Indian Virtual reality affective database with self-report measures and EDA

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ABSTRACT

The current work assesses the physiological and psychological responses to the 360° emotional videos selected from Stanford virtual reality (VR) affective database [Li et al., 2017], presented using VR head-mounted display (HMD). Participants were asked to report valence and arousal level after watching each video. The electro-dermal activity (EDA) was recorded while watching the videos. The current pilot study shows no significant difference in skin-conductance response (SCR) between the high and low arousal experience. Similar trends were observed during high and low valence. The self-report pilot data on valence and arousal shows no statistically significant difference between Stanford VR affective responses and the corresponding Indian population psychological responses. Despite positive result of no-significant difference in self-report across cultures, we are limited to generalize the result because of small sample size.

CCS CONCEPTS

• **Human-centered computing ~ Virtual reality**
• Social and professional topics ~ Cultural characteristics

KEYWORDS

Virtual Reality, 360° videos, Valence, Arousal, EDA

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1 Introduction

The advent of VR technology has made it possible to study psychological processes which were once unimaginable, especially in case of emotion experiences. It is assumed that VR 360° view and the dynamic nature of stimuli gives an extended degree of immersion and hence a better experience as compared to when the stimuli are presented using other modalities, such as movies on desktop or theater [Wilson and Soranzo, 2015; Srivastava et al., 2019].

The current study employs 2D circumplex model [Russell, 1980] to understand the affective emotional experience from Indian population. We are using valence, which measures how attractive or repulsive participant feels about a stimulus, and arousal that measures how awoke or activated the participant feels in response to the stimulus, for this study [Russell, 1980]. Different emotions fall in different areas of this 2D circumplex model [Russell, 1980]. Studies report a difference in emotion perception across cultures [Lim, 2016], where Western population report high preference to high arousal emotions and Eastern population shows preference to low arousal emotions [Lim, 2016], suggesting the role of social context in experiencing emotion. Currently, we have Stanford's publicly available VR database [Li et al., 2017] for VR effective research. This database reports valence and arousal ratings for 73 stimuli which lack responses from the Indian population. The validation of Stanford database becomes essential for future research related to the Indian population, because of the difference between emotional experience between Asian and Western population.

Though self-report measures are one of the most indispensable measures of emotion perception, they are still not sufficient measurements to assess one's emotional experiences. Studies have shown a correspondence between electro-dermal activity (EDA) and self-reported valence and arousal state of one's emotional experience [Mauss and Robinson, 2009]. The current study employs both: the psychological and physiological data to study the 360° VR affective stimuli. We used SAM scales for valence and arousal ratings as psychological measures (Figure 1) [Bradley and Lang, 1994] and for physiological data, EDA data was recorded while watching the videos.

2 Method

10 naïve university students (M = 5; F = 5; age range: 18-30 years), were recruited for this study. 10 videos (ranging from 1 to 10 minutes) were selected from the Stanford database based on their valence and arousal ratings. The scales for both valence and arousal were divided into three categories: high(rated>5.5),

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low(rated<4.5) and moderate (between 4.5 and 5.5) scale. Total four videos were used for high and low valence, four videos for high and low arousal and two videos for moderate arousal and moderate valence. The stimuli were presented randomly to participants using Oculus Rift CV1. We used BIOPAC MP150 system sensors with Acqknowledge 4.3 to record EDA data. The EDA data was recorded with and without event. Participants' were asked to rate the valence and arousal on the SAM scale (1 to 9, 1 being the lowest and 9 being the highest) [Bradley and Lang, 1994], immediately after completing each video.

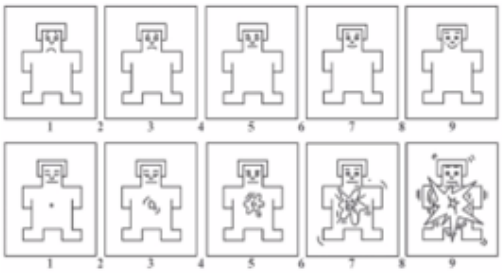

Figure 1: The Self-Assessment Manikin (SAM) used to rate the affective dimensions of valence (top panel - unpleasant -to-pleasant) and arousal (bottom panel - deactivation-to-activation) [Bradley and Lang, 1994]

3 Results and Conclusion

The EDA data collected with a sampling rate of 1000 Hz was analyzed using SC analysis software Ledalab (available at http://www.ledalab.de) [Benedek and Kaernbach, 2010]. Due to the duration of the videos, the data was quite large and hence was down sampled to 100 Hz. Then the data was smoothed with a gauss window of 8 samples width. Continuous Decomposition Analysis (CDA) was performed to obtain the change in skin conductance response (SCR) at various instances. The mean of these values, for each stimulus, was taken for further analysis. The pilot result shows no significant difference between the baseline SCR (presented as 0 level) and low, high and moderate valence rating. Similar results were obtained for low, high, and moderate arousal (Figure 2).

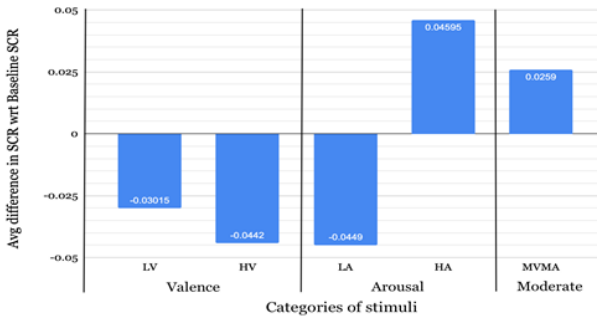

Figure 2: Difference between the baseline and affective SCR

A cartesian graph was plotted (Valence vs Arousal) to compare the Stanford ratings with the ratings that we obtained. Each point in the graph (Figure 3) represents the valence and arousal ratings of the 'n'th video in the Stanford database (refer to [Li et al., 2017] for the video number reference). The current pilot data shows partial alignment with the Stanford database valence and arousal measures, with certain exceptions: 1st, 20th, 50th, 58th and 67th video. We observed more variation in valence than in arousal.

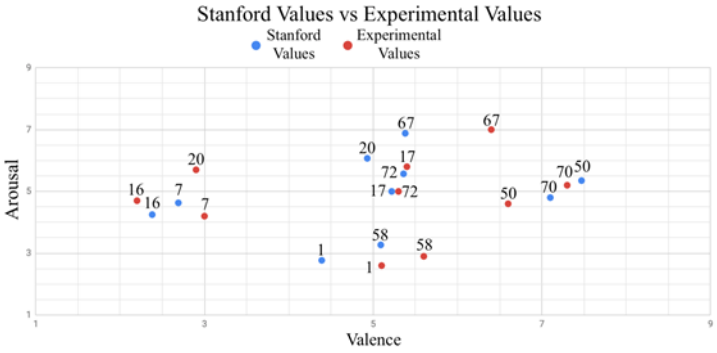

Figure 3: Graph comparing Stanford ratings with experimental ratings

The comparative variation in psychological responses favors the role of social context in emotion perception and experience. However, the current study is limited to generalize the cartesian distribution because of no statistically significant difference between the self-report from Stanford population and Indian population and the small sample set. We plan to extend this study further with an increased sample set and examine the correlation between behavioral, physiological and psychological data to perform better comparison with the Stanford database.

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