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The impact of emotions and brain training on creative thinking

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The impact of emotions and brain training on creative thinking

Can induced mood change people's level of creativity? Can we manipulate our brains and level of creative insight?

By Sue Langley

Introduction

In the keynote address at the Third World Congress in Positive Psychology in June 2013, Martin Seligman pointed to creativity as the next most important area in positive psychology.

Creativity is increasingly seen as vital in business to generate innovation that will lead to competitive advantage, and leaders are under increasing pressure to deliver creative solutions under stress. Organisations require employees to solve problems every day, from small tasks that require accessing information or solutions that have been encountered, to much more complex problems that require deeper levels of creative insight and emotional intelligence. Employee moods and emotions influence several critical elements in organisations, from creativity to job performance, collaboration and decision making.

Data on the impact of positive emotion on performance is significant (Amabile et al 2005), both in individuals and organisational settings. Positive moods have been shown to be beneficial for big picture, creative, innovative thinking (eg Fredrickson 2001; Jung-Beeman 2007; Subramaniam et al 2009; Caruso & Salovey 1990). Negative moods have been found to create more accuracy, bottoms up processing and problem finding (eg Forgas & Wyland 2006). Research has also explored how important emotions are to our cognitive processing and how they can change people's creative output. Recent neuroscience research may provide insights into how the brain works to encourage more creativity in the workplace.

Recent neuroscience research may provide insights into how the brain works to encourage more creativity at work. We also know from mindfulness experiments that experienced meditators can shift their level of brain activity around compassion, in effect, dialling up or down their activity levels (Lutz 2008). In addition, placebo effect studies tell us that belief that something will work is enough to make it work, influencing capacity to learn.

This series of research experiments brought together elements of positive psychology and neuroscience to see if inducing mood, and training around brain activation, could change levels of creative output and insight.

Abstracts

STUDY 1: Positive emotions and creativity

The purpose of this study was to investigate the impact of mood on creative output. Positive moods have been shown to be beneficial for big picture, creative, innovative thinking and negative moods have been found to create more accuracy, bottoms up processing and problem finding.

This experiment aimed to induce either a positive or negative mood before participants undertook a creative task. Video clips used to induce mood showed an impact on subjective mood experienced in the moment, and analysis of creative output found that positive mood led to a greater creative result than the negatively induced mood. The results were statistically significant.

This study concludes that positive moods seem to be beneficial for creative output, both quantity and quality.

STUDY 2: Neuroscience and creativity

The purpose of this study was to investigate the impact emotional state, understanding the brain and practicing attentional focus can have on creative insight.

Particular areas of the brain, such as the anterior cingulate cortex and the right superior temporal gyrus, have been found to be active prior to the moment of insight (Jung-Beeman et al 2004).

This experiment aimed to build on the first study by investigating whether having an understanding of the brain regions that fire during moments of insight, combined with attentional focus around this area of the brain could induce higher incidences of insight.

The outcome of the research found support for the positive mood impact and some support for the attentional focus hypothesis as well as some additional interesting findings based on education levels. These findings were not statistically significant yet lead the way to future research building on the hypotheses and learning from challenges faced during the study.

STUDY 3: Neuroscience and creativity

We have designed a third, more in-depth study targeting neuroscience training and attentional focus. We will conduct this online study in January 2014, and are currently calling for study participants.

Study 1:
Positive emotions and creativity

Objectives

Purpose

The purpose of this study was to investigate the impact of mood on creative output. This experiment aimed to induce either a positive or negative mood before participants undertook a creative task.

Hypothesis

The null hypothesis (H0) is that mood will have no impact on the creative output of the task. Literature and research to date suggest that positive moods are beneficial for creative output, therefore the hypothesis (H1) is that positive moods lead to higher creative output than negative moods.

Emotions impact our cognitive processes

Positive moods help with creative tasks, likely to be more original, generate a greater number of arguments/options.

More receptive, big picture, positive.

Neutral or slightly negative moods result in a more careful, systematic, bottoms-up approach; better quality arguments.

