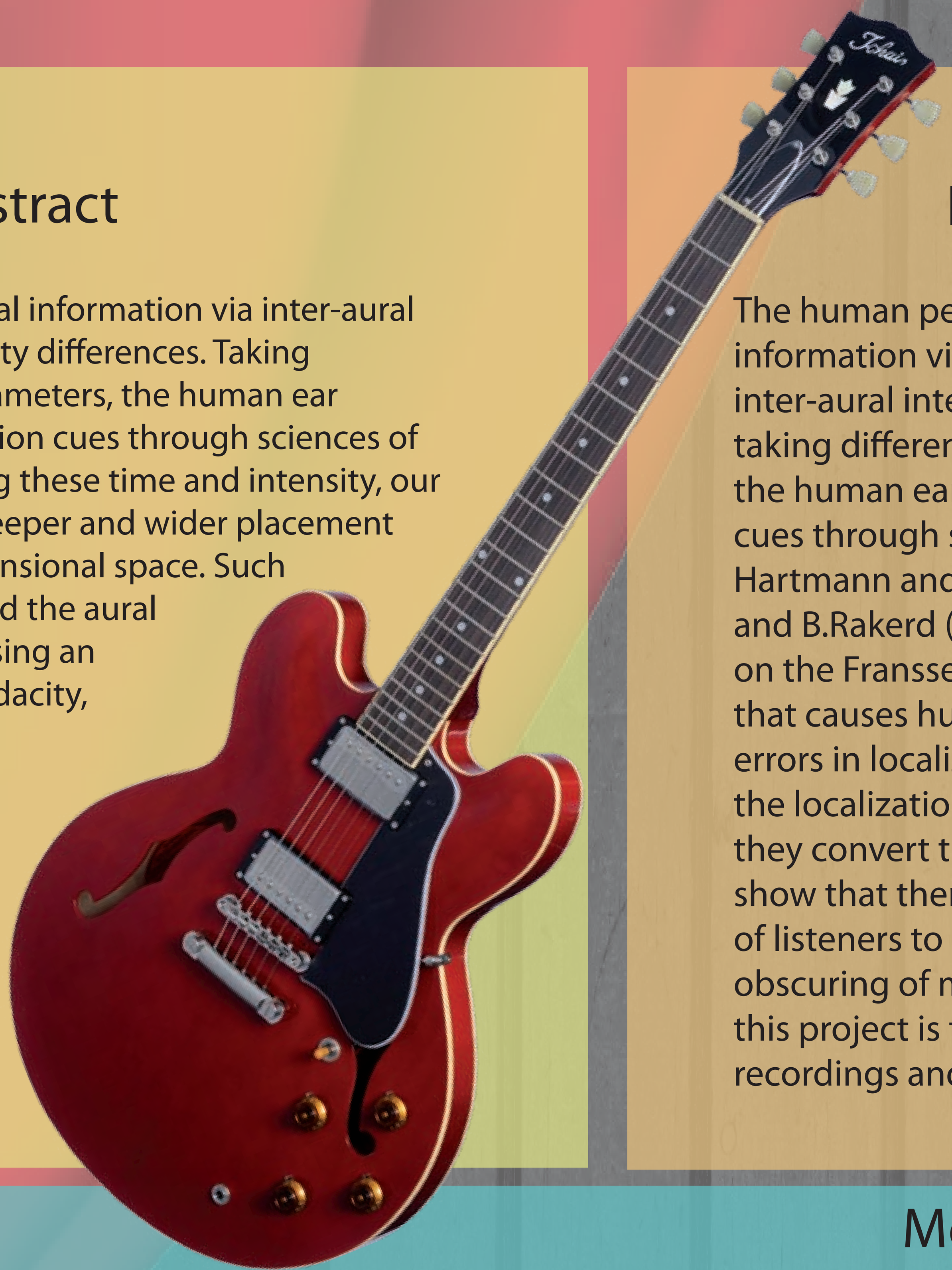
SPATIAL AUDIO ENHANCEMENT TECHNIQUES

Abstract

The human perceives spatial information via inter-aural time and inter-aural intensity differences. Taking differences from these parameters, the human ear determines sound localisation cues through sciences of psychoacoustics. By varying these time and intensity, our objective is to recreate a deeper and wider placement of sound sources in 3-dimensional space. Such enhancement would extend the aural sensation of the listener. Using an audio editor tool called Audacity, we carry out filtering and signal processing to simulate and recreate spatial sound cues to achieve the desired aural effect. Using binaural recordings and output,we are able to recreate a deeper and wider sound field.



