

Effect of Positive Affect on Creativity: A Preliminary Meta-Analysis

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ABSTRACT

Fredrickson's (2001) broaden-and-build theory states that positive emotions have the "ability to broaden people's momentary thought-action repertoires, and build their enduring personal resources" (p. 219). The broaden hypothesis states that experiencing positive affect allows people to have diverse thoughts and actions, widened attention and increased creativity (Fredrickson & Branigan, 2005). The present study employed the meta-analytical method to integrate empirical studies on the effect of positive affect on creativity. A total of 16 studies met the criteria for inclusion. Results revealed that positive affect improved creative performance, with a significant overall effect size, $d+ = .430$, $SE = .062$, $p = .000$, and fail safe N (fsn) of 181.

INTRODUCTION

Amabile's (1983) componential framework espouses the role of task motivation on creativity. Motivation fueled by joy of discovery (Finke, Smith, & Ward, 1992) and interest signifies the presence of positive emotions (Fredrickson, 2001). The broaden and build theory by Fredrickson (2001) states that positive emotions allow a person to become more creative. The affect-as-information approach introduced by Schwarz (1990) theorizes that affect has an impact on a person's perception of the psychological situation, and accordingly influences his/her information processing strategy. Positive affect according to Fiedler (2001) can act as a signal that the environment is safe. As such, it will stimulate exploratory and risk taking behaviour and produce creative responses. Using a meta-analytical approach, we examine literature that can provide evidence that supports the effect of positive affect on creative problem solving.

POSITIVE AFFECT AND CREATIVITY

In her proposed build and broaden theory, Fredrickson (1998) elaborates the relationship of affect and cognition. The theory focuses on five discrete positive emotions – joy, interest, contentment, pride and love. These emotions "share the ability to broaden people's momentary thought-action repertoires and build their enduring personal resources, ranging from physical and intellectual resources to social and psychological resources" (Fredrickson, 2001, p.219). It is believed that actions aroused within broadened states lead to building (Cohn & Fredrickson, 2006; Fredrickson, 1998). Broadening allows people to build enduring personal resources. Joy encourages the individual

to play more, push the limits, and be creative. A person who is exposed to play builds his/her intellectual resources by increasing his/her “levels of creativity, creating theory of mind, and fuelling brain development” (Fredrickson, 2001, p.220). In the broadened hypothesis, Fredrickson (1998; Fredrickson & Branigan, 2005) believes that experiencing positive affect allows people to have more diverse thoughts and actions, widened attention and increased creativity, while negative emotions shrink or narrow them. In the same vein, Amabile (1983) mentions in her socio-componential theory that intrinsic motivation is essential in creative performance. Task interest is an intrinsic motivation (Amabile, 1983) and interest is a positive emotion (Fredrickson, 1998). Both Amabile (1983) and Fredrickson (1998) show in their research and theories the relationship between positive affect and cognition. There is still a need to explain why positive affect broadens a person’s thoughts (Fredrickson, 1998), and why task interest improves creative performance (Amabile, 1983). To answer this missing link, Schwarz (1990) presents the affect-as-information approach, focusing on the role of affect as a signal of a psychological situation. Given any task, happy people will tend to look at the situation as safe, while sad people will find it problematic. Being in a perceived safe environment, individuals will tend to be more playful with their own cognition, and come up with more novel responses. However, feeling that a situation is problematic will lead individuals to take fewer risks, and be more careful with their responses. This implies that their cognitive strategy will be more detail-oriented.

Using the adaptive learning perspective, Fiedler (2001) considers a similar theoretical orientation to Schwarz’s model. According to this theory, positive and negative affect can be seen as appetitive and aversive situations respectively. In the aversive situation, a person employs avoidance behaviour, making sure that everything is working reliably and error-free. The person then believes that performance on this task has to be perfect and stimulus-driven, making it essential to avoid mistakes and not to overlook significant environmental stimuli. In the appetitive set during positive situations, the individual is more prone to exploration. He/she would tend to put more weight on curiosity than to safety and avoidance of mistakes.

