1. Introduction

Human evolution has focused on emotion. "...neurochemical processes by which the body monitors changes in its internal situation and is thereby alerted to the need for certain responses to its everchanging states" (Johnson, 2001). Emotion and cognition are strongly linked (Pessoa, 2013; Dolcos et al., 2014; Okon-singer, 2015). Emotion's influence in sensory binding is another hot topic of inquiry. Finally, the idea that all causal mechanisms in neuroscience can be formulated in terms of material particles inside the brain (thus, forsaking all intrinsically psychological contents) has one restriction: the natural laws motivating this idea have been shown to be limited in light of theoretical advancements in basic Physics in the late 20th century. Contemporary basic physical theory differs greatly from classic physics on how human consciousness enters into the structure of empirical phenomena, contradicting the older idea that local mechanical processes alone can explain all observed empirical data (Schwartz et al., 2005). This breakthrough has given neuroscientists and psychologists a new conceptual framework to analyze and characterize neurological and perceptual processes to varying degrees (Busemeyer et al., 2006, 2011; Khrennikov, 2009; Aerts, 2012). This non-classical framework is based on quantum theory, one of the most empirically successful theories of physics, and has introduced subjective and objective psychological constructs, tied by rules that directly specify the causal effects of the subject's choices on the brain without needing to specify how these choices came about. In Ochsner et al. (2002), intention-induced modulation of brain processes is essential for emotional self-regulation in the active cognitive reappraisal condition. This thesis aims to examine brain dynamics under the impact of external visual and auditory stimuli and the complexity and structural importance of the stimuli in triggering emotional responses in the observer.

In recent years, there has been a lot of growth in the study of how different bodily signs change over time [Dutta, 2016]. Analysis of linear statistics (like mean values, Fourier analysis, variability measures, and spectra analysis) of bodily data does not directly show how complicated, irregular, or predictable they are. Methods based on non-linear dynamics and "chaos" theories reveal subtle abnormalities in the physiological signals that may not be found by traditional (i.e. "linear") measures of variability. This makes them a useful tool for a thorough evaluation of the properties of complex physiological systems [Hausdorf, 2001]. With the development of nonlinear dynamics, it is now clear that simple nonlinear systems behave in a way that is highly complex and chaotic [Ikegawa'2000, Liu'2004, Grassberger'1983, Parker'1989, Buczkowski' 1998, Kim'1999]. This is because they are very sensitive to their initial conditions, and any change, no matter how small, will change their future forever. There is a self-similarity effect in complex signals. This means that there is a smaller scale structure that looks like the larger scale structure in complex biological signals like EEG, ECG, and EMG signals, to name a few [Ghosh, 2017]. Complex systems make data sets that change over a wide range of time scales and/or have a "broad distribution" of values. In cases with and without stability, natural changes often follow a scaling relationship over several orders of magnitude. Such scaling rules allow fractal (or Multifractal) scaling exponents to be used to describe the data and the complex system that created it. These exponents can be used to compare the systems with other systems and models as if they were fingerprints. Many data sets from experimental physics, geology, medicine, physiology, and even the social sciences and engineering (such as civil, mechanical, electrical, electronics, biotechnology, etc.) have shown fractal scaling behavior. Most of the time, the exact reasons why fractal growth is seen are not known. Fractal or Multifractal characterisation can be used to create substitute (test) data, describe the time series, and make predictions about extreme events or future behavior. But the major use is still to describe the different states or phases of a complicated system based on how it scales.

Several tools have been made so that fractal and multifractal scaling behavior in time series can be seen. In addition to older methods that assume the data are stable, there are newer methods that can tell the difference between real fractal dynamics and fake scaling behavior caused by non-stationary data. [Kantelhardt, 2008] Also, it is important to make a clear distinction between short-term and long-term relationships in order to show how fractal scaling works.

2. Objective

Our objective is to emphasize the following aspects:

- We use robust non-linear analysis of brain electrical activity and auditory and visual stimuli to study their neurobiological and cross-modal impacts.
- Comparative study between musician and non-musician using two opposite emotion invoking North Indian Classical Ragas along with color stimuli.
- Nonlinear analysis of cognitive engagements in different lobes of the brain using recitation and color as stimuli.
- Effect of syntax, semantics & prosodic on nonlinear analysis of audio and color stimuli with matching and contrasting combination.
- Translating this research into the development of a Automatic Emotion Recognizer.

3. Contribution of the Work:

The emotional tone of a person's voice changes the whole the mind and even the society. This is still something that needs to be looked into. In the same way, understanding music is also important. Honing et al. (2015) still don't know how people learn to understand music. A lot has been learned about where emotions come from and what affects they have. Answers to these questions can help us understand how music makes us feel or why its emotional traits are so widely appealing. Traditionally, a lot of these problems belonged to subjective reality, which was usually outside of scientific objectivity.

With the rise of cognitive psychology in the 1960s, scientists began to talk about the possibility and necessity of putting subjective experience back into scientific study. They also came up with experimental methods and theoretical models to help them understand the hidden mental machinery of human perception, cognition, and action. To quote the great E.P. Wigner (1995): "Both Physics and Psychology claim to be all-encompassing disciplines; the first because it tries to explain all of nature and the second because it studies all mental events, and nature only exists for us because we know about it. Both fields could still be combined into one without putting too much pressure on our ability to think abstractly. In physics, the first test of a scientific theory is how elegant and beautiful it is. This means that it should be able to explain a large body of knowledge using only a few basic principles and make statements that can be tested in the real world. Future study in the cognitive sphere should use all the big guns, like physics, neuroscience, and psychology, to create a mutual environment where ideas and their testability can grow beyond intellectual gate keeping. This thesis hopes to get the ball going in that way and be the starting point for such a huge project.