Synthesis

A synthesis of the word 'short'

The goal of this project was to synthesize short(/ʃɔɹt/) using SynthWorks. In order to achieve this, I divided the synthesis into several steps: simplification, voicing, formant, pitch, amplitude, and naturalization. I modified the parameters little by little to improve the sound quality gradually. Feedback from the professor and the teaching assistant was extremely helpful.

1. Simplification

There are more than 20 parameters in SynthWorks. Since bandwidth (b1-b5, b#1 – b#5) is not necessary in prototyping, I removed it. I erased nasal parameters since they are not relevant to this project.

2. Voicing

By examining the spectrogram, I figured out that voicing starts at 285ms and ends at 550ms. I changed the amplitude of the voicing parameter (av) value during this period. Two devoiced sections exist, which are an alveolar fricative and an alveolar stop. Although they do not have formants, the frication noise was not distributed uniformly throughout the spectrogram. I followed the professor and the teaching assistant's advice to modify the values of these formants. Tweaking amplitude of frication noise(af) and aspiration noise(ah) created a reasonable /ʃ/ and the release of /t/. 
3. Formants

While a vowel sound lasts, the formants change constantly. This change creates a curve similar to a sine wave. Since it is a curve, it is not an easy job to create the graph since interpolating between two values creates a line, not a curve. Instead of interpolating between two points, I collected exact values of the formants by using “Create-Analysis-Table” Praat script created by Setsuko Shirai. I modified the original script to be able to collect formant values every 5ms. Also, I added a functionality to collect the fourth formant as well. However, some values were not similar to the actual graph. For these part, I modified and interpolated the data.

4. Pitch

Pitch occurs when sounds are voiced, which is from 285ms to 550ms. The modified version of Shirai's script did not give me a smooth curve on the spectrogram. Abrupt changes of the data were modified.

5. Amplitude

Shirai's script does collect the amplitude information. However, the values are too high in Syntheworks. I simply subtracted 20 decibels from the original values.

6. Aspiration & Naturalization

In my program, the release of /t/ sounded more like /s/. To fix this problem, I reduced the period of release of the burst. This gave me a /ts/ sound. Dampening the amplitude of the frication sound and adding the amplitude of the aspiration sound gave me a reasonable /t/ sound. Changes of op and tl parameter improved the voice quality.
7. Miscellaneous

The spectrogram which was reflected in SynthWorks created a bump around 350ms. It turned out that the abrupt changes of f1 values cause the problem. This issue was solved by examining each values of f1 and interpolating them.