When objects in the world vibrate, pressure changes form sound waves. These waves are then propagated through air. Human hearing has evolved to adequately capture as much information about the environment as possible from these waves. Hearing is fundamental for a lot of specifically human activities, most obvious examples being speech and music. Pitch is a sensation that people infer from repetitive properties of sound waves. Many sounds in our environment produce pitch, as they consist of a fundamental frequency (F0), and a set of frequencies that are multiplications of the F0. Scientists think that detecting F0 is one of the main mechanisms of pitch perception, although the accurate description of this process is an area of intense study.

Here we propose a new view of pitch perception based on a theory of predictive coding. Contrary to popular belief, predictive coding proposes that perception is a process of making constant predictions about the immediate future. The sensory organs serve as a means to check the correctness of these predictions. If predictions are confirmed by the senses, everything goes well - the perception is successful. If not - prediction errors are transmitted through the nervous system to influence future predictions. According to this, pitch perception would result from the predictions about the future periodicities in sound waves.

Highly periodic sounds are called harmonic sounds. Example harmonic sounds are the sounds of people talking or musical instruments. On the other hand, if the sound is highly random (not periodic), it is called inharmonic. These sounds are often described as noises, pops, crackles, screeches etc. Previous studies have shown that harmonic sounds are easier to compare in terms of pitch while inharmonic sounds are more difficult to “hear out” in noisy backgrounds.

In this project we aim to investigate if harmonic sounds of changing pitch will produce a stronger brain response than inharmonic sounds. We think this is the case because changes in harmonic sounds should produce stronger prediction errors than changes in inharmonic sounds. We plan to use electroencephalography (EEG), a non-invasive procedure that records electrical brain activity. In three experiments, groups of volunteers will listen to series of artificially created harmonic or inharmonic sounds. Changes in EEG signal will be then compared to see if our predictions were correct.

The results of this project will help to advance knowledge of mechanisms of pitch perception. This is very important for our understanding of basic human faculties such as language or music. If the hypotheses gain support, it would highlight the role of predictions and harmonicity in pitch perception and in sound discrimination in general, providing new insights into the predictive nature of hearing. Potential future applications of this project include pitch-related algorithms for hearing aids, audio engineering and new music training methods.