the simultaneous experience of fear/anxiety. Experiencing less positive affect than low FOPE individuals could lead to inferior performance on creative problem solving tasks following a positive mood induction. Participants had their FOPE, neuroticism, and pre-induction mood assessed, underwent either a positive or neutral mood induction, and took tests of two domains of creative problem solving, divergent thinking and relational thinking. The hypotheses of the study were not confirmed. High FOPE participants exhibited greater residual positive affect post-induction than low FOPE participants, and there was no relationship between positive affect and creative problem solving in the sample. Potential explanations for these unexpected results are discussed.

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CHAPTER 1

INTRODUCTION

Greater creative problem solving ability is associated with fewer dysfunctional thoughts and irrational beliefs, less blaming coping styles, and even less disease related stress among those battling with cancer (Heppner, Reeder, & Larson, 1983; Nezu, Nezu, Felgoise, McClure, & Houts, 2003). Clinical interventions such as problem solving therapy that specifically address creative problem solving ability have been found to reduce anxiety and depression (Nezu, 1986; Nezu & Perri, 1989). Creative problem solving can also benefit society as a whole. Experts in the field have noted that the eradication of the smallpox virus could not have occurred without excellent creative problem solving (Nandakumar, Beswick, Thomas, Wallack, & Kress, 2009).

Two widely measured facets of creative problem solving are relational thinking and divergent thinking. While there are certainly other aspects of creative problem solving worth exploring (see Cropley, 2000), these concepts were selected for this study because they have previously responded to mood inductions (Isen, 1987; Isen, Labroo, & Durlach, 2004)

Relational thinking is the ability to see connections between entities that would not normally be thought of as related and then use those connections to come up with innovative solutions. For instance, someone might notice that there is a relationship between how disgruntled the building maintenance staff is on a given day and the speediness of repairs. Then, he or she starts dropping off coffee at the maintenance office when he or she needs an urgent repair completed. Measures of relational thinking have been shown to correlate with advisers' ratings of their students' creativity, the creativity of ideas exhibited during brainstorming sessions, and performance on creative problem solving tasks such as Duncker's candle problem (Fodor & Greenier, 1995; Forbach & Evans, 1981; Mednick, 1962).

Divergent thinking is the ability to generate a variety of solutions that go beyond stereotypical responses when faced with a question that has no one correct answer. For example, there are many potential uses for a brick, but there is no one correct answer for how the brick should be used. However, someone trying to lose weight who puts a brick in a briefcase to burn a few extra calories per day is an example of excellent divergent thinking. Social creative problem solving often falls under the umbrella of divergent thinking, as social problems often do not have one specific answer. Some research challenges the link between divergent thinking and real world problem solving, arguing that the goal of generating a large quantity of responses does not necessarily breed greater quality in those responses (Haaga, Fine, Terrill, Stewart, & Beck, 1995). Still, divergent thinking is associated with the personality trait openness, a trait that has been linked to greater creativity and creative success in a variety of fields (Feist, 2006; Silvia et al., 2008). Divergent thinking measures are also associated with teacher ratings of children's creativity across a wide range of ability levels (Runco, 1984).

Increased positive affect has led to better performance on relational and divergent thinking tasks in a majority of the literature (Baas, De Dreu, & Nijstad, 2008; Baron, 1990; Davis, 2008; Estrada, Isen, & Young, 1994; Greene & Noice, 1988; Isen, 1987; Isen & Means, 2001; Rowe, Hirsh, & Anderson, 2007). This effect can be explained in the context of Fredrickson's Broaden and Build theory, which posits that the function of positive emotion is to broaden attention and build potential skill bases, because broadened attention has been shown to increase creative problem solving abilities (Fredrickson, 2001). Participants with a specific type of brain damage that is associated with broadened attention were more than twice as likely as non-brain damaged participants to solve a difficult creative problem solving task, and participants in another study who were put in a more attentionally diffuse state through alcohol

intoxication scored higher on another creative problem-solving task than sober participants (Jarosz, Colflesh, & Wiley, 2012; Reverberi, Toraldo, D'Agostini, & Skrap, 2005). There is some research that challenges the link between positive affect and creative problem solving, stating specifically that positive emotion leads to satisficing strategies and the intrusion of irrelevant information (Kaufmann & Vosburg, 1997, 2002; Vosburg, 1998a, 1998b). However, follow-up research has indicated that individuals with greater positive affect solve problems more efficiently than control participants (Isen & Means, 2001).

Still, performance on these two creative problem solving dimensions could be complicated by an outside factor. Emotional state can be affected by a variety of factors that could in turn impact creative problem solving ability. One potential factor, fear of emotion, directly relates to people's current emotional experience, impacts their overall emotional state, and has not been accounted for in any previous creative problem solving study.