Introduction

The human perceives spatial information via inter-aural time and inter-aural intensity differences. By taking differences from these parameters, the human ears determine auditory localization cues through sciences of psychoacoustics. Hartmann and Rakerd William M. Hartmann and B.Rakerd (1989) reported ona research on the Franssen effect, which is an illusion that causes human listeners to make large errors in localizing a sound source. To study the localization precedence effect (operating in rooms), they convert the illusion into an experiment. The results of the experiment show that there are two components contributing to the illusion. One of them is the inability of listeners to localize a sine tone in a room in the absence of an onset and the other is the obscuring of modulation cues by the irregular transient response of a room. Our objective of this project is to recreate (psychoacoustic) a deeper and wider sound field by using binaural recordings and output.

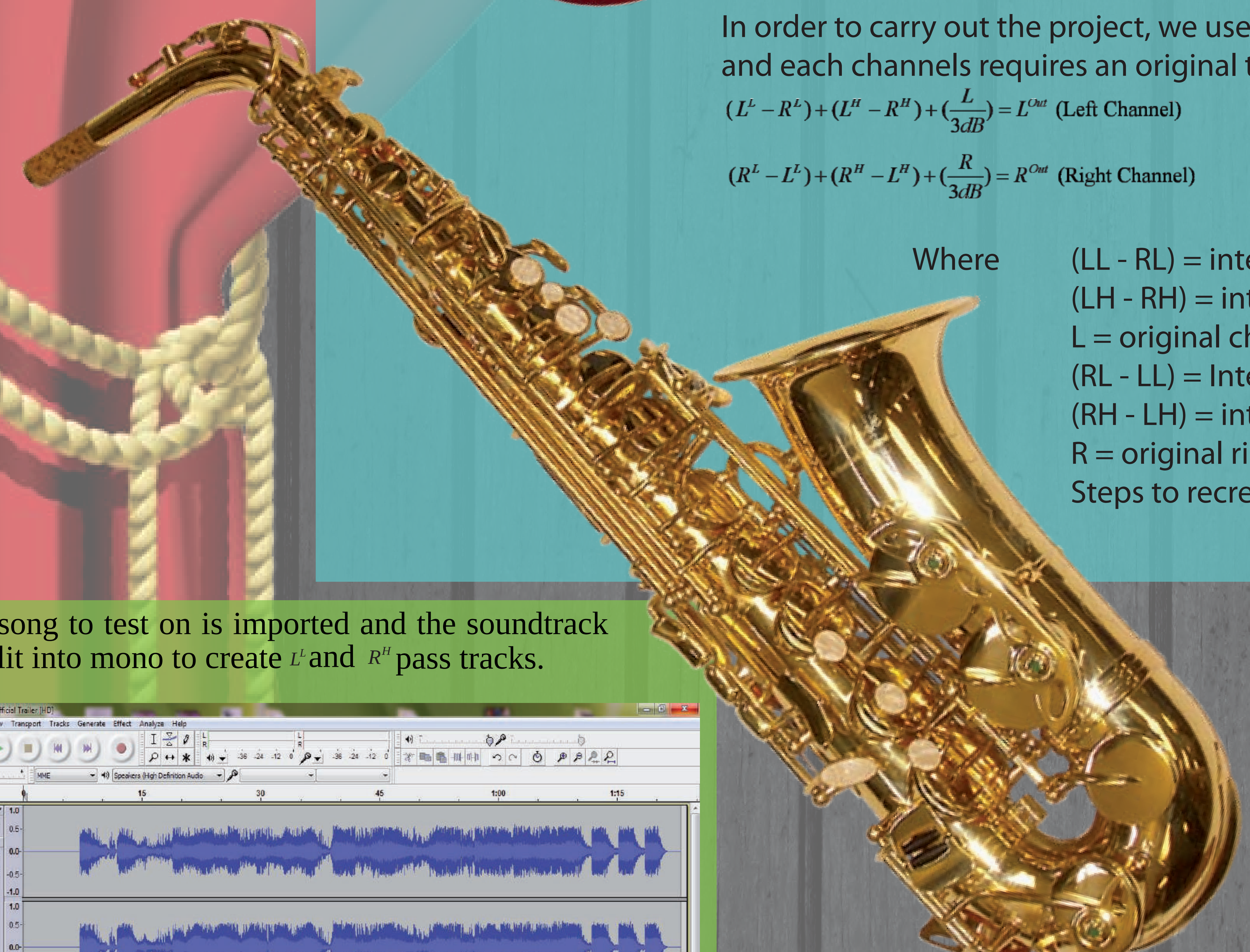
Methodology

In order to carry out the project, we used the equation (as shown below) which includes two channels (Left and Right) and each channels requires an original track, a low pass and a high pass track.

