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GSR REACTIVITY FOR EMOTIVE STIMULI & IMPACT ON VIGILANCE OF STUDENTS

[1]Kamaljeet Sandhu and [2]Priya Gupta
[1]Professor, Head and Dean, [2]Research Scholar
Department of Psychology, Faculty of Social Sciences
Dayalbagh Educational Institute (Deemed University), Dayalbagh, Agra.

Abstract: The recent technological advances suggested various ways in which, different emotional states influence individual's cognitive functions. The aim of the present research paper was to study the effect of positive and negative emotive stimuli (happiness and fear) on vigilance and GSR reactivity. The purposive sample consisting of 100 university students with average emotionality was selected from in and around Agra city. Their age range was in between 20 – 30 years. Bourdon-Wiersma vigilance test was used to measure vigilance. Two videos (selected and validated) were used as emotive stimuli to arouse positive and negative emotions in students. The results showed a significant difference between means of pre and post-test measures of vigilance for both positive ($Z= 4.789$, $p<0.01$) and negative ($Z= 4.855$, $p<0.01$) emotive stimuli. The findings also indicated a significant difference in between both emotive groups for only pre-test measures of vigilance and not for post-test measures. The GSR data of reactivity for emotive stimuli also display a significant change, where arousal level has increased in comparison to the non-emotive stimuli. The present investigation has implications for university students as their vigilance and concentration is significantly affected by visually projected emotional states.

Key words: **Positive and Negative Emotive stimuli, Vigilance, GSR Reactivity.**

Conceptual Framework

Writings of ancient philosophers like Socrates, Plato and Kant have always focused on understanding the nature of different emotions and their role in life and the relationship between thinking and feelings in everyday life experiences. Implications of these rational and emotional processes have a significant effect on behaviour. There are many contradictions in researchers' understanding of the relationship between emotion and thinking as some believed that emotions or mood overshadow rationality as well as endangers logical thought processes, whereas others suggested that emotions are basic and adaptive aspect of cognition, which expands and broadens rational thought processes (Forgas, 2008). The advances in cognitive neuroscience inspired psychologists to explore emotion and cognition and understand the influence of different affective states on cognition. Emotional responses modulate and guide cognition to enable adaptive responses to the environment. Emotions also determine our perception of world, organization of memory and making important decisions.

Additionally, the impact of positive emotional states on wide variety of human behaviour and various cognitive processes is well recognized (Isen, 1999). It is also shown that many positive feelings evoked by simple events such as viewing a short comedy film, receiving a small gift, or unexpectedly finding a small amount of money have potential to produce significant changes in thinking and behavior. Positive affect has been associated with greater efficiency with both fundamental and complex cognitive processes. Memory and learning also enhance when subjects are in a positive state as compared to a neutral or negative affective state. Creativity, problem solving and risk-assessment show influence of positive affective states as compared to neutral or negative affective states (Isen, 1999). In addition to cognitive tasks, subjects experiencing positive affective states have greater motivation to exercise and engage in more pro-social behavior such as altruism and donating time or money to charity as compared to subjects experiencing neutral or negative affective states (Isen, 1999). Therefore, it is evident that a negative affective state might not promote full concentration on the task to be executed. In other words, under such a situation, people seem to have vigilance related issues.

Vigilance is the ability to maintain concentrated attention over prolonged periods of time. It is observed that emotional stimuli rapidly draw more attention and hold back attention disengagement for extended time than neutral stimuli. For example, in visual search tasks, the detection of a target amid distractors is quicker when the target is emotional, compared to neutral. It is also found that emotionally salient information limits humans' ability to attend during complex tasks. Moreover, human cognitive processes are affected by emotions, including attention (Vuilleumier, 2005), learning and memory (Phelps, 2004; Um et al., 2012) and reasoning (Jung et al., 2014).

Long (2008) examined the effect of fear and joy on participants' ability to find an associated search stimulus and observed that search times are reduced, when the target is threatening. Giron and Martins (2010) experimented with 366 participants by administering two DVD films, one containing aversive stimuli and one containing neutral stimuli. After viewing the DVD, anxiety, working memory, and attention were assessed. They concluded that aversive visual stimuli increase anxiety and decrease attention and working memory performance.

Nadler, Rabi and Minda (2010) studied the effect of mood states on cognitive processing with a category learning task in which participants were required to classify stimuli by rule-described categories. Music and video clips were adopted to induce happy or sad mood. Evidence shows that the performance in the happy mood was better than that in the sad mood. Fabio et. al. (2015) investigated the influence of anxiety on memory and attention and found that less anxious participants showed best memory capacity and less attention biases than more anxious participants.