Fear of emotion (FOE; Williams, Chambless, & Ahrens, 1997) is a fear response to the emotions one is already experiencing, a meta-emotion. Fear of emotion may result from the fear of losing control over oneself due to the emotion, and so it is possible to be afraid of positive emotions as well as negative ones (Williams, Chambless, & Ahrens, 1997). For example, a person with a high fear of positive emotion might respond to news of a promotion at work not just with happiness, but with fear that if he or she will lose control due to the happiness and do something he or she will regret, such as getting a speeding ticket on the way home. People without clinical anxiety who demonstrated high fear of emotion have responded with symptoms similar to those of panic attacks when put into anxiety inducing situations (Berg, Shapiro, Chambless, & Ahrens, 1998). Fear of emotion also predicts severity of Post Traumatic Stress symptoms, distress, and skin conductance during a negative mood induction even when the

experimenters control for negative affect (Price, Monson, Callahan, & Rodriguez, 2006; Salters-Pedneault, Gentes, & Roemer, 2007). Additionally, fear of emotion can predict both emotional vulnerability and feelings of invalidation (Sauer & Baer, 2010).

Direct links between the amount of primary emotion someone is experiencing (e.g., positive affect) and the amount of meta-emotion they are experiencing (e.g., fear of emotion) have been established. As a result, an increase in the amount of primary emotion experienced predicts an increase in the amount of meta-emotion being experienced (Mitmansgruber, Beck, Hofer, & Schussler, 2009). Therefore, if high FOE participants complete an induction that significantly increases positive mood, those participants may also experience a significant rise in their fear and anxiety. Negative emotions have been shown to narrow focus in previous research, so the fear and anxiety these participants experience in response to strong positive emotion could result in a limited range of focus (Finucane, 2011; Fredrickson, 2001). This narrowing of focus could in turn lead to participants being less able to break their normal mental sets, draw together disparate concepts, or generate off-the-wall ideas. Subjects placed in a fear condition responded more quickly to tasks demanding selective attention than control participants, and participants shown fearful faces responded with more narrowed focus relative to a control group, while a happy mood of equal magnitude did not result in narrowed focus (Birk, Dennis, Shin, & Urry, 2011; Finucane, 2011). Participants in attention-narrowing situations have shown lesser creative performance in a variety of situations, including team sports, visual tasks, and a writing task (Friedman, Fishbach, Forster, & Werth, 2003; Kasof, 1997; Memmert, 2007).

The detrimental effect of fear of emotion on creative problem solving ability could also be explained in a context that focuses on positive emotion. High FOE participants could choose to resist the mood induction in an attempt to avoid an uncomfortable fear experience. This

resistance of the mood induction could lead to high FOE participants experiencing less positive affect. High FOE participants could also have a reduced feeling of positive affect even if the induction is effective, since their simultaneous experience of fear may blunt their positive feelings. Since the amount of positive affect experienced is associated with creative problem solving ability, experiencing less positive affect would likely result in worse performance on creative problem solving tasks.

I predict the heightened level of fear high FOE participants will experience during a positive mood induction will result in their experiencing less positive affect than participants with low FOE who also experience the positive mood induction. If greater positive affect leads to better performance on creative problem solving tasks, a positive mood induction should benefit higher FOE participants less than it does low FOE participants.

CHAPTER 2

METHODS

Participants

Ninety-nine participants were drawn from the American University undergraduate student population via a participant research pool where students contacted the experimenter via e-mail. The participants could receive required or extra credit in undergraduate psychology courses for participating in the study. The participants' ages ranged from 18 to 32, with a mean of 19.9 (SD = 2.54). Seventy-five (76%) participants were female and twenty-four (24%) were male. Sixty-seven participants (68%) identified as White/Caucasian, nine (9%) identified as Black/African American, eight (8%) identified as Hispanic/Latino(a), five (5%) identified as Asian/Pacific Islander, two (2%) identified as Middle Eastern, and six (6%) identified as Multi-Racial/Multi-Cultural or Other. Two participants (2%) did not provide their race/ethnicity. Eighty-eight participants (89%) reported English as their first language, while eleven (11%) reported that English was not their first language.

A power analysis for detecting an interaction with a continuous dependent variable using multiple regression indicated that ninety-six participants would give power of .80 given an effect size in between small and medium (f^2 = .075) and α = .05. Actual power for some of the tests was lower, as some of the dependent measures became dichotomous due to floor effects of the measures. Three of the ninety-nine participants were dropped from the analyses because the experimenter became aware of their condition during the course of the experiment and could have affected their subsequent performance through demand effects, resulting in ninety-six participants with analyzable data.

Measures

Affective Control Scale – Positive Affect Subscale (ACS-P; Williams et al., 1997). The ACS-P is a measure of fear of emotion that contains thirteen 7-point Likert scale questions such as "I can get too carried away when I'm really happy." The scale has high internal consistency (α = .84), good 2 week test-retest reliability (r = .66), and strong inter-correlations with subscales measuring fear of other emotions such as anger and anxiety (r = .56-.69)(Williams et al., 1997). The scale also significantly correlates (r = .50) with the State-Trait Anxiety Inventory (Mennin, Heimberg, Turk, & Fresco, 2005). The internal consistency of the scale in this sample (α = .82) was good.

NEO Five Factor Inventory Neuroticism Subscale (NEO-N; Mccrae & Costa, 1987). The NEO-N is a twelve item measure of the personality trait neuroticism. Fear of emotion is related to negative emotionality (Tull, Jakupcak, McFadden, & Roemer, 2007). Controlling for neuroticism in analyses using fear of emotion helps ensure that any effects of fear of emotion are due to it rather than general negative affectivity. The measure's scores correlate significantly with peer reports of neuroticism (r = .43-.51) and have good internal reliability (α = .85-.93) (Mccrae & Costa, 1987). The internal consistency of the scale in this sample (α = .83) was good.