META-ANALYSIS

Meta-analysis is a method that integrates a collection of results from various studies (Glass, 1976). It is a method that surveys research reports, but not people (Lipsey & Wilson, 2001). Briefly, meta-analysts search through the databases for studies related to the topic of interest. They collect the results from these studies and statistically analyze them so that the findings may be integrated (Kulik & Kulik, 1989). As meta-analysis uses quantitative results to synthesize research findings regarding the topic, the method allows the researcher to have a strong basis for supporting or

contradicting a hypothesis. An important statistic in meta-analysis is the *effect size* (Lipsey & Wilson, 2001). According to Cohen (1988), effect size is “the degree to which the phenomenon is present in the population or the degree to which the null hypothesis is false” (pp. 9 - 10) and therefore should be truly rejected by the researcher. The significance criterion (or level) should not be the sole basis to check the existence of a phenomenon because it tends to be biased with large sample sizes. The significance level is the rate to which the researcher rejects a true null hypothesis (Cohen, 1988). The smaller the alpha, the smaller is the chance of rejecting a true null hypothesis. Rosenthal and Rosnow (1984) present an equation to show how dependent the significance level is to the effect size:

where n_1 is the sample size of the treatment group and n_2 is the sample size of the control group. This equation shows that the smaller the n , the smaller is the resulting t . When a person looks into the statistical table, the smaller the t , the larger is the p or significance level; lessening the chance of rejecting the null hypothesis. It could be inferred then that the larger the sample size, the more chances of rejecting the null hypothesis. Because of this, there is a chance of failing to reject a null hypothesis that is indeed false. Studies having small sample sizes may have been concluded to have no significant effect; when in fact, the treatment does have a significant effect, but the sample size was not large enough to aid in rejecting the null hypothesis. Effect size takes into account how *large* the effect of treatment is, without it being too dependent on sample size. Therefore, effect sizes are able to represent studies with both small and large sample sizes. The researchers are not implying that effect size testing is more valuable in research than significance tests. Although power analysis is defined as “the probability of not making a type II error, i.e. of not overlooking an effect or a relationship that is really there” (Rosenthal & Rosnow, 1984, p. 355), it does not simply focus on the effect size. According to Cohen (1988), in power analysis, all three components (significance test, effect size, and sample size) are necessary to determine the probability that a certain phenomenon exists. Significance tests allow one to lessen the chance of committing a type I error, while effect sizes lessen the chance of committing a type II error. Reliability, which is often assessed by the standard error statistic, is *always* dependent on the sample size.

The meta-analyst uses systematic and structured steps to document validity of the search and to integrate results. Meta-analysis allows the researcher to handle information from a large body of literature in an organized way. This does not ignore the fact that meta-analysis could be done with a small body of literature, as few as two or three study findings (Lipsey & Wilson, 2001).

Meta-analysis has helped clarify misunderstandings regarding the relationships of certain variables. For example, Eysenck (1952) claimed the non-beneficial effects of psychotherapy. The claim was challenged as the literature showed that psychotherapy yielded positive, negative and null results

(Lipsey & Wilson, 2001). Glass and Smith responded to Eysenck's claim using meta-analysis by standardizing and averaging treatment-control differences for studies done on psychotherapy. They showed that psychotherapy is indeed effective (Kulik & Kulik, 1989; Lipsey & Wilson, 2001). In another study on ability grouping and its effect on the performance of elementary students, Kulik and Kulik (1984) analyzed 28 studies on achievement. Twenty studies showed that grouped classes achieved better than ungrouped classes.

METHOD

Literature Search

The studies included in this meta-analysis were identified from the published papers in the PsycInfo database. Keywords used in the search were the following: positive affect, negative affect, mood, positive emotions, negative emotions, humour, divergent thinking and creativity. As of April 14, 2008, there were 154 journal articles on affect and creativity. The following criteria of inclusion were used for the present study: (a) positive affect or mood was the independent variable; (b) positive affect was compared to a control group; (c) creativity or any dimension of creativity was the dependent variable; (d) it was an experimental study, with participants randomly assigned to conditions; (e) affect should have been manipulated through external means; (f) manipulation check was used to confirm the success of the affect induction; (g) creative performance measure should have been done immediately after affect induction and/or manipulation check; (h) data reported enabled computation of effect size. The literature search identified ten journal articles, with sixteen relevant studies. Only papers with full text were included for analysis.

Independent Variable

Positive affect is the independent variable of this study. Operationally, positive affect refers to the presence of elevated pleasant mood, as measured by mood scales after affect manipulation. Control group was operationally defined as the group that did not receive any manipulation, or presence of a neutral treatment.

Dependent Variable

Creative performance was the dependent variable which was defined as an outcome measure for any creative activity. Laboratory studies used varied ways of measuring creativity, such as unusualness of responses (originality), number of ideas generated (fluency), performance in the Remote Associates Test and candle-box problem (cognitive flexibility), and creative outcome measured independently by expert judges (consensual assessment).

Effect Size

Cohen's *d* (otherwise known as the *standardized mean difference*) was used to measure effect size in this study. According to Lipsey and Wilson (2000), this effect size statistic is used for research findings "that contrast two groups on their respective mean scores on some dependent variable that is *not* operationalized the same across study samples" (p. 48). This is true for the present meta-analysis because experimental studies are the target of this analysis. All the dependent measures used are dimensions of creativity. For example, Kaufman and Vosburg (2002) uses fluency as their measure for creativity, while Fong (2006) uses the Remote Associates Test to measure cognitive flexibility, which is a dimension of creativity.

