# WANTS

("We Are Not the Same")

8 Channel Piece for Soprano and Motorcyclist

MAT 276N Final Project

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## Introduction

The idea for this piece came to me as I was taking my weekly ride down California's Pacific Coast highway on my motorcycle. Perhaps due to the intensely focused, trance-like state of my mind while riding at highway speeds for most the 90-mile trip from Santa Barbara to Santa Monica, hints of musical structure started to appear in the environmental noise reaching my ears through the helmet. With each trip I became more and more aware of certain points of climax in the ride along with the crescendos of noise leading up to them as I would drive at higher speeds to approach windy areas near the ocean. I wanted to capture field recordings of this experience.

Though often intense, a long ride can also lead one to a state of thought and reflection. For me this usually involves thinking about how my personality and surroundings have drastically changed since moving to California. I remember parts of me that are no long present within myself (such as the part that once said he would never own a motorcycle because they were too dangerous), and I think about the kind of person I am becoming with all the new creative stimuli in California. I wanted this piece to contain a major component to express the simple idea that "We are not the same" where "we" refers to the dual personalities present within any person experiencing drastic change in his or her life. The acronym for this phrase is also a duality in the sense that it refers to our "wants."

## Techniques

Driving and "playing" a motorcycle while attempting to capture properly leveled field recordings is not a trivial (or safe) task. I wanted to find a somewhat controlled environment to record while driving- something low in traffic with relatively few sharp turns where I could slowly build up speed. The PCH tends to be high in traffic on the weekends, contains several sharp turns, and often has windy conditions that interfere with recording. I decided to record on the safer, relatively quieter section of highway 101 just north of Goleta, CA. The ride starts in a neighborhood off of Cathedral Oaks road, slows and accelerates at a few stop signs, reaches a faster point at a 50mph section of Cathedral Oaks, and eventually leads to higher speeds on the 101. It took me 5 attempts to learn the highest possible gain setting for the recorder that would still prevent clipping from highly transient noise. I used an Edirol R09 recorder with an electret condenser microphone placed in each of my ears under my helmet.

Vocals for this piece were captured from Sasha Metcalf, an opera-trained soprano and graduate student in the music department at UCSB. She was told to sing, read, and whisper the phrase "We are not the same" along with the individual words of the phrase in English and French. I did not direct the key that she was to sing in, but simply gave instructions as to whether she should sing higher, lower, louder, quieter, and with more or less vibrato. I also specified whether I would like

a more varying and dramatic phrase, or a more monotone reading. Recordings were made in UCSB's Studio Varese on a MOTU Ultralite with Shure Beta 58a microphone.

Once all sounds had been collected, the next task was to edit the best takes and create a scheme of organization. I began by cutting up the vocal samples in Ableton Live. No warping or sonic manipulation of any kind was done the vocals. I simply divided the words and phrases into different categories based on language, take number, and word or phrase.


*Ableton Live clip view. Two tracks for each category: spoken words, spoken phrase, sung words, sung phrase, fast (spoken), whispers, screams*

Categorizing the motorcycle recordings was a much simpler task since the rides themselves provide the underlying macro-structure to the piece. In the end I had only 3 usable field recordings from the rides, each 3-5 minutes in length. I took the best starts, stops, accelerations, and high-speed noises from these and laid them out using 2 pairs of 4 stereo tracks in Logic Pro.

Using an Akai MPD 32 midi controller, I assigned each pad on the controller a word or phrase and recorded my playing of the pads live in Ableton (after several takes) to match the underlying motorcycle track. The Structure section of this paper talks more about the chosen structure of the sequences of words and phrases. Once each section of the vocal sequences was completed, it was rendered as a .WAV file to be read by my MATLAB spatialization routine.

One of the aesthetic goals of my piece was to implement several high-speed circulations of sound as well as Fibonacci spirals of sound. Commercial applications such as Logic Pro and Pro Tools HD have surround sound panning utilities, but at least in Logic these are limited to standard surround setups (quad, 5.1, 7.1, etc). Even given an octaphonic panner with automation, it would be extremely tedious to realize a sound that circles around one's head thousands of times within a minute. I found that programming a spatialization routine in MATLAB allowed me to have precise control over the number of circles a sound made in it's duration, as well as create an algorithm for computing the radius at any given time for a Fibonacci spiral. See Appendix A for the MATLAB code.

The MATLAB routine assumes the eight speakers are placed equidistantly on a unit circle with the +90 degree location facing the listener. The program takes as input the number of spirals or circles the sound should make over the course of its duration and computes an angle (theta) for each sample of the sound. Using the angle and radial distance of the sound, the program computes the distance to the nearest speaker location. Then, a gain reduction multiplier is computed from 1-0.5*distance. So, for a sound at the opposite end of the circle from the speaker (distance = 2), the multiplier is 0, and for a sound at the speaker location (distance = 0), the multiplier is 1.