The Mindfulness Process Questionnaire (MPQ; Erisman & Roemer, 2012) The MPQ is a seven item measure of the process of mindfulness, including questions like "I intentionally try to be accepting of my thoughts and feelings as they occur." The measure was included for purposes beyond the scope of this study.

Mood Forms (Burton, & King 2004). The Mood Forms Measure is designed as a manipulation check to see if the positive affect induction was effective. Before and after the induction, participants filled out mood forms to confirm the manipulation, rating how they felt

"right now" on a scale from 1 (not at all) to 7 (extremely much) for both positive (e.g. happy, pleased, joyful) and negative (e.g., upset, anxious, unhappy) emotions. These scores have excellent internal consistency (α = .90-.96) (Burton & King, 2004). The internal consistencies of the positive (α = .88) and negative (α = .86) subscales in this sample were excellent.

Remote Associates Test (RAT; Mednick, 1962). The RAT is a seven-item measure of relational thinking abilities. For each item, the participant was given three seemingly disparate words and asked to supply a fourth word that links all of the words together. For example, the participant is shown the words: nuclear, foreign, and meter where the correct answer is power. These items have been tested and shown to be of medium difficulty, eliminating the potential confound of the problems being too easy or too difficult for an average participant (Isen, 1987). The participant received one point for each correct answer. While some have used the RAT as a measure of divergent thinking, this is not conceptually accurate, since there is a singular correct answer to each question and true divergent thinking questions do not have a "correct" answer. Scores on the RAT correlate strongly with advisers' ratings of psychology graduate students' research creativity (r = .55) and architectural students' design creativity (r = .70). The Spearman-Brown reliability of the test has been shown to be between .91 and .92 (Mednick, 1962).

Divergent Thinking Top Two Task (Silvia, 2008). The Divergent Thinking Top two task is a measure of divergent thinking where the participants were asked a question such as "What uses can you think of for a brick?" After three minutes of generating responses, the participants were instructed to indicate their two most creative responses to the task. This method controlled for a potential confound in previous measures of divergent thinking where participants who generated more responses were consistently rated as more creative, even though the two abilities are not necessarily related (Silvia et al., 2008). Also, the agreement between participants and

experts about their most creative responses is high, so having the participant choose their most creative responses eases the rating process without sacrificing validity (Silvia, 2008). The tasks have high construct intra-scale reliability (H = .75-.79) and correlate significantly (r = .58) with the personality factor openness, which has been linked to better creative problem-solving performance (Silvia, 2011; Silvia, Martin, & Nusbaum, 2009). Scores on both the brick and knife task were determined by 3 trained raters, who rated each response on a 1 (not at all creative) to 5 (highly creative) scale. Raters were masked to all other variables, and all raters rated all responses. The two-way random intraclass correlations between raters were acceptable for the brick task (r = .82) and the knife task (r = .73). The scores on the two measures were significantly and positively correlated (r = .29, p = .004), and the two scores have been combined to create a higher order divergent thinking variable in previous research (Silvia et al., 2009). For this study, scores on the two tasks were averaged to form a composite divergent thinking score.

Emotion Induction

For the positive affect induction, participants wrote for twenty minutes about a personal, intensely positive experience: This type of intervention is based on the expressive writing paradigm that has been shown to significantly increase positive mood after only one induction (Burton & King, 2007; Pennebaker, Kiecolt-Glaser, & Glaser, 1988). For the control induction, participants wrote for the same duration about the contents of their bedroom at home, a task that does not significantly affect participants' ratings of either positive or negative mood states (Burton & King, 2004; Burton & King, 2007).

Procedure

Participants were assessed for fear of positive emotion using the ACS-P, mindfulness using the MPQ, neuroticism using the NEO-N, and initial emotional state using the Mood Forms

measure. The presentation order of these measures was randomized using computer software. Then, the participants went through the positive mood induction or neutral writing task, and completed the Mood Forms measure a second time. Subsequently, they performed behavioral tasks related to two different aspects of creative problem solving: relational thinking (RAT) and divergent thinking (Top Two Task). The RAT was completed first because there is more literature linking performance on the task to emotional state. Participants then completed a demographics form and were debriefed.

CHAPTER 3

RESULTS

Preliminary Analyses

Three participants were dropped from the analyses because the experimenter became aware of whether they were in the positive or neutral mood induction during the course of the experiment. The experimenter could have influenced subsequent participant performance via expectancy effects, so their results are not reported here.

The means and standard deviations for all variables collected from the remaining 96 participants based on condition can be found in Table 1, and the correlations between those variables are displayed in Table 2.