More closed, detail oriented, focus on what won't work.

Method

Participants

In total, 141 participants replied to the invitation to participate via email through the organisation Emotional Intelligence Worldwide and their database; 43 adults (62.8% female) completed the research activity. The sample was statistically normal.

The majority of participants were working full-time (53.5%) or self-employed (34.9%). Most worked in management level positions (CEO 11.6%, senior executive 11.6%, management 32.6%, team leader 9.3%). The most frequent industries of employment were training and development (37.2%), ITC (14%), financial services (7%) and retail (7%). Participants were relatively well educated (doctorate 4.7%, masters 32.6%, post-graduate 20.9%, bachelors 16.3%, high-school 25.6%).

Materials

Stait-Trait-Cheerfulness Inventory (Ruch, Kohler & van Thriel 1996). Assessment of mood based primarily on cheerfulness and bad mood sub-scale. Short form used to reduce likelihood of induced mood dissipating.

Myers Briggs Type indicator (Myers 1990). Only the dimension for N (iNtuiting) or S (Sensing) measured to identify how participants prefer to gather information.
Participants asked to choose words from a list which most represented them.

Positive and negative mood videos. Selected by researcher for ability to induce positive or negative mood. No access to videos validated for research.

Creative output task. A simple random outline of shapes. Participants asked to list all the things the image could represent or be used for.

Ethics

All ethical requirements were met (confidentiality, anonymity, right to withdraw). Serious consideration was given regarding inducing negative mood, with online debrief and personal contact offered (this was not taken up).

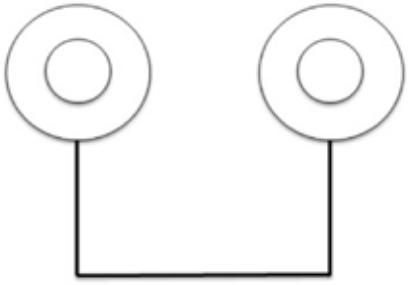
Procedure

1. Invitation to participate, demographic survey, personality preference. Incentive offered (copy of paper), hypothesis not provided.
2. Participants randomly assigned to positive or negative mood group.
3. Participants completed research activity online. They watched respective video, completed current mood questionnaire and creative output task.
4. Creative task output measured for quantity (number of ideas) and quality (subjective assessment and scoring by panel of experts).
5. Analysed using non-parametric statistics, Mann-Whitney U tests, Spearman correlation.

Positive mood video: Tiger and lion cubs playing with humans, music in the background.

Negative mood video: Sussex Roads Embrace Life ad simulating a father having a car crash, emotive music in the background.

Creative output task



Examples of creative output (subjective rating)

Circles connected by three lines...

Two eyes...

Two wheels...

Two Mexicans in sombreros sitting by the bank of a river fishing and sipping Corona...

An old radio transistor I used to play music on as a kid...

Results

Key findings

The positive mood group was significantly associated (r_s =.26, p=.049) with higher quantity of creative output (mean rank 25.72) than the negative mood group (mean rank 19.32).
The two groups did not differ significantly on quality of creative output (p=.319).