$$(L^L - R^L) + (L^H - R^H) + (\frac{L}{3dB}) = L^{Out} \text{ (Left Channel)}$$

$$(R^L - L^L) + (R^H - L^H) + (\frac{R}{3dB}) = R^{Out} \text{ (Right Channel)}$$

Where
(LL - RL) = inter-aural time difference for output left channel
(LH - RH) = inter-aural intensity difference for output left channel
L = original channel
(RL - LL) = Inter-aural time difference for output right channel
(RH - LH) = inter-aural intensity difference for output right channel
R = original right channel
Steps to recreate the new sound field



The song to test on is imported and the soundtrack is split into mono to create L^L and R^H pass tracks.

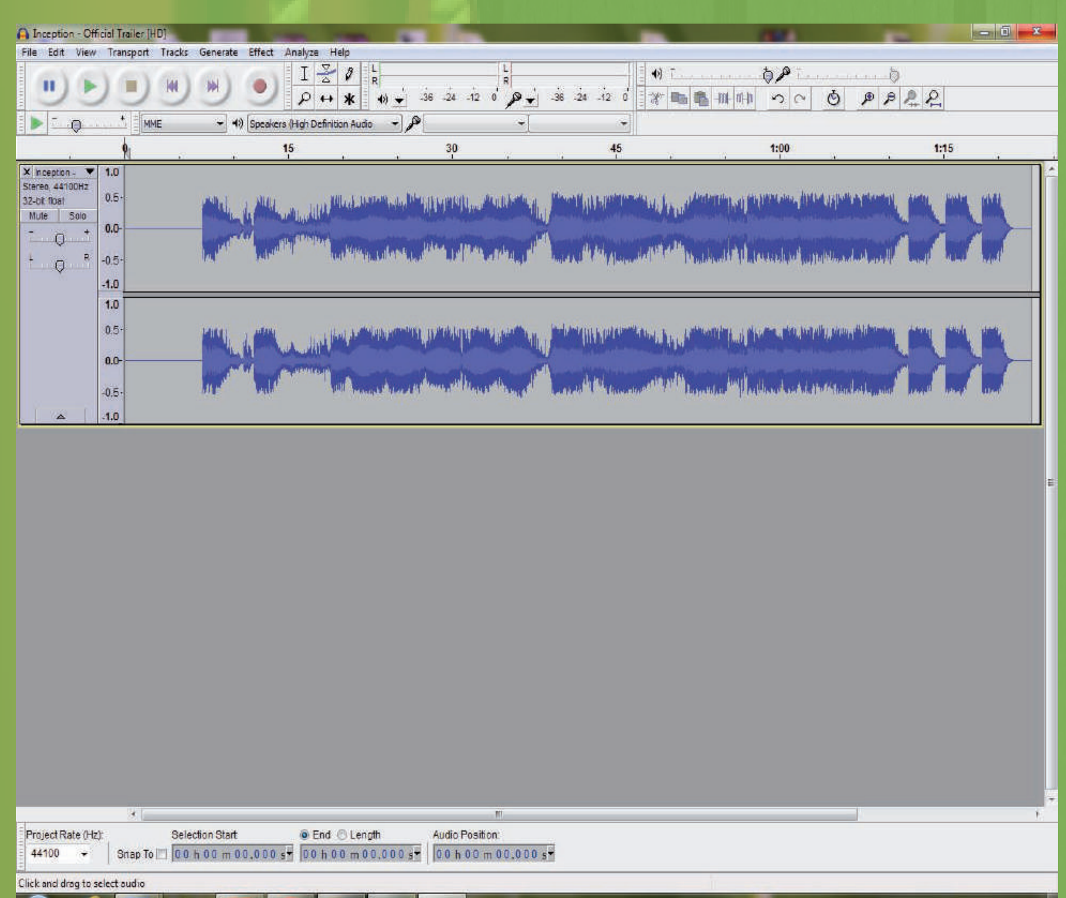


Figure 1: Importing sound track

Each channel is duplicated twice to obtain a total of 6 audio tracks. The tracks are named as follows: Left, Right, Left-high pass, Right-high pass, Left-low pass, and Right-low pass.