Table 1. Means and Standard Deviations of Variables by Condition

	PMI		NMI	
	M	*SD*	*M*	*SD*
ACS-P	40.63	(8.66)	41.90	(9.50)
NEO-N	35.90	(8.33)	33.69	(7.79)
Pre PA	4.40	(1.07)	4.62	(0.94)
Pre NA	2.56	(1.01)	2.49	(1.10)
Post PA	5.00	(1.24)	4.42	(1.17)
Post NA	2.08	(1.02)	2.38	(1.28)
RAT	0.52	(1.13)	0.48	(1.13)
DT	2.86	(0.40)	2.87	(0.53)

Note: M = Mean, SD = Standard Deviation, PMI = Positive Mood Induction, NMI = Neutral Mood Induction, ACS-P = Affective Control Scale Positive Subscale, NEO-N = NEO Five Factor Inventory Neuroticism Subscale, Pre PA = Pre-induction Positive Affect, Pre NA = Pre-Induction Negative Affect, Post PA = Post-induction Positive Affect, Post NA = Post-Induction Negative Affect, RAT = Number of correct responses given to Remote Associates Test, DT = Average score of Brick and Knife task

Table 2. Correlations Between Major Variables

	ACS-P	NEO-N	Pre PA	Pre NA	Post PA	Post NA	RAT
NEO-N	.325**						
Pre PA	-.302**	-.444**					
Pre NA	.392**	.456**	-.496**				
Post PA	-.237*	-.224*	.642**	-.355**			
Post NA	.399**	.402**	-.448**	.754**	-.606**		
RAT	.015	.050	.041	.035	.100	-.035	
DT	.041	.154	-.062	-.008	-.116	.032	.127

Note: ACS-P = Affective Control Scale Positive Subscale, NEO-N = NEO Five Factor Inventory Neuroticism Subscale, Pre PA = Pre-induction Positive Affect, Pre NA = Pre-Induction Negative Affect, Post PA = Post-induction Positive Affect, Post NA = Post-Induction Negative Affect, RAT = Number of correct responses given to Remote Associates Test, DT = Average score of Brick and Knife tasks

*$p < .05$**$p < .01$

The numbers of participants among the non-Caucasian groups were not sufficient to responsibly conduct difference tests, but I tested for differences between Caucasian participants and non-Caucasian participants. Means and standard deviations for variables that have group differences between Caucasians and Non-Caucasians are broken down by race/ethnicity in Table 3. There were differences in fear of positive emotion and pre-induction positive affect based on race/ethnicity. Non-Caucasian participants were less afraid of positive emotion, $t(94)= 2.54$, $p = .013$, and had greater positive affect pre-induction, $t(94)= -2.28$, $p = .025$, than Caucasian participants. All subsequent analyses including these variables were run while controlling for race/ethnicity and the results did not differ. Given the absence of differences, the results reported below do not control for race/ethnicity. There were no other significant differences based on race/ethnicity.

Table 3. Means and Standard Deviations of Variables with Differences Between Caucasians and Non-Caucasians Based on Race/Ethnicity

	W/C		B/A		H/L		A/PI		ME		MR		NG	
N	67		9		8		5		2		6		2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
ACS	42.8	9.35	38.1	6.37	36.8	5.99	41.3	4.93	42.0	0.00	34.8	12.5	40.5	7.78
PPA	4.36	0.99	4.76	0.97	4.93	0.95	3.76	0.86	4.07	0.51	5.74	0.62	4.71	0.00

Note: W/C= White/Caucasian, B/A = Black/African-American, H/L = Hispanic/Latino(a), A/PI = Asian/Pacific-Islander, ME = Middle Eastern, MR = Multi-Racial/Multi-Cultural, NG = Race Not Given, N = Number of Participants in each Race/Ethnicity group M = Mean, SD = Standard Deviation, ACS = Affective Control Scale Positive Subscale, PPA = Pre-induction Positive Affect

Participants who reported that English was not their first language reported significantly less pre-induction negative affect, $t(94)= 2.00$, $p = .048$, than participants who spoke English as a first language. There were no other significant differences on pre-induction variables based on whether English was the first language of the participant.

Setwise regressions showed that demographic variables were unrelated to the changes in positive and negative affect, indicating that demographic variables did not influence the impact of the mood induction. A linear regression revealed that speaking English as a first language was a significant predictor of score on the divergent thinking tasks, $t(94)= -2.48$, $B = -.396$, $p = .015$, with participants who spoke English as a first language scoring significantly higher. All analyses containing this variable were run controlling for English as a first language, and the results did not differ, so the results reported below do not control for English as a first language. There were no other significant differences on post-induction variables based on demographic variables.

Primary Analyses

Manipulation Checks

A setwise regression predicting post-induction positive affect with pre-induction positive affect entered in the first step and condition in the second step demonstrated that participants in the positive mood induction experienced higher residual post-induction positive affect, $t(93) = -4.19$, $\beta = -.31$, $p < .001$.

I then tested whether the positive mood induction would be less effective for participants high in fear of positive emotion after controlling for neuroticism using a setwise regression (Cohen & Cohen, 1983). In the first step I entered the dummy coded variable for condition, centered fear of emotion scores, pre-induction positive affect, and neuroticism. In the second step I entered the interaction between group centered fear of emotion and group centered condition. The main effect for fear of emotion was non-significant, $t(90) = .015$, $p = .998$, while the main effect of condition was significant, $t(90) = -4.18$, $p < .001$. However, this main effect is modified by a significant interaction between fear of emotion and condition, $t(90) = -2.47$, $p = .015$. The coefficients, degrees of freedom, and *t* values of the predictors are presented in Table 4.