In models of affect and cognition, it is held that positive affect broadens the scope of attention. Consistent with this notion, previous researches have indeed suggested that positive affect is associated with impaired selective attention as evidenced by increased interference of spatially distant distractors. However, other findings cast doubt on the consistency of this notion. Bruyneel et. al. (2013) examined whether selective attention in a visual flanker task is influenced by positive mood induction. Across three experiments, positive affect consistently failed to exert any impact on selective attention.

Emotions also bring about many changes in physiological system of the person such as skin conductance, facial expressions, brain signals, heart-rate, pulse rate, body temperature, etc. For instance, sweat glands are more active during fear experiences, whereas warm and energetic feelings are engulfed by happiness (Nummenmaa and Ratti, 2013). Eventually, advancements in biomedical devices has enabled to identify even a smallest change in these physiological parameters by using tools like EEG, ECG, GSR, etc. (Hamdi and Philippe Allain, 2012; Nagarajan, 2011).

The above stated researches indicate that positive and negative emotions influence attention, working memory, logical reasoning and other aspects of cognition. Yet, the results of these researches are mixed as some suggest that positive emotions increase attention and other cognitive functions as compared to negative emotions and vice-a-versa. Thus, the present research investigated comparison of vigilance scores in emotionally aroused students to understand how these students can be helped to keep their vigilance intact and perform better in adverse and emotionally arousing situations.

Objectives:

- To study the significance of difference in Pre and Post-test measures of vigilance for positive and negative emotive stimuli (videos eliciting happiness and fear) groups.
- To compare the significance of difference in the impact of emotive stimuli on vigilance in between the Pre and Post-test measures of groups.
- To compare the GSR reactivity value of the subjects in relaxed, neutral and aroused states due to positive and negative emotive stimuli.

Hypothesis:

- There will be a significant difference in the pre and post-test measures of vigilance for positive and negative emotive stimuli groups.
- There will be a significant difference in the impact of emotive stimuli on vigilance in between the pre and post-test measures of groups.
- There will be difference in GSR reactivity value of the subjects in relaxed, neutral and aroused states due to positive and negative emotive stimuli.

Variables:

Independent Variables: Emotive Stimuli – Positive (Happiness) and Negative (Fear)
Dependent Variable: (1) Vigilance; (2) Galvanic Skin Response (GSR)

Operational Definitions:

- *Emotive Stimuli:* Emotive stimuli are capable of arousing intense emotional feelings, for example, a video clip showing intense emotions and arouse specific emotions of viewers.
- *Vigilance:* Vigilance refers to situations, in which nothing much is happening, but a person pays attention in the hope of detecting something, whenever it does happen.
- *GSR:* Galvanic Skin Response refers to the electro-dermal changes in the skin conductance due to the environmental stimuli. In other words, it is the change in electrical properties of the skin caused by psychological variables.

Sample:

A sample of 100 college students was purposively selected from areas in and around Agra city. Only those students, who were average on emotionality and intelligence (tested through Eysenck Personality Questionnaire Revised –Short form and Standard Progressive Matrices), were included in the sample. Their age range was in between 20-30 years and they belonged to different streams. Students taking any counseling sessions as reported by college authorities were excluded from the sample. Students from broken homes were also excluded. Out of the sample of 100 students, a randomly selected sample of 20 students was further taken to generate data of GSR reactivity.

Tools:

Bourdon-Wiersma Vigilance Test is a dot cancellation test used to measure perceptual speed and accuracy indicating vigilance of subjects. The test consists of 50 rows of groups of 3, 4 or 5 dots with 8 groups of 4 dots in each row. The task is to strike out the groups of 4 dots in each row as accurately and quickly as possible within 4 minutes time. The scores are based on the number of correct responses and error responses. The test is sufficiently reliable and valid and used for various researches earlier.

Emotive Stimuli includes selected 5 min. videos of "Saving Kitten" (arousing happiness) and "Natural Disaster" (arousing fear) were shown to the subjects as positive and negative emotive stimuli respectively. The videos have Inter-Rater Reliability from 0.62 to 0.65. The internal consistency value is ranged from 0.79 to 0.81, which indicates that content validity is also good.
GSR is measured by 8 Channel computerized polygraph Test (Physiopac PP 4), manufactured by Medicaid Systems, Chandigarh, India. It is measured by placing electrodes on tips of the alternative fingers of each subject.

Research Design

Pre and Post Test design was used to compare the impact of the positive and negative emotive stimuli on vigilance (Table 1a).