Some procedures were introduced in our analysis. In cases when means were not provided but significance results were, the *F*, *t*, or *chi-square* was converted to *d*. If the *F*, *t* or *chi-square* was not provided, the significance results and the corresponding sample sizes for the treatment and control groups were converted to *d*. If the effect size was reported, but a different effect size statistic was used, this was converted to *d*. The Cohen's *d* effect size index had been shown to be biased when results were based on small sample sizes. Therefore, Hedges provided a computation that corrects this bias (Lipsey & Wilson, 2001). This is used in the present study. The resulting weighted effect size is symbolized as "d+." Multiple performance measures within studies were averaged to derive one effect size for each study (Lipsey & Wilson, 2001; Stanne, Johnson & Johnson, 1999). Tests for homogeneity of variance of effect size and the fail safe *N* (*fsn*) were also calculated. We used the Comprehensive Meta-Analysis Programme to run the statistics for this research.

RESULTS

Characteristics of the Studies

A total of sixteen studies from ten journal articles met the criteria for inclusion. The characteristics of the studies are found in Table 1. Majority of the studies published in the PsycInfo database, with full text available, were from the years 2000-2007. The samples used were all undergraduate students. Majority of the studies used videos, 42.9% to induce positive affect among their participants. Almost all of the studies used a neutral treatment, 87.5%, for their control group. Mood scales remain the most common manipulation check, 42.9%. Most of the investigators would choose to give the manipulation check right after affect induction, 92.9%, rather than giving it after the creative performance task.

Table 1 *Characteristics of the Studies included in the Meta-Analysis*

Characteristic	No. of Studies	% of Studies
Year published		
1980 – 1989	2	25
1990 – 1999	1	12.5
2000 – 2007	5	62.5
Age of Participants		
High school	0	0
Undergraduates	8	100
Adults	0	0
Gender of participants		
< 5% male; > 95% female	0	0
5% - 50% male; 50% - 95% Female	3	37.5
50% male; 50% female	1	12.5
50% - 95% male; 5% - 50% Female	0	0
>95% male; < 5% female	0	0
Cannot tell	4	50
Treatment style or orientation		
Video	6	42.9
Velten procedure	2	14.3
Recall task	3	21.4
Gift	0	0
Food/snacks/drinks	0	0
Read a passage	0	0
Affectively valenced words	1	7.1
Combination of video and gift	0	0
Combination of food/snacks/drinks and gift	2	14.3
Nature of control group		
No manipulation	0	0
With neutral treatment	7	87.5
Combination of no manipulation and neutral treatment	1	12.5
Manipulation Check		
Mood scale (e.g. PANAS)	6	42.9
Rating of pleasantness of unknown words	2	14.3
Pleasantness of word associates	2	14.3
Combination of mood scale and rating of pleasantness of unknown words	3	21.4

Writing of one's feelings after affect induction	1	7.1
Time of Administration of Manipulation Check		
Immediately after affect induction	13	92.9
After creative performance test	1	7.1

Note: There were a total of ten journal articles. Multiple studies in one journal article were considered as one study. There were multiple studies in 5 journal articles (two multiple studies in four journals; three multiple studies in one journal) $10 + 6 = 16$ total studies in the meta analysis. For treatment style or orientation, manipulation check and time of administration of manipulation check, multiple studies were coded independently. Authors use different treatment styles and manipulation checks for each of their studies.

Creative Performance Results

A total of 14 studies yielded 14 independent averaged effect sizes. Using the fixed model, the overall effect size showed positive affect promotes higher creative performance as compared with those under neutral condition, $d_+ = .430$, $SE = .062$, $p = .000$. The studies were homogeneous, $Q = 21.359$, $df = 13$, $p > .05$. The Rosenthal's (1979) $fsn = 181$. "The fail-safe N estimates the number of unpublished studies reporting null results needed to reduce the cumulated effect across studies to the point of nonsignificance" (Lipsey & Wilson, p. 166). This means that for the present study, 181 studies not accounted for in this paper should show nonsignificant results for the present weighted effect size to go down to a nonsignificant level. Accordingly, the outcome of this study supports the claim that positive affect does improve creativity.

DISCUSSION

The initial question investigated in this study was whether positive affect can improve creative performance. Although a number of researchers have looked into the relationship of positive affect and creativity (e.g. Isen et al., 1985), we wanted to summarize this observation using meta-analysis.