Table 4. Setwise Regression Analysis Testing Condition as a Moderator of the Relationship Between Fear of Positive Emotion and Residual Post-Induction Positive Affect

Step	Predictor	*Df*	*β*	*t*	*P*
1	Condition	91	-.737	-4.01	.590
	ACS-P	91	-.003	-.312	< .001
	Pre PA	91	.841	8.19	.756
	NEO-N	91	.007	.563	< .001
2	Condition	90	-.748	-4.18	< .001
	ACS-P	90	.000	.015	.988

	Pre PA	90	.912	8.78	< .001
	NEO-N	90	.011	.881	.381
	C*ACS-P	90	-.050	-2.47	.015

Note: β = Unstandardized Regression Coefficient, *Df* = Degrees of Freedom, ACS-P = Affective Control Scale Positive Subscale Pre PA = Pre-Induction Positive Affect, NEO-N = NEO Five Factor Inventory Neuroticism Subscale, C*ACS-P = Interaction of Dummy Coded Condition and Fear of Positive Emotion

Using analysis of partial variance methods developed by Cohen and Cohen (1983), I evaluated the interaction to interpret the moderation effect. This technique consists of creating hypothetical participants with low and high levels of the predictor variables by either adding or subtracting the standard deviation of a predictor variable from the mean of that predictor variable and subsequently predicting a score on the task by multiplying the calculated values by the regression model coefficients. The results of this analysis of partial variance are reported in Table 5.

Table 5. Analysis of Partial Variance Examining the Effect of Condition on Fear of Positive Emotion's Effect on Residual Post-Induction Positive Affect

		ACS-P	
		Low	High
Condition	PMI	1.44	2.35
	NMI	0.85	-0.05

Note: ACS-P = Fear of Positive Emotion, PMI = Positive Mood Induction, NMI = Neutral Mood Induction

The positive mood induction resulted in more residual positive affect for both low and high fear of positive emotion participants than the neutral mood induction. However, the participants with high fear of positive emotion experienced a greater rise in positive affect due to the positive mood induction than low fear of positive emotion participants. This relationship

between fear of positive emotion and residual post-induction positive affect is the opposite of what I hypothesized.

As anxiety exhibited a floor effect, I used a setwise binary logistic regression to evaluate whether high fear of emotion participants in the positive mood induction were more likely to experience an increase in anxiety post-induction than low fear of emotion participants while controlling for neuroticism. Neither the main of effects of condition, β = -.59, SE = 0.708, p = .403, and fear of positive emotion, β = .02, SE = 0.039, p = .537, nor the interaction between fear of positive emotion and condition, β = -.11, SE = 0.074, p = .147 were significant predictors of the odds that a participant would experience an increase in anxiety post-induction.

Therefore, high fear of positive emotion participants in the positive mood induction exhibited more residual post-induction positive affect than low fear of positive emotion participants and did not experience a significant rise in anxiety.

Hypothesis Testing

I tested the hypothesis that fear of positive emotion would moderate the effect of condition on creative problem solving ability. I ran a setwise regression predicting the participant's score on the divergent thinking tasks with a dummy coded variable for condition, centered fear of positive emotion scores, and neuroticism scores entered in the first step and the product term of fear of emotion and condition in the second step. The exclusion of neuroticism from this and subsequent models did not affect any of the results. All results reported are with neuroticism included in the model. Fear of positive emotion failed to predict score on the divergent thinking tasks, $t(91)$= -0.08, p = .935, as did condition, $t(91)$= -0.02, p = .984. The interaction between fear of positive emotion and condition did not predict scores on the divergent

thinking tasks, $t(91) = 0.544$, $p = .588$. These results indicate that the main effect of fear of positive emotion, the main effect of condition, and the interaction of fear of positive emotion and condition do not predict residual performance on divergent thinking tasks.

The potential moderation of fear of emotion on condition in predicting scores on the RAT could not be assessed using a parametric setwise regression due to a floor effect on the scores of the RAT. Therefore, I performed a setwise logistic regression using the same predictor variables to determine if they predicted getting at least one answer correct on the RAT. The odds ratio for fear of positive emotion was not a significant predictor, $\beta = .02$, $SE = 0.03$, $p = .576$, and the odds ratio for condition was not a significant predictor as well, $\beta = -0.22$, $SE = 0.47$, $p = .636$. The odds ratio of the interaction between fear of positive emotion and condition was non-significant, $\beta = .02$, $SE = 1.10$, $p = .731$. Therefore, neither the main effects of fear of positive emotion or condition nor the interaction between fear of emotion and condition predict residual performance on the relational thinking task.

Participants in the positive mood induction performed no better on the creative problem solving tasks than participants in the neutral mood induction, even though participants in the positive mood induction reported greater residual post-induction positive affect than participants in the neutral mood induction. The hypothesized mechanism of fear of positive emotion's association with creative problem solving, where high fear of positive emotion led to less positive affect in response to a positive mood induction and subsequent decreased creative problem solving ability, hinged on higher positive affect being associated with better creative problem solving. Perhaps the failure of the interaction of fear of positive emotion and condition to predict creative problem solving ability was due to a non-relationship between higher residual post-induction positive affect and creative problem solving. To test this hypothesis, I used a

setwise linear regression to predict the scores on the divergent thinking tasks, with pre-induction positive affect entered in the first step and post-induction positive affect in the second step. The effect of residual positive affect was non-significant, $t(93)= -0.685$, $p = .495$, so higher residual post-induction positive affect did not predict residual score on the divergent thinking tasks.

