

The Brain's Response to Music with fMRI

Introduction

In 1993 fMRI (functional Magnetic Resonance Imaging) emerged as a new technique for MRI (Magnetic Resonance Imaging). This technique uses MRI technology to map brain activity in response to various stimuli. An opportunity to use an MRI scanner under the direction of Dr. Oliphant from the EE Department has presented itself. With this scanner, I would like to use fMRI technology to study the brain's response to stimuli of different forms of music.

Goals

1. As an Electrical Engineering major, one major goal of this research project is to better understand the signals and sequences associated with fMRI technology.
2. As a future Biomedical Engineer, another equally important goal is to discover the brain's response to various types of stimuli.

Objectives

1. Learn the fundamentals of Magnetic Resonance Imaging
2. Develop an appropriate pulse sequence for an fMRI experiment
3. Use fMRI technology to conduct a constructive experiment
4. Interpret the images received from the MRI scanner
5. Analyze the brain's response to soft and hard music
6. Analyze prolonged response to these stimuli

Pertinent methods

I will conduct this experiment by first familiarizing myself with the GE Dual Gradient MRI scanner and MRI technology in order to adequately carry out a scan and appropriately interpret the results. This will require that I develop an appropriate pulse sequence to conduct fMRI on the scanner. My Advisor, Dr. Oliphant, has conducted research with medical imaging devices before and will be resourceful in this phase of experiment.

Materials to achieve goals

I plan to use the fMRI machine available at the Utah Valley Regional Medical Center. As an alternate, there is an fMRI machine available at the University of Utah, which is accessible to students after proper procedures are followed.

Processes

The experiment will be carried out by selecting three individuals who will each undergo a series of seven 3 minute scans. The first scan will be a control measuring brain activity with no external stimuli. The following 6 scans will be an initial scan and a delayed time scan (10 minutes) of the brains response to 3 types of music: soft contemporary (The

Sundays), hard contemporary (Jimmy Eat World), and classical (Beethoven). Scans will be evaluated based on the image map that the MRI returns. The MRI scanner is sensitive to areas of increased blood flow and oxygenation. Regions of the brain that are being used and their level of activation will be highlighted on the image map. By comparing the image maps, I will observe how the brain responds to the music stimuli.

Expected results

I expect to discover 2 unique qualities about the brain from this experiment. First, music has a distinct and recognizable effect on brain activity. I expect that soft music will have a measurable response that is common to each subject and that is different to its response to hard or classical. I expect that the music stimuli will affect areas of the brain that regulate mood. The activation will most likely occur in similar areas for each genre of music, however I expect to see an increased level of activation for hard music as opposed to soft or classical. I will compare scans of all individuals for each genre of music to discover effects on the brain that are unique to that genre.

Second, the brain's response to music will change over time as it adapts to function in a different environment. I expect a decrease in overall brain activity as well as some areas that no longer are active. I will compare the initial and delayed response scans to determine how the brain adapts to the music background over time. I hope to discover that the brain adapts in such a manner that it uses less activity to respond to the same stimuli.