Conclusion

Although the effect of recreating the placement of sound sources in 3-dimensional space was brought out, the method used varies accordingly with different genres of music and sound. Due to differences in audio spectral energy content of music genre variety, we would have to experiment by changing the values of the high pass filter, low pass filter, amplified value, etc. Besides,to-date, there is no specific formula available to any genre in order to bring out the intended effect. Adding too much effect may sometimes cause the audio clips to be more distorted as compared to the original. Hence, we would have to experiment on other ways to bring out the intended effect.

Results

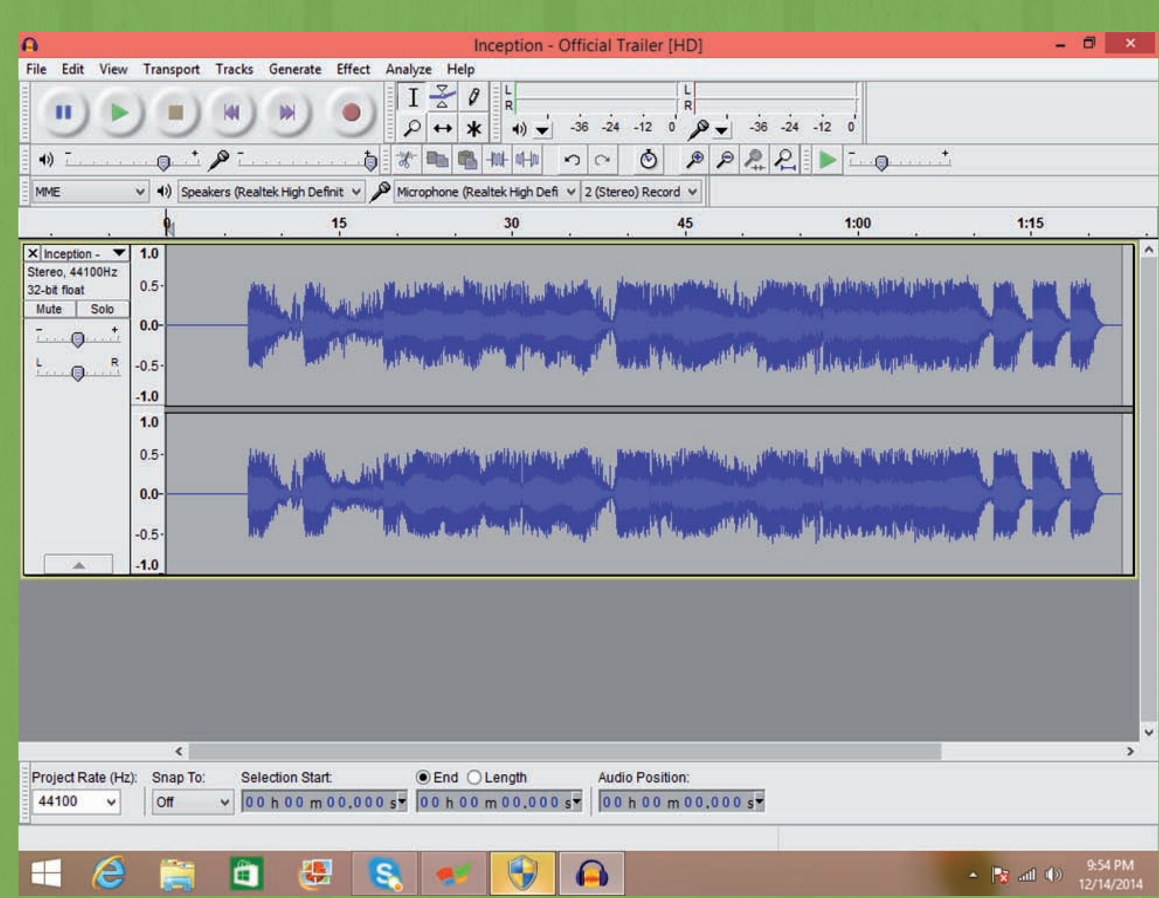


Figure 5: End product after using the formulas

Science Members:
Wong Shu Qi, Hu Zirui, Zhang Jian, Lois Yeo
NYP Supervisor:
Mr Cheong Chee Seng
ZHSS Mentor:
Mrs Lin Jiaxuan
AEP Members:
Chua Woon Khai, Celest Poh
AEP Techers:
Ms Ang Hwee Qin, Ms Magdalene Tan

SCIENCE AND TECHNOLOGY SYMPOSIUM 2015

ZHONGHUA SECONDARY SCHOOL 中华

NYP NANYANG THE INNOVATIVE POLYTECHNIC