The relationship between residual post-induction positive affect and scores on the remote associates test could not be tested using a parametric linear regression because scores on the RAT exhibited a floor effect. Seventy participants (73%) did not get any answers on the RAT correct, while 26 participants (27%) got at least one answer correct. The relationship was instead evaluated using a setwise logistic regression where getting at least one answer correct or not on the RAT was predicted by entering pre-induction positive affect in the first step and post-induction positive affect in the second step. The odds ratio was non-significant, $\beta = .395$, $SE = .258$, $p = .126$, so higher residual post-induction positive affect did not significantly predict the probability that a participant would get at least one answer correct on the RAT.

As reported in Table 2, the correlations between post-induction positive affect and scores on the divergent thinking and RAT tasks were non-significant, implying that post-induction positive affect was not related to creative problem solving even while not controlling for pre-induction positive affect. As both post-induction positive affect and residual post-induction positive affect appear to be unrelated to performance on creative problem solving tasks in this sample, the analysis of positive affect as a mediator of condition on creative problem solving ability was not conducted.

Exploratory Analyses

Since residual post-induction positive affect was unrelated to creative problem solving, I tested some hypotheses that may have accounted for the lack of relationship between the two

variables. Some previous research suggests that experiencing more positive affect may cause participants to satisfice, or give the first easy answer, rather than think through the problem thoroughly (Vosburg, 1998a). How long participants spent working on the RAT was recorded, so if greater positive affect was related to spending less time on the RAT then there might be some evidence of satisficing by participants with greater positive affect. A setwise regression predicting total time spent on the RAT with pre-induction positive affect in the first step and post-induction positive affect in the second step was marginally significant, $t(93)= 1.84$, $p = .07$, indicating that participants with more residual post-induction positive affect actually spent marginally more time on the RAT task than participants with less residual post-induction positive affect. A linear regression indicated that condition did not predict spending more or less time on the RAT, $t(94)= 0.87$, $p = .389$.

Another hypothesis floated by other research is that the experience of positive affect causes irrelevant information, defined by the researchers as responses of low quality, to intrude while the participants are engaged in the creative problem solving process (Kaufmann & Vosburg, 1997; Vosburg, 1998b). By this logic, participants with greater positive affect should produce more responses of lesser quality. Therefore, I used setwise regressions to predict the number of responses the participants gave to the divergent thinking tasks, entering pre-induction positive affect in the first step and post-induction positive affect in the second step. Residual post-induction positive affect failed to predict the residual number of responses to the divergent thinking tasks, $t(93)= -1.03$, $p = .307$.

Previous studies that have found a relationship between positive affect and creative problem solving would induce positive affect by having the experimenter give the participant a gift bag of candy or by having the participant watch a humorous video. In both of these

scenarios, participants' attention is focused on the acts of others during the positive mood induction. Perhaps positive affect that results from focusing on the acts of others is related to creative problem solving while positive affect that results from focusing on one's own actions is not related to creative problem solving. I used the Linguistic Inquiry Word Count program (LIWC, Pennebaker, Francis, & Booth, 2001) to analyze the responses participants wrote during the writing induction and determine how self-focused the participants were in the essays they wrote. I did this by taking the number of first person singular words (e.g., I, me, mine) the participants wrote in the essays and subtracting the number of first person plural (we, our) words, third person singular words (he, she), and third person plural words (they, them) participants wrote. Similar techniques have been used to measure self-focus in past research (Campbell, 1999; DeWall, Pond, Campbell, & Twenge, 2011). I then performed a setwise regression predicting the score on the divergent thinking tasks with pre-induction positive affect in the first step, group centered post-induction positive affect and group centered self-focus words in the second step, and the product term of post-induction positive affect and self-focus words in the third step. The coefficients, degrees of freedom, and *t* values of the predictors are presented in Table 6.

Table 6. Setwise Regression Analysis Testing Self-Focus as a Moderator of the Relationship Between Residual Post-Induction Positive Affect and Scores on the Divergent Thinking Tasks

Step	Predictor	*Df*	*β*	*t*	*p*
1	Pre PA	94	-.026	-.540	.590
2	Pre PA	92	.005	.076	.939
	Post PA	92	-.040	-.780	.437
	SF Words	92	-.010	-.774	.441
3	Pre PA	91	-.007	-.113	.910

Post PA	91	-.036	-.710	.480
SF Words	91	-.009	-.725	.470
SFWds*PostPA	91	-.021	-2.42	.018

Note: β = Unstandardized Regression Coefficient, *Df* = Degrees of Freedom, Pre PA = Pre-Induction Positive Affect, Post PA = Post-Induction Positive Affect, SF Words = Self-Focus Words, SFWds*PostPA = Interaction of Post-Induction Positive Affect and Self-Focus Words

Residual post-induction positive affect did not predict residual scores on the divergent thinking tasks, $t(91)= -0.710$, $p = .480$, nor did self-focus words, $t(91)= -.725$, $p = .470$. However, the interaction between residual post-induction positive affect and self-focus words did predict residual divergent thinking tasks score, $t(91)= -2.42$, $p = .018$. Using analysis of partial variance methods, I evaluated the interaction to interpret the moderation effect. The results of this analysis are reported in Table 7.

