The Relation between Colors, Emotions and Heart using Triangle Phase Space Mapping (TPSM)

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Emotion is the complex psychophysiological experience of an individuals state of mind as interacting with environmental influences. Researches show that there is an association between colors, emotions and physiological response. Although the exact nature of the association is not well understood and there isnt any useful method for measuring emotions. In this paper, we try to find the relation between colors, emotions and heart response using Triangular Phase Space Mapping (TPSM), a novel method for representation of heart rate. TPSM is obtaining by using RR interval time series signal to plot the Triangle mapping consist of all the ordered pairs: (RR(i), abs(mean(RR)-RR(i))), i=1,,N. We used four colors as a visual stimulus while the lead II of ECG was recorded from 16 girls as subjects during the stimuli. For relating colors to the emotions, Self-Assessment Manikin Test and 2D emotion model were used. By analyzing the answers obtaining by the subjects in the experience, the results show that colors blue, yellow, red and green induced emotions pleasure, sadness, anger and joy respectively. For analyzing the heart responses to this stimulation and induced emotions, we used eight features obtained from TPSM. Kruskal-Wallis test was used to define the level of significance of each feature to demonstrate the usefulness of them in distinguishing responses to different colors and induced emotions. The results show that these features discriminate anger from sadness by $p<1E-3$; anger from joy by $p<1E-5$; anger from pleasure by $p<2E-4$; sadness from joy by $p<2E-3$; sadness from pleasure by $p<1E-2$; and pleasure from joy by $p<1E-2$. The results proved the hypotheses of relation between colors and emotions and effects of them on heart function without awareness of subjects. So it seems that TPSM is useful method for measuring emotions using heart response.