Table 1

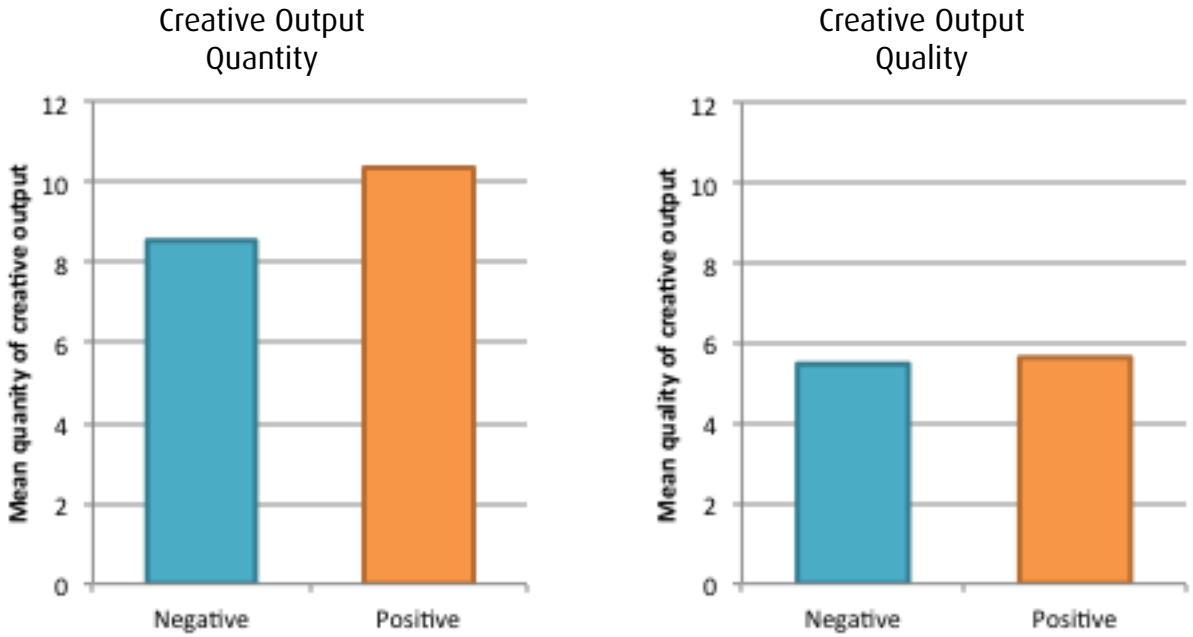
Mean differences between positive and negative mood groups

	Mean (SD)		Mean Rank			
	Negative (N = 25)	Positive (N = 18)	Negative (N = 25)	Positive (N = 18)	*Z*	*p*
STCI						
CH	26.10 (6.18)	29.28 (3.68)	18.46	26.92	-2.18	.015
BM	15.74 (6.82)	11.91 (2.48)	25.00	17.83	-1.88	.030
SE	27.78 (4.54)	28.00 (5.08)	21.14	23.19	-.53	.298
Creativity						
Quantity	8.54 (7.86)	10.33 (6.99)	19.32	25.72	-1.66	.049
Quality	5.48 (2.31)	5.64 (1.64)	21.24	23.06	-.47	.319

N=43. Positive = positive mood group; Negative = negative mood group; STCi = State-Trait-Cheerfulness Inventory; CH = Cheerful; BM = Bad mood; SE = Serious. All p values one-tailed.

Figure 1

Mean differences in creative output between positive and negative mood groups



There was evidence for the efficacy of the mood induction procedure, as the positive group was associated with a statistically significant (p=.015) higher mean rank (M=26.92), in comparison to the negative group (M=18.46) on the CH sub-scale. Similar correlation occurred on the BM sub-scale.

The intuitive personality dimension correlated positively and significantly with quality (r_s =.28, p=.037) yet not significantly with quantity (r_s =.25, p=.054). Thus, higher levels of intuition are associated with higher levels of creativity quality. The sensing dimension correlated positively and significantly with quantity (r_s =-.39, p<.01) and not significantly with quality (r_s =-.04, p=.81). Higher levels of sensing are associated with lower absolute levels of creative output.

Study 2:
Neuroscience and creativity

Objectives

Purpose

The purpose of this study was to investigate the impact emotional state, understanding the brain and practicing attentional focus can have on creative insight.

Using RCT methodology, the experiment aimed to see if teaching people about the brain regions that fire during moments of insight, together with attentional focus in this brain area, could induce higher incidences of insight above what could be achieved purely through positive mood inducement.

The objective was to establish if individuals can control the energy and focus in their brain to increase their ability to have moments of insight.

Hypothesis

The null hypothesis (H0) is that mindful attention on the relevant brain region will have no impact on creative insight.

The hypothesis (H1) is that relaxed attention will lead to a greater difference in creative insight than positive mood or no attention.

Method

Participants

In total, 328 participants replied to the invitation to participate via email through the organisation Emotional Intelligence Worldwide and their database; 116 adults (70% female) completed all activities. The sample was statistically normal.