Table 1(a): Framework of Experimental procedure for data collection and analysis

EMOTIONS	PRE-TEST	IV	POST-TEST
Positive (Happiness)	Vigilance test	Video of saving kitten	Vigilance test
Negative (Fear)		Video of natural disasters	

Table 1(b): Framework of Experimental procedure for GSR data collection and analysis

RELAXED STATE	NEUTRAL STATE	AROUSED STATE
Baseline	Non-Emotive video	Emotive video
GSR	GSR	GSR

Procedure: The GSR baseline measure was taken initially followed by presentation of a neutral stimuli (non-emotive video) and then emotive video (Table 1b). The GSR measures were taken during the presentation of non-emotive and emotive stimuli for a comparative analysis. The conditions during pre and post-test and GSR measures were maintained the same.

Data Analysis

Wilcoxon-T test was computed to analyze difference in pre and post-test measures of vigilance for the positive and negative emotive groups. Mann Whitney U-test was used to compare the pre and post-test measures of vigilance for both emotive groups. GSR measurement was also taken for comparison of reactivity value of the students.

Table 2: Showing Mean Scores and Z values of Pre and Post-test measures of Vigilance for Positive and Negative Emotive Stimuli Groups (N=50)

GROUP	TEST	MEAN SCORES	Z VALUES	LEVEL OF SIGNIFICANCE
Positive Emotive Group	Pre-Test	49.88	4.41	p<0.01
	Post-Test	40.68		
Negative Emotive Group	Pre-Test	66.88	4.86	p<0.01
	Post-Test	47.18		

Table 2 displays the mean values of pre and post-test measures of vigilance for positive emotive group (49.88 and 40.68 respectively) and for negative emotive group (66.88 and 47.18 respectively). The obtained z values for positive emotive group (Z= 4.41, where p< 0.01 level) and for negative emotive group (Z= 4.86, where p<0.01 level) are significant. It means that the post-test performance of students on vigilance task has significantly decreased as compared to the pre-test performance of the students. It is also evident from the mean scores and bar diagram (fig. 1) where, the bar for the post test is lower for both the groups, displaying the decrease in the vigilance scores.

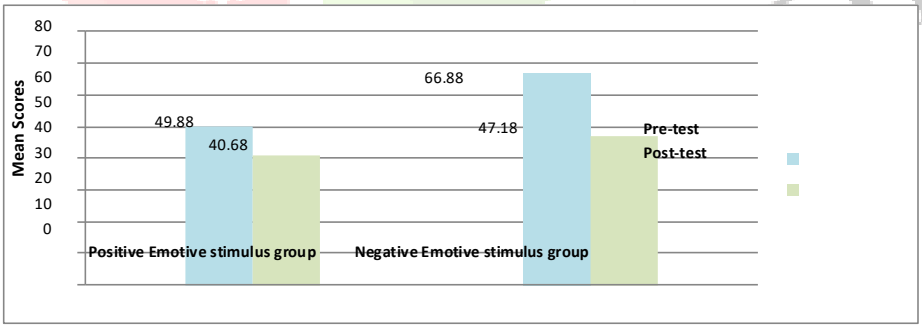

Figure 1: Bar diagram exhibiting difference in mean values of Pre and Post-test for vigilance for positive and negative emotive groups

Considering the above mentioned results, the hypothesis stating that 'There will be a significant difference in the pre and post-test measures of vigilance for positive and negative emotive groups' is accepted. The results show that when positive and negative emotive stimuli are presented to an individual, it significantly reduces the vigilance in the post-test performance. Further, the analysis in the Table 3 presents results comparing both the pre-test and post-test of the positive and negative emotive groups.

Table 3: Showing Mean Scores and Z values of Pre and Post-test measures of Vigilance for Positive and Negative Emotive Stimuli Groups (N=50)

TEST	GROUP	MEAN SCORES	Z VALUES	LEVEL OF SIGNIFICANCE
Pre-Test	Positive Emotive Group	42.62	2.72	p<0.01
	Negative Emotive Group	58.38		
Post-Test	Positive Emotive Group	46.38	1.42	p>0.05
	Negative Emotive Group	54.62		

The results indicate that the difference in the pre-test of vigilance for both the groups is significant indicating that the negative emotive group has performed better than the positive emotive group in the pre-test for vigilance. Apparently, in the post-test of vigilance for both positive and negative emotive groups, there is a decline in the performance but the difference in between the groups is not significant. The positive emotive group has shown better performance than pretest, whereas the negative group has shown a decline according to the mean scores. This indicates that whether the emotive stimulus is positive or negative, it is equally capable of bringing about the change in the performance on a vigilance test. Therefore, the hypothesis stating 'There will be a significant difference in the impact of positive and negative emotive stimuli on vigilance in between pre and post measures of groups' is rejected. The positive and negative emotions are equally capable of creating higher level of arousal and therefore, the change in performance in both the groups is evident but the difference is not significant. The line graph in Fig. 2 indicates the change, which is not significant. Comparing the two line graphs, it is observable that the lines are coming nearer in the post-test, thus reducing the difference that exists in the scores.