Table 7. Analysis of Partial Variance Examining the Effect of Self-Focus Word Usage on Residual Post-Induction Positive Affect's Effect on Scores on the Divergent Thinking Tasks

		SF	
		Low	High
PA	Low	2.87	3.00
	High	2.99	2.71

Note: SF = Self-Focus Words in Essays, PA = Residual Post-Induction Positive Affect

Among participants with high self-focus, there was a negative relationship between residual post-induction positive affect and residual scores on the divergent thinking tasks. Therefore, participants with high self-focus scored lower on the divergent thinking tasks the greater their residual post-induction positive affect. Among participants with low self-focus, there was a positive relationship between positive affect and scores on the divergent thinking tasks. Therefore, participants with low self-focus scored higher on the divergent thinking tasks

the greater their residual post-induction positive affect. A logistic regression predicting whether a participant would get at least one problem on the RAT correct using the same predictor variables as the previous regression showed no main effects, as group centered positive affect, β = -.396, SE = .045, p = .420, and group centered self-focus words, β = .003, SE = .062, p = .957 were both non-significant predictors. The interaction of residual post-induction positive affect and self-focus words was also non-significant, β = -.04, SE = .045, p = .420. So, the self or other focused nature of participants' positive affect appears to be predictive of scores on divergent thinking tasks but not relational thinking tasks[1].

[1] The arousal level of the positive emotion experienced has been shown to influence the relationship between the emotion and creative problem solving ability (Baas et al., 2008; Davis, 2008; Frijda, 1986; Fritz & Sonnentag, 2009). In a brief analysis I created a new LIWC category of level of arousal, using words that have been associated with this construct in previous research, by subtracting the number of low arousal positive affect words used in the essays from the number of high arousal positive affect words used in the essays (Tsai, Knutson, & Fung, 2006). No relationships were found between level of emotional arousal words in the essays and creative problem solving outcomes, either on their own or in interactions with residual post-induction positive affect. Anyone wanting more information about the analysis may contact the author.

CHAPTER 4

DISCUSSION

The hypothesis that fear of positive emotion would moderate the effect of condition on creative problem solving was not confirmed. The interaction of fear of emotion and condition failed to significantly predict scores on the divergent thinking tasks, and also failed to predict the likelihood that participants would get at least one answer correct on the RAT.

While the positive mood condition did exhibit higher residual post-induction positive affect than the neutral mood condition, the relationships between residual post-induction positive emotion and scores on the creative problem tasks were all non-significant. The lack of relationships is likely not due to this sample scoring differently than others on the main variables, as participants scored similarly to other college samples on the measures of fear of positive emotion (Mennin et al., 2005), positive affect (Burton & King, 2004), divergent thinking tasks (Silvia et al., 2008), and the RAT (Isen et al., 2004)[2]. Tests for evidence of satisficing or the intrusion of irrelevant information, previously raised explanations for the lack of a link between positive affect and creative problem solving, were also non-significant. So, while there was no relationship between residual post-induction positive affect and creative problem solving, previously proposed explanations did not account for the lack of a relationship.

In an attempt to explain the non-relationship between post-induction positive affect and scores on the creative problem solving tasks, I hypothesized that the type of positive affect elicited in this study differed from the type of positive affect elicited in previous research that found a relationship between positive affect and creative problem solving ability. I observed that

[2] Non-parametric tests had to be used in Isen and colleagues' 2004 sample, implying skewed data in that case as well. While the seven questions on the RAT were "moderately difficult" when they were originally administered, there are now two more recent samples with lesser performance. This version of the RAT may not be appropriate for current college samples. As an alternative, 144 associative word pairings similar to the original RAT have been developed, but no psychometric work has been done on specific combinations of those associative word pairings together in a single measure (Bowden & Jung-Beeman, 2003).

previous studies finding a link between positive affect and creative problem solving performance have primarily had participants focus on the actions of another during the positive mood induction, while in this study the participants were more focused on their own actions during the positive mood induction. An analysis was performed to test if the interaction between how self-focused a participant was during his or her induction essay and residual post-induction positive affect would predict creative problem solving performance. Self-focus did appear to moderate the relationship between positive affect and divergent thinking ability, but not relational thinking ability. Among participants with low self-focus, there was a positive relationship between residual post-induction positive affect and divergent thinking ability, consistent with the previous literature. However, among participants with high self-focus the relationship between residual post-induction positive affect and divergent thinking ability was negative. The positive mood induction in this study may have been more self-focused than positive mood inductions in previous studies, leading to the non-relationship between positive affect and divergent thinking ability in the current study. Asking participants to recall and re-experience one of their most wonderful personal experiences could elicit more self-focus than having the participants focus on actions of a comedian telling jokes or an experimenter giving out candy. Then again, neither the brick or knife task exhibited this pattern of moderation individually, and both actually exhibited separate moderation patterns from one another. Also, the correlation between scores on the brick and knife tasks, while significant, was relatively small. Perhaps the two tasks were getting at two slightly different abilities, rather than one overarching construct. Therefore, these results should be interpreted carefully.