The majority of participants were working full-time (70%) or self-employed (19.8%). The most common job role was management (31%), followed by other (25%), development (14%), administration (13%) and support services (10%). The most frequent industries of employment were education and training (21.6%), government (14.7%), ITC (11.2%) and HR/recruitment (8.6%). Participants were relatively well educated (doctorate 0.9%, masters 21.6%, post-graduate 17.2%, bachelors 36.2%, high-school 19.8%, no HSC 4.3%).

Materials

Stait-Trait-Cheerfulness Inventory (Ruch, Kohler & van Thriel 2996). Assessment of mood based on cheerfulness, seriousness and bad mood sub-scale. Short form used to reduce likelihood of induced mood dissipating.

Positive mood video. Selected by researcher and tested with group for ability to induce positive, uplifting, inspiring emotions. No access to videos validated for research.

Creative insight task. A series of compound remote associate problems (Bowden & Beeman 2003); valid, reliable and suitable for measuring insight. 15 CRAs selected.

Neuroscience training and exercise. Short online lesson on the brain around creative insight, mindfulness and attentional focus, followed by attentional focus exercise. Included images of brain regions highlighting anterior cingulate cortex and right anterior superior temporalgyrus so participants were clear where to focus attention and energy. Instructions in English reading age 13 where possible.

Ethics

All ethical requirements were met (confidentiality, anonymity, right to withdraw).

Procedure

1. Invitation to participate. Incentive offered (copy of paper), hypothesis not provided.
2. Participants randomly assigned to three groups (control, positive mood, experimental).
3. Participants completed demographic survey and research activity online, starting with current mood questionnaire, then:

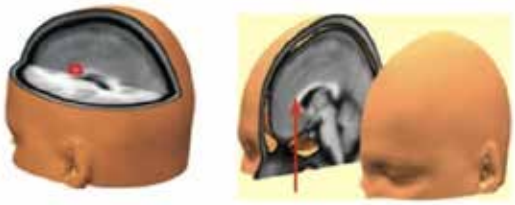
   Control group completed creative insight task.

   Positive mood group watched positive mood inducing video then completed creative insight task.

   Experimental group took neuroscience lesson then completed creative insight task.
4. Method of creative task solution measured by self-report (immediate insight, delayed insight or exploration). Subjective comments of video watchers collected.
5. Analysed using mean comparison, Mann-Whitney U test, correlation, linear regression.

Positive mood video: Lucas expressed gratitude to friends by spending his 30th birthday giving away 30 presents to 30 strangers. Video shows joyful responses he received.

Neuroscience training
(attention directed to brain areas)



Sample CRA problems

Participants respond to three words with a fourth that combines with the others to form new words or phrases.

COTTAGE SWISS CAKE (answer CHEESE)

LIGHT BIRTHDAY STICK (answer CANDLE)