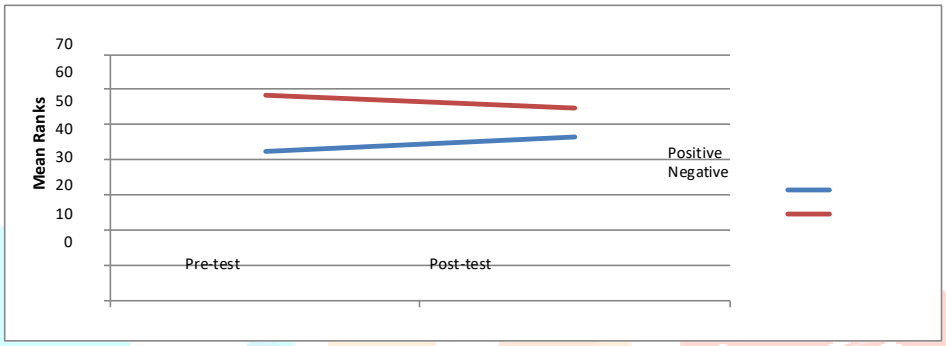

Figure 2: Line graph for vigilance of positive and negative emotive stimulus groups

The results are also analyzed in terms of physiological measures of GSR of the subjects. Figure 3 indicates comparison of the GSR values of the subjects in between relaxed state and emotionally aroused state. The graph clearly shows that the GSR value of the subjects in relaxed state is lower than when they are in emotionally aroused state. This indicates that the conductivity of skin is more when the person is in aroused state.

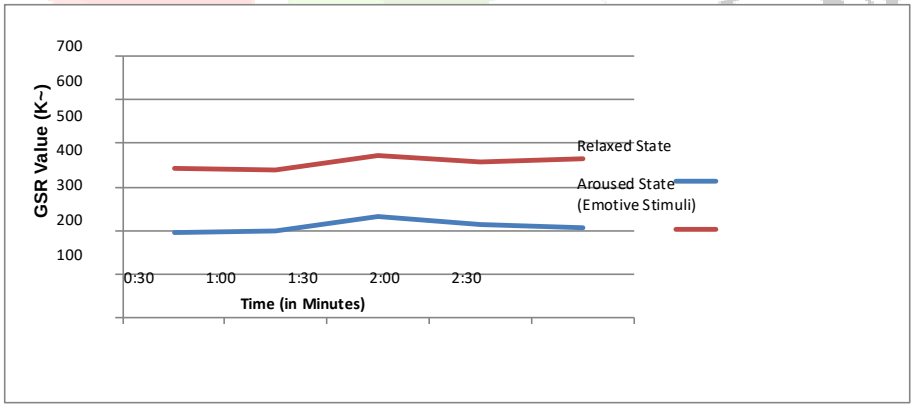

Figure3: Line graph showing average GSR Reactivity for Emotive Stimuli

Figure 4 shows the average GSR reactivity of the subjects for non-emotive stimuli. The graph clearly displays that there is very little difference in GSR reactivity of the subjects when they were relaxed or in neutral state (viewing the non-emotive video).

