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Advanced Technologies in Music Production and Collaboration

David Besonen

Abstract

My Honors Senior Creative Project was to compose and produce a short album of original music alongside talented musicians here at the University of Nebraska-Lincoln (UNL) as well as around the world.

Purpose

This project gave me the opportunity to utilize the skills I've learned in my major and minor degree programs by combining my passions for both computer science and music technology. In addition, producing an album of original music has given me the opportunity to explore the practical applications of my UCARE research, which was to design a phase vocoding musical instrument called a "harmonizer."

This project has also helped me to push my own perception of what it means to digitally collaborate on music. Due to the COVID-19 global pandemic, very little of this project involved in-person interaction. I was forced to find creative solutions to writing music that didn't involve necessarily being in the same room as another musician. By leveraging the different technologies available to me, I was able to do even *more* than I thought possible, even involving an artist from Australia in one of my songs.

Overview

This short album consists of five original compositions, written by myself and Erik Skoog, a fellow STEM major and music technology student here at UNL. Each composition features a different musical style, as well as different musicians Erik and I know and have met during our time in the various music ensembles offered by UNL's Glenn Korff School Music. The musical styles we have chosen to emulate with our compositions include jazz, contemporary, alternative, and pop genres, making this album very diverse in nature.

Sparrow is the first composition we have completed. This piece features Erik and myself on piano, saxophone, and percussion. *Sparrow* also features Noah Floersch, a talented vocalist and former UNL music student, as well as Little Green, a local artist from Sydney, Australia. I met

Amy (Little Green) over social media during quarantine over the summer of 2020. We found each other's music on Instagram, started talking and decided to start writing together.

Sparrow features components from a variety of musical genres, including pop, rock, and alternative styles, with a heavy overall jazz influence. Both Erik and myself understood the vast production possibilities that this piece presented due to the convergence of contrasting musical styles and talented array of musicians we were working with. We were able to employ many of the music production techniques we'd learned in class, as well as other tricks we've both picked up in our separate musical endeavors.

Clouds is the second composition we have completed for our album. This piece also features Erik and myself on instrumentals, as well as our friend Stefanie, who is a talented vocalist and marketing major here at UNL. *Clouds* has a very different feel than *Sparrow*. It is a light-hearted pop tune with a jazz influence that makes you want to tap your foot and relax at the same time. When writing and producing this tune, Erik and I wanted to see how much we could make with as little as possible. This mindset was applied to lyrics, instrumentals, overall complexity and production. We are both very happy with the result.

Technical Analysis of Work

One way we added excitement and depth to the sonics of our music was by using a vocoder called VocalSynth 2 to augment our singer's voices. A vocoder is a type of digital synthesizer that produces a certain sound from an audio file. In this case, our vocoder replicates a singer's voice across a series of pitches chosen via a MIDI keyboard. This creates a rich wall of sound by making a single vocalist sound like a choir. Based on the various settings you can manipulate, this sound can add an edge to the sound that's hard to determine when listening, but obvious to hear if it were taken away.

VocalSynth 2 plugin from 'Sparrow' Logic Pro X Session

I learned about this particular vocoder while researching phase vocoding alongside Dr. Justin Bradley during my sophomore year. As a UCARE scholar, I developed a vocoder called a "harmonizer" that was very similar in concept to VocalSynth 2, but with less functionality.

My harmonizer read in MIDI values from a piano keyboard and stored them in an array. It did this while also analyzing the pitch of a vocal signal that was being read in real-time. It then applied a pitch shift to a duplicated vocal signal based on the corresponding MIDI value in the array, and output it along with the original vocal signal. The result was a vocal chord. Below is a pseudocode depiction of the logic used to develop the harmonizer.

```
//A MIDI value is the numerical value for a note on a piano.
//For example, a middle C is MIDI value 60
while → program is running
        signal → audio signal from microphone
        midiMessage → MIDI value from piano keyboard

        for 0 → number of MIDI signals received
                if note is pressed down
                        add it to array of MIDI values

        for 0 → number of elements in MIDI array
                midiValue → current MIDI value
                difference → difference (Hz) between vocal signal pitch and midiValue pitch
                shift the duplicated audio signal by difference
                output new audio signal
```

In addition to a vocoder, we also utilized a complex keyboard library called Keyscape to add depth and maturity to our compositions. Keyscape is an amazing piano library that features 36 different keyboard instruments, as well as 500 different configurable piano sounds. We used it to add soft electric piano textures in *Clouds*, as well as more aggressive, energetic sounds to *Sparrow*.

Keyscape Soft Piano Keyboard Patch From 'Sparrow' Logic Pro X Session

Keyscape Rhodes Electric Piano Patch from 'Clouds' Logic Pro X Session

While we were able to maintain safe distance from the artists we were collaborating with by largely limiting in-person interactions over the course of this project, Erik and I were still able to get together and record in a safely distanced environment when necessary.

Erik Recording Drums in the Glenn Korff School of Music Studio

Conclusion

This project has taught me what it means to dedicate yourself to a certain goal while also giving me the opportunity to further explore my passions for computer science and music production. Erik and I will treasure this music we were able to create together for years to come; a sonic reminder that even dark times can yield tremendous beauty. I would like to thank Dr. Justin Bradley for assisting me in the development of a harmonizer, for teaching me how to research, and for showing me what it means to apply myself in ways I never thought possible. I would also like to thank Dr. Tom Larson for his meaningful instruction over the past few years and thoughtful advice on the music Erik and I have created together. Their impact is all over this project, and I am sincerely thankful for their assistance.

Deliverables

Sparrow .mp3 file

Clouds .mp3 file

Google Drive Folder Link

https://drive.google.com/drive/folders/1v9jDw5KljfroLwJIQoOe_ktO7VWIVtKV?usp=sharing