

Assignment #3: Granular Synthesis / CSS

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I. INTRODUCTION

Granular and Concatenative Synthesis are powerful techniques in the audio domain. The first one consists of dividing a sound source (an audio file, for instance) into small grains whose duration is smaller than 100ms [1]. The second technique, as the name suggests, consists of concatenating short samples of recorded sounds, and it is used, for example, in speech synthesis [2].

This report describes a composition, using these two techniques, created with Pure Data (Pd) and Reaper, for the Sound Synthesis for Digital Media (SSMD) course (Master in Multimedia, FEUP).

II. RESEARCH AND EXPERIMENTATIONS

Composing music was always one of my weaknesses in the audio domain. I always focused more on the technical part due to my background. This work has led me to contradict that.

The starting point of my work was to review the concepts learned and worked in the classes about Granular and Concatenative Synthesis. From there, I expanded my research to know more about these two techniques and how to compose with them. In the next subsections, I explain in more detail the experiments done with both techniques.

A. Granular Synthesis

Since the first stage of this assignment was mainly experimental, I tried every Pd patch from the classes.

Starting with the granulator and using the random walk algorithm, I experimented with several sounds, from simple sound effects to songs from various genres. I also tried generating only simple grains instead of creating a full sample with the granulator.

Besides exploring Pd patches, I also explored some programs, such as Audio Damage AD046 Quanta [4], but unfortunately, the best programs are paid, which led me to abandon this approach.

This stage helped me understand the technique's potential and possible uses in this assignment. From these experiments, I concluded that this technique could be helpful for time-stretching or pitch-shifting of audio samples. Overall, the results I obtained with this technique did not look good to create a composition, so I only used it to generate short effects.

B. Concatenative Synthesis

Moving on to the second technique, I tested several applications learned in the classes, including mosaicing, shaking, visual navigation, and a continuator. From what I experienced, the most promising application would be the continuator. However, it felt that it did not have the musicality needed from a composition.

Besides the patches studied in the classes, I explored earGram [3], and I decided to use it as the main component of the composition. I experimented with various songs' genres and sound snippets, concluding that the best approach was using classical music as the basis with percussion instruments complementing it.

C. Sampling

Besides the two main techniques examined in this assignment, I also explored Sampling, part of the Granular Synthesis class. With this technique, I could reproduce songs, or parts of them, at different speeds, including playing them backward.

III. COMPOSITION

As said before, the main objective of this assignment was to create a composition based on

the Granular and Concatenative Synthesis. After all the experimentations described in the previous section, I composed a small piece, with about 2 minutes, using these two techniques and sampling.

A. Main Idea

The composition should show something similar to a soundscape, where the listener can experience a stormy, rainy day.

The basis of the composition is the song “La Valse D’Amelie”, from Yann Tiersen. With sampling, the music plays backward. This approach transmits sadness, typical of the days the song tries to represent. The generated version of the song also has a part that can be interpreted as the hope that the rainy weather will blow over and give way to better days.

B. Concatenative Synthesis

To complement the song, I used earGram [3], with a short modification to allow recording sounds, to generate several layers according to it. I used random percussion instruments and recordings of a buoy sound and a thunderstorm. I also experimented with other percussive sounds, such as beatboxing and drones, but none of them seemed to fit this composition well. With these new layers, the composition became more appealing, resembling even more to a soundscape.

C. Granular Synthesis

As said in the previous section, the experiments with Granular Synthesis did not achieve a great result. Thus, this technique was only used to generate some effects.

The first one was recorded using the granulator already mentioned, which used the random walk algorithm to play different grains. Using drums and applying some reverb, I could achieve a powerful sound that looked good with the thunders.

Finally, the second and last effect was recorded from a bongos’ snippet. By recording some grains of this sound, I could recreate the sound of waterdrops dropping in some wood material.

D. Final Result

As said before, this composition was divided into several layers. I used REAPER v.6.43 to gather all

the layers into the final result. There were also some effects applied within REAPER to improve the sound quality, such as the VST Omnicompressor and band-pass filters.

The final result is available in [this folder](#) in the mp3 and the WAV format. The full REAPER project, with all the assets generated for the composition, is available in [this compressed file](#).

IV. CONCLUSIONS AND FUTURE WORK

Although the final result could be improved in several ways or be reproduced using different techniques, I think I achieved a very good result. Other people have heard this composition and described it as melancholic, as people usually feel when it rains, which was its main goal. Besides, with this assignment, I learned a lot more about Granular and Concatenative Synthesis and discovered several programs that could be helpful to apply these techniques in the future.

In future work, I could explore even more the Granular Synthesis to generate different effects, more characteristic of rainy days. I could also explore these techniques separately, explore other concepts, or even explore other feelings by creating other compositions. Last but not least, I think that exploring tools, such as AD046 Quanta [4], can help the students to easier understand these concepts.

V. REFERENCES

1. Bernardes, Gilberto. Granular Synthesis. https://moodle.up.pt/pluginfile.php/139722/moodle_resource/content/0/Aula%236.pdf
2. Bernardes, Gilberto. Concatenative Sound Synthesis. https://moodle.up.pt/pluginfile.php/144946/moodle_resource/content/0/Class%238-CSS.pdf
3. Bernardes, Gilberto. (2020). earGram. <https://sites.google.com/site/eargram>
4. Audio Damage. (2022). AD046 Quanta. <https://www.audiodamage.com/products/ad046-quanta>