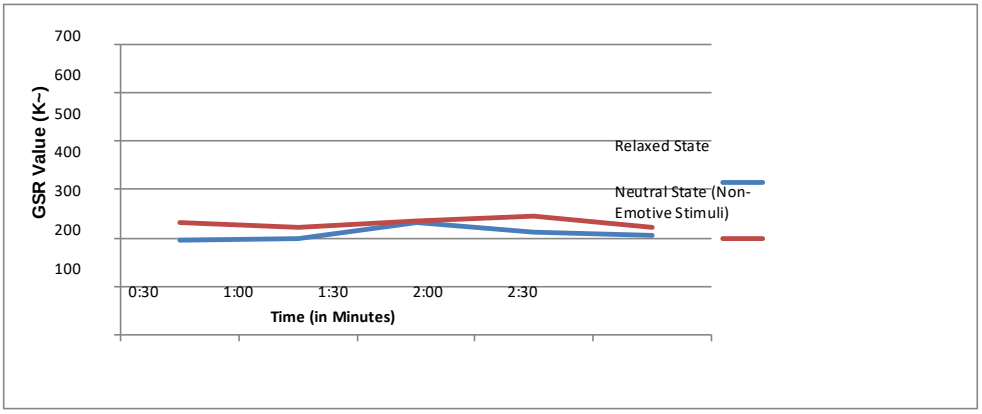

Figure 4: Line graph showing average GSR Reactivity for Non- Emotive Stimuli

Discussion

The results of the study indicate that emotionally aroused students significantly change in their performance on vigilance as evident from the post-test measure. It can be interpreted that the emotive stimuli brought about a significant difference in the vigilance of the group of students. The aroused state of the individual significantly affects the vigilance as the individual may be distracted by the emotive stimuli, no matter it is positive or negative. This also significantly influences his/her ability to be vigilant on the task due to an arousal state. According to the motivational dimension model of emotion, high-arousal positive emotion, which is high in approach motivation (e.g., desire) narrows cognition, whereas low-arousal positive emotion which is low in approach motivation (e.g., pleasant, happy) broadens attention (Gable and Harmon-Jones, 2010). In other words, the motivational dimension of affect influences the expansion or the narrowing of the cognitive repertoires in positive or negative affect conditions. This lends support to our findings about vigilance where the vigilance is influenced in an aroused state. Specifically, the positive or negative affect , which is high in motivational intensity, will be responsible for narrowing or expanding cognition and attention.

Many previous researchers also found that the person's emotional states have significant impact on cognitive flexibility, attention and concentration (Bruyneel et al., 2013; Sacharin, 2009). Blanchette and Richards (2004) found that emotions impair reasoning performance, no matter whether they are positive or negative. Dreisbach and Goschke (2004) also suggested that positive mood reduces perseveration or it increases person's ability to switch the cognitive sets when the context requires it. In addition, it also increases distractibility or it reduces the ability to focus on a task when there are distracting stimuli.

Shafer et al. (2012) studied the impact of emotional distraction on performance in a shape discrimination task, by manipulating both (i) the degree of emotional charge of the distracting information (from highly to absolute neutral) and (ii) the attentional demands of the main cognitive task, by varying the task difficulty (low vs. high perceptual load) and the time of presentation (short vs. long duration). Behavioral findings revealed impaired performance by emotional distraction reflected in longer reaction times (RTs) for negative than for neutral items, regardless of manipulations of attentional demands. However, the detrimental effect of emotional distraction was strongest when the difference in emotional content was the greatest (highly emotional vs. absolute neutral comparison) and the attentional resources were most available (low load).

Nath and Pradhan (2014) induced positive emotion through positive/neutral writing or watching movie. Participants were required to perform a shape detection task in order to measure cognitive function. Their results showed that Reaction Time between the positive state and the neutral state did not differ significantly. A number of other studies using various tasks of measuring cognitive functions, like Stroop task (Phillips et al., 2002), fluency tasks (Carvalho and Ready, 2010), attentional orienting task (Compton et al., 2004), anti-saccade task (Van der Stigchel et al., 2011), also showed that the positive emotion did not enhance certain cognitive functions.

The above mentioned researches all lend complete or partial support to the results of the study. It can also be stated here that negative stimulus arousal may be more as compared to the positive stimulus arousal state.

Conclusion

Thus, on the basis of above findings and discussion, it can be concluded that the person's emotional state, whether positive or negative, have significant impact on his/her vigilance.

Some *limitations* of the study and *suggestions* for future researchers that can be pointed out are that only college students of the age group of 20–30 years were considered. Future research may also include higher and lower age groups as well. This study includes only one cognitive function i.e. vigilance. Other cognitive functions like working memory, decision making, imagery, etc. can also be included in future endeavours. Future research can also include intervention programs to improve the students' cognitive performances if it declines tremendously when they face emotional turmoil. It is also a known fact that the optimum arousal state improves performance. So, which emotive stimulus brings about optimum arousal can also be explored in future research.

The *implications* of the present research can be traced for the college students as it helps them to understand their emotional states and try to remain calm and still perform, in case they face such a situation. They tend to get disturbed by numerous distractions in their life, which consequently is reflected in their cognitive functioning also. Such students, if identified and provided timely assistance, will be insulated enough so that their cognitive functioning remains effective and does not negatively

interfere with their academics. Consequently, they are able to make a smooth transition towards work, which will be a great help to them on the whole.

Declaration of Conflicting Interests

The authors have no conflicts of interests with respect to the authorship and/or publication of this article.

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