Another potential difference between the positive emotional experience in this study and positive emotional experience in previous studies that found a link between positive emotion and

creative problem solving was the inclusion of an explicit manipulation check of positive affect immediately post-writing induction. This manipulation check likely explicitly alerted participants to the source of their positive mood. The feelings-as-information theory predicts that people who are explicitly aware of the source of their emotions will make less use of their mood as information, often decreasing the link between mood and task performance (Schwarz, 1990). A meta-analysis of the mood and creative problem solving literature indicated that the inclusion of an explicit manipulation check decreased the population effect size of positive affect on creative problem solving by 35% (Davis, 2008). Participants in the present study may have naturally attributed their positive mood to the writing exercise even absent a manipulation check given its open focus on re-experiencing the emotions from an intensely positive experience. However, the inclusion of an explicit manipulation check could have further attenuated the relationship between positive affect and creative problem solving performance. There are techniques for doing implicit manipulation checks that would theoretically not affect the relationship between emotion and creative problem solving (Isen, 1985; Isen & Daubman, 1984). Therefore, future designs should consider making use of implicit manipulation checks to maintain as strong a relationship as possible between affect and task performance.

However, even if there had been a link between positive affect and creative problem solving, this study did not yield the expected relationships between participants in the positive mood induction's fear of positive emotion scores and either their residual post-induction positive affect or their residual post-induction fear/anxiety. Contrary to my hypotheses, high fear of positive emotion participants in the positive mood induction experienced more residual post-induction positive affect than low fear of positive emotion participants and did not experience a rise in fear/anxiety from pre to post induction. One can understand these counter-intuitive results

by examining what exactly high fear of positive emotion participants fear and how they might respond if that fear were somehow mitigated. Fear of positive emotion is defined as the fear of losing control due to feeling strong positive emotion. If the positive mood induction is administered such that a participant does not have to fear losing control over the situation, high fear of positive emotion individuals may not experience a rise in fear/anxiety or dampen the amount of positive emotion they experience. In this study's induction, participants had a high amount of control over the context that induced their emotions, as they were allowed to choose the situation they wrote about and how deeply to re-immerse themselves in that previous emotional experience. This sense of control could have allowed high fear of emotion participants to experience positive affect while thinking about a positive memory in a way they would not normally allow themselves to. If high fear of positive emotion participants do not normally choose to experience intensely positive events on their own, they may have also benefitted from the novelty of the experience, as increased novelty of an experience has been shown to increase the experience of positive affect (Buchanan & Bardi, 2010; Wilson & Gilbert, 2008). On the other hand, low fear of positive emotion individuals likely re-experience intensely positive events on their own more often and could be less likely to benefit from the novelty effect. Perhaps if the positive mood induction had involved a context where participants felt more out of control, high fear of positive emotion participants would have experienced an increase in fear/anxiety and dampened their positive emotions.

Another possibility is that this type of positive mood induction was not strong enough to induce the fear of positive emotion that could theoretically narrow the focus of high fear of positive emotion participants, thereby decreasing creative problem solving ability. On average, participants with the top half of fear of positive emotion scores in the positive mood induction

experienced a rise of 0.80, from 3.99 to 4.79, on a seven-point positive affect scale. This level of positive affect may not be enough to cause high fear of positive emotion participants to feel like they are "filled with joy" (Item 2 on ACS-P), "ecstatic" (Items 5 and 11), or "on cloud nine" (Item 8). Perhaps the relationship between the amount of positive emotion high FOPE individuals experience and how anxious they are is non-linear. High FOPE individuals may be able to tolerate a certain amount of positive emotion without much distress, but once a certain threshold is surpassed the fear and anxiety in response to the positive emotion kick in. A relatively small rise resulting in a moderate amount of positive emotion may fail to meet this threshold, thereby not increasing fear and anxiety in high FOPE individuals.

The hypothesis that fear of emotion would affect creative problem solving ability via positive affect inherently assumes a significant relationship between positive affect and creative problem solving ability that was not observed in this sample. This study has revealed that, absent a relationship between positive affect and creative problem solving ability, fear of positive emotion does not affect creative problem solving ability. Using knowledge from this study and the general literature about the relationship between positive affect and creative problem solving, future researchers should be able to construct a study that maximizes the potential link between positive affect and creative problem solving and test the fear of emotion hypothesis under those conditions. Specifically, when attempting to elicit high levels of positive emotion, researchers could have participants be minimally self-focused during a positive mood induction where they feel a minimal sense of control and use an implicit manipulation check to confirm the effectiveness of the mood induction. A stronger positive mood induction or a positive mood induction where participants have less control over the context in which they experience the emotion may also be necessary, as the positive mood induction in this study did not induce

greater anxiety post-induction for high fear of positive emotion participants. Also, the positive mood induction in this study might have worn off some by the time participants completed the divergent thinking task, so future researchers may want to test only one aspect of creative problem solving at a time so as to maximize the effect of the induced positive affect. Testing for fear of positive emotion as a moderator of the relationship between positive vs. neutral condition and creative problem solving in a sample where positive condition and creative problem solving are related and the positive mood induction is appropriate for inducing anxiety in high fear of positive emotion participants would be a substantial contribution to the literature.

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