Overall Results

In general, positive affect can improve creative performance for individuals ($d_+ = .430$). This result is congruent with the research reviews indicating the influence of positive affect on creativity (e.g. Fredrickson, 2001). The homogeneity of the overall effect size results show that the "various effect sizes that were averaged into a mean value all estimate the same population effect size" (Lipsey & Wilson, 2001, p. 115). Although different dimensions of creativity were used as an outcome variable, combining them under one construct, "creativity," is plausible. The variation in their effect sizes can be attributed from sampling error alone (Lipsey & Wilson, 2001).

Future Meta-Analysis Search

Limiting our search into the PsycInfo database, with full text articles available shows that majority of the behavioural researches on the role of positive affect on creativity is done by Isen and her colleagues. This coincides with Fredrickson's (2001) observation in her own literature review. This result may lead to a bias towards Isen's work. It is suggested that a more extensive search in other databases should be done to find other authors' work in the same field. Widening the inclusion criteria to field studies and other research designs may also give a broader insight regarding the role of positive affect on creativity.

CONCLUSION

The meta-analysis above signified the beginning of our investigation on the effect of positive affect on creativity. The search was quite limited since we only considered experimental studies which were published in PsycInfo database, with full text articles. The result of this meta-analysis supports the hypothesis that positive affect, specifically momentary positive mood, can increase creative performance ($d^+ = .430$, $p = .000$). This result supports the theories of Amabile (1983), Fiedler (2001), Fredrickson (2001), Schwarz (1990), and the two decades of behavioural research done by Isen and her colleagues (1984, 1985, 1987, 2004). It further strengthens Isen's research on positive affect and creativity. Extensive search of literature on this topic would be done to include studies from varied e-databases.

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APPENDIX Listing of Studies including Studies with Effect Sizes and Creative Performance Tasks

Author and year	Effect size(d+)	Average effect size (d+)	Dependent measure	Control condition	Subsample Groupings
Filipowicz, 2006	.787	.191	Creativity – consensual assessment technique	Watch a neutral video	Gender: male and female
	-.370		Creativity – consensual assessment technique		
Fong, 2006	-.113	-.113	Remote Associates Test	Recall a neutral event	None
Isen, Daubman, & Nowicki, 1987, Study 1	1.328	1.328	Cognitive flexibility: Candle-box problem	Watch a neutral film	None
Isen, Daubman, & Nowicki, 1987, Study 2	1.327	1.327	Cognitive flexibility: Candle-box problem	Watch a neutral film	None
Isen, Johnson, Mertz, & Robinson, 1985, Study 1	.784	.784	Originality: mean number of unusual associates	Word associations to neutrally valenced words	None
Isen Johnson, Mertz, & Robinson, 1985, Study 2	.000	.256	Originality: mean number of unusual associates	Watch a neutral film	Word stimuli: positive, negative and neutral
	.813		Originality: mean number of unusual associates		
	.000		Originality: mean number of unusual associates		
Isen, Labroo, & Durlach, 2004, Study 1	.625	.808	Cognitive flexibility: Remote Associates Test	Receive a drink of water and no manipulation	None
	.593		Originality: number of unique answers		

Isen, Labroo, & Durlach, 2004, Study 2	.849	.609	Cognitive flexibility: Remote Associates Test	No manipulation	None
	.768		Originality: number of unique answers		
Kaufman & Vosburg, 2002	.520	.520	Fluency	Watch a neutral film	None
Author and year	Effect size(d+)	Average effect size (d+)	Dependent measure	Control condition	Subsample Groupings
Mikulincer & Sheffi, 2000, Study 1	-1.203	.280	Categorization: number of poor exemplars accepted as category members	Remember a neutral event	Adult attachment style: anxious, avoidant and secure
	.198		Categorization: number of poor exemplars accepted as category members		
	.715		Categorization: number of poor exemplars accepted as category members		
Mikulincer & Sheffi, 2000, Study 2	-1.232	.245	Cognitive Flexibility: Remote Associates Test	Remember a neutral event	Adult attachment style: anxious, avoidant and secure
	.520		Cognitive Flexibility: Remote Associates Test		
	.531		Cognitive Flexibility: Remote Associates Test		
Mikulincer & Sheffi, 2000, Study 3	-.869	.375	Cognitive Flexibility: Remote Associates Test	Watch a neutral film	Adult attachment style: anxious, avoidant and secure
	.235		Cognitive Flexibility: Remote Associates Test		
	.817		Cognitive Flexibility: Remote Associates Test		
Murray Sujan, Hirt, & Sujan, 1990, Study 1	.337	.337	Categorization: number of categories formed	Read neutral statements	None

Murray Sujan, Hirt, & Sujan, 1990, Study 2	.636	.809	Fluency	Read neutral statements	Task focus: listing similarities and listing differences
	.995		Fluency		