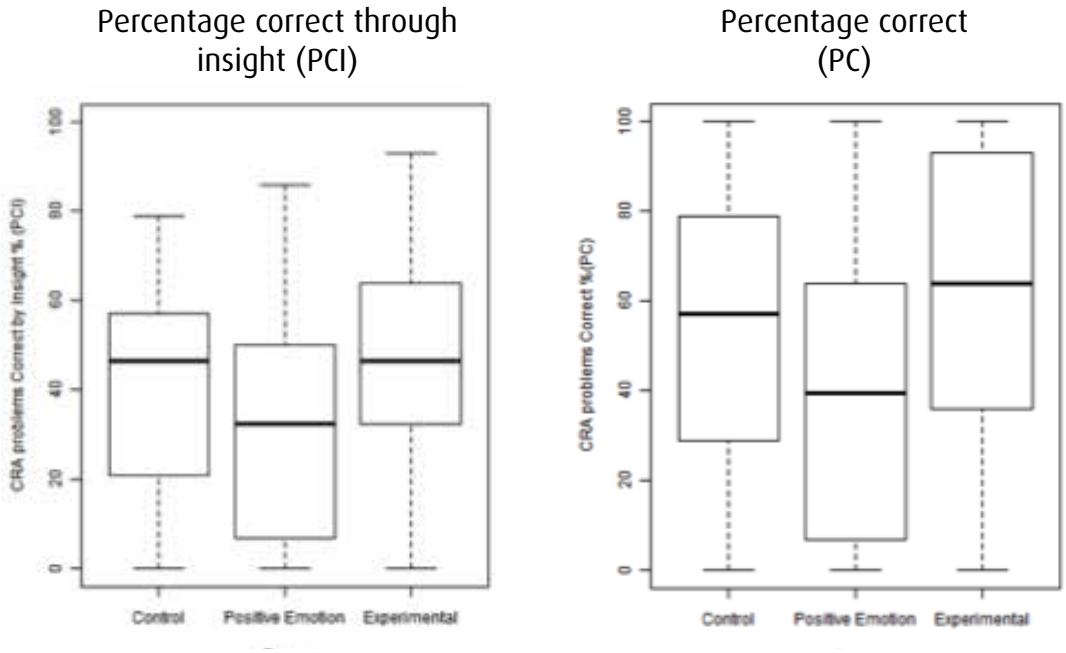
Results

Key findings

The hypothesis that knowledge of the brain and attentional focus could increase creative insight through deliberate brain manipulation was not significantly supported. There were no significant differences between the experimental and control group in either PCI (p=0.50) or PC (p=0.35). However, the experimental group did have higher percentage correct across each of the creative insight areas (immediate insight, delayed insight and exploration).

Figure 2

Percentage of CRA problems correctly solved plotted against groups

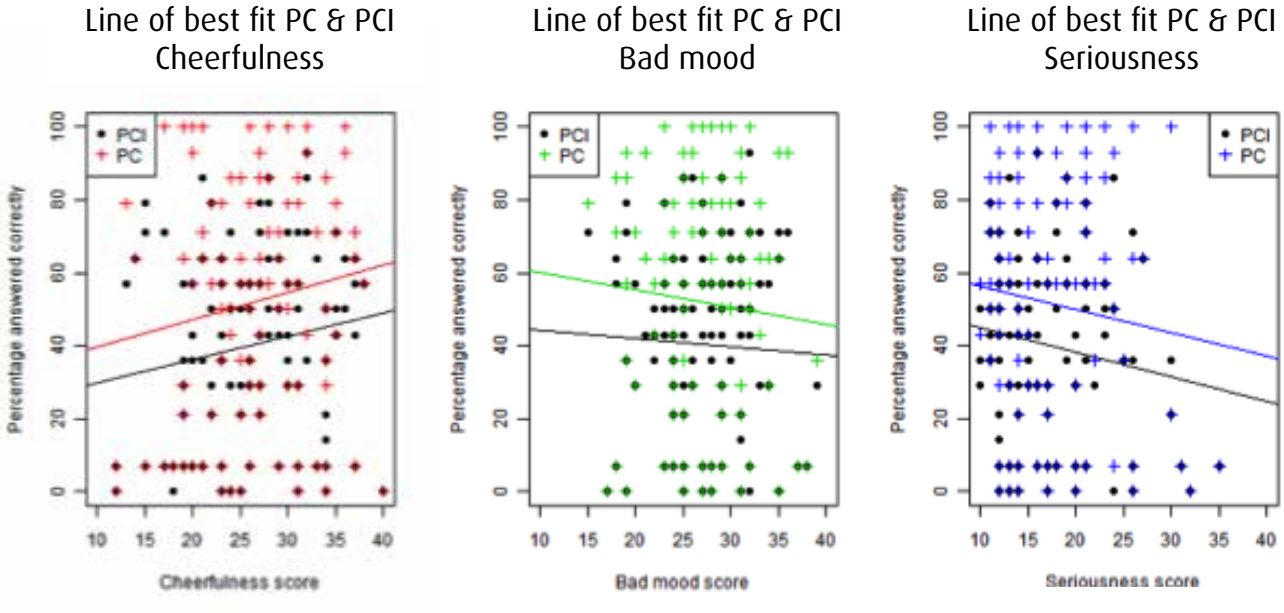


Control group (N=44); Positive mood group (N=36); Experimental group (N=36).
PCI median percentage 47, 33, 47 respectively. PC median percentage 57, 40, 64.

Results

Figure 3

Scatter plot and lines of best fit of PC and PCI against mood score



Both PC and PCI were found to rise with increase in cheerfulness and decrease in bad mood and seriousness, though results were not statistically significant (CH p=0.75, BM p=0.23, SE p=0.80).

Group and demographic comparison highlighted confounding results. Participants with least education (no HSC) had highest PCI scores. Four out of 5 were in the control group, causing it to have higher scores than would be seen in normal population. While numbers are low, an interesting finding was possible negative correlation between higher levels of education and problems solved by insight.

Lower positive mood group scores, and lack of significant change in the emotional scores, indicate the video did not have the desired effect. Subjective comments confirmed mixed emotional reactions.

Conclusions

Discussion

This research concludes that positive moods seem beneficial for creative output, both quantity and quality, and are more effective than negative moods in generating creative output. We found some promising support for the more novel hypothesis that knowledge of the brain and attentional focus could increase creative insight.

We cannot conclude that people can deliberately manipulate their brain through learning and attentional focus at this stage. This research, when originally conceived, was considered 'odd' by many, yet provides a glimmer of what could be possible. Can we really teach people to use mindfulness and attentional focus to direct energy to the parts of their brain that need to be activated? Experiments by Matthieu Ricard and Richard Davidson (Lutz 2008) have paved the way, and respected practitioners and researchers are already designing brain training incorporating neuroplasticity.

We hope these studies lead to new ways of designing research building on the hypotheses and methodologies and learning from challenges faced during our research.

Challenges and limitations

Mood induction appeared efficacious. However we were limited by lack of access to videos validated for research. Mixed emotional responses to videos in both studies, especially the second, appeared to have reduced impact of targeted mood and significance of results. Technical problems experienced watching videos also likely affected people's mood.

Online experimentation was challenging. We found no way to accurately record time spent doing activities and if distractions caused mood dissipation. We do not know if people actually read or understood the lesson or completed the mindfulness exercise. Another limitation was possible influence of dispositional mood (eg cheerful, non-serious) on individuals.

Next steps

We have designed a third, more in-depth study targeting neuroscience training and attentional focus. This longer study, conducted online, will allow for knowledge and skill development in the experimental group, while controlling for attentional focus. Validated emotion-inducing videos will also be critical.

We will conduct the research project in January 2014, and are currently calling for study participants.

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Sue Langley

Sue Langley is a speaker, master trainer and researcher who inspires people to apply emotional intelligence, positive psychology and neuroscience to become the best they can be. Founder and CEO of Emotional Intelligence Worldwide, she is the leading advisor in Australia on the practical workplace application of these fields.

She has chaired conferences and presented her work and research internationally, most recently at the 3rd World Congress on Positive Psychology, the 48th APS Conference, NexusEQ, and the upcoming EQ Emotional Intelligence African Summit.

Sue holds a Masters in Neuroscience of Leadership from Middlesex University, a BA in Psychology and Management from Monash University and has studied positive psychology at Harvard. As the lead developer and facilitator of Australia's first Diploma of Positive Psychology and Wellbeing, Sue is making positive psychology research and applications accessible to busy professionals. She has developed large-scale multi-year projects with organisations such as Oracle, Coca-Cola Amatil, Schneider Electric, Perpetual and Camp Quality to cultivate creativity, positive culture and emotionally intelligent leadership. Sue recently featured as an emotional intelligence expert in the ABC TV series *Redesign My Brain* and has appeared on *Sydney Morning Herald, Smart Company* and *Channel Seven News.*

Sue partners with CAPP to bring strengths-based organisational development and accreditation to Asia-Pacific. She is a Director of Wellbeing Australia, and member of the Australian Psychological Association and the International Positive Psychology Association.

Acknowledgements

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