Fibonacci spirals are essentially circles with a continuously decreasing radius. For each 90-degree arc, the radius of the spiral decreases from one Fibonacci number to the previous. Thus, 4 times the number of complete 360 degree spiral rotations will give the index of the highest Fibonacci number needed to construct the spiral. For example, a 720-degree (twice around) spiral would require 2*4 = 8 Fibonacci numbers. However, since my program divides the gain of the sound by the square root of the radius, the first Fibonacci number, 0, would result in infinite gain once the center of the spiral has been reached. Thus, for 2 rotations, my program would read2*4+1 = 9 Fibonacci numbers to reach a final radius of 1. So the radius of the spiral would begin at the 9$^{th}$ Fibonacci number, 34, and decrease to the 8$^{th}$ Fibonacci number, 21 after 90 degrees, and continue.

Running the MATLAB routine for each sound results in 8 mono sound files, one for each channel. The spacialized sound files were imported into Ableton Live's multi-tracking view. For example, the first section of the piece involves 2 Fibonacci spirals and 4 circles simultaneously, for a total of 2*8 + 4*8 = 48 tracks. Setting a single slider on my midi controller to simultaneously control all 8 channels of a particular sound allowed me to mix the spirals and circles. The final mixes were then recorded down to 8 tracks in Logic Pro.

## Aesthetic Goals

For the listener there are two sources of sound: the environmental noise reaching the ears through the motorcycle helmet and the voices of thought coming from within the rider's head. The underlying motorcycle tracks define their own aesthetics and are for the most part left unaltered. Attention to detail was taken in the recording of the rides.

However, sonifying voices in one's head is much more open-ended. I chose to let the sonic qualities of the voices remain unaltered, so as to represent purity in the connection between the rider and his thoughts. The piece was composed so that the intensity of the level and timbre of the voices matches sections of the ride. While the correlation between intensities is often consistent, there are also times of anticipation or recovery that do not map to direct correlations between voice,

machine, and environment. I choose to use two languages for the vocals, English and French, to add to the theme of multiple identities.

Spatialization proved to be the key in representing the voices. There is no way (other than perhaps defining various pathways of neurons) to accurately define the space within one's head from which thoughts are "heard". To represent space within one's head and utilize a circular 8-channel speaker arrangement, I decided to use several overlapping circles of sound moving in contrasting clockwise and counterclockwise directions at once. The Fibonacci spirals approximate the golden ratio at larger distances and provide a continuously worse approximation as the sounds move closer to the listener. Thus, the spirals serve as a way to build into chaotic sections. The circulations of voices move at rates varying from about 2 rotations per minute to 2000 rotations per minute. I experimented with the high-speed circulations to explore the effects of wave field synthesis. The vibrating, humming, buzzing tremolo effects of the resulting wave field synthesis often complement the hum of the motorcycle engine.

## Structure

The piece is divided into three sections with a single underlying macro-structure based on a motorcycle ride. As the ride begins we hear the engine start and slow accelerations as the voices invoke potential for excitement. There are a couple slowing and stopping points due to stop signs in the road. The voices become more serious and focused as the speed of the ride increases, though the words are not made completely clear. The overall vocal structure of this section includes two Fibonacci spirals of sound of 5 and 8 rotations traveling in opposite directions. Additionally, 4 other circles of sound with number of rotations determined by the Fibonacci numbers 233, 377, 2584, and 4181 fade in and out. The first section ends after the rider slows down to a break in the ride after a moderately high-speed section of the ride.

The second section begins with a low clicking sound, the sound of the rider fully closing the windshield on the helmet. This sound signifies that high speeds will be reached soon. Before reaching these speeds, the second section slows down and repeats the helmet shutting sound to enter a non-real-time state in which the rider is preparing for transformation of self by riding at high speeds. The voices, traveling in high-speed circles, now become much shorter in duration and the listener can begin to decipher some of the words, though they are in two languages. The rhythm of the section increases in speed and the voices become more coherent until finally the phrase "We are not the same" can be heard clearly in both languages.

Once the phrase is clearly stated, acceleration of the motorcycle begins to take us into the third section. The voices become incredibly fast whirling whispers that begin to blend in with the environmental noise. There are breaks in the intensity of the ride caused by the rider ducking under the windshield of the bike in

which the whispers become coherent and restate the phrase.  The speed continues to increase and the voices are no longer words but screams traveling in opposing directions in the rider's head until finally the ride comes to a stop.  The bike is turned off and we heard the rider dismount and take off his helmet to reveal the sound of the outside world.

**Appendix A. MATLAB Spacialization Routine**

```
% Ryan McGee 2009

snd = wavread('whisper1.wav'); %input wave file
sndsize = size(snd); % get size array [number of samples,
number of channels]
ss = sndsize(1); %number of samples (note: matlab's lowest
index is 1, not 0 like in c++)
FS = 44100;
%%%%%%%%%%%%%%
startdeg = 90; % starting position in degrees
C1=112.5; % octaphonic speaker positions in degrees
C2=67.5;
C3=247.5;
C4=292.5;
C5=157.5;
C6=22.5;
C7=202.5;
C8=337.5;
Cdeg = C1; % position of speaker for channel to be rendered
in degrees (must currently run program 8 times per sound)
direction = 1; % 1 for CCW, -1 for CW
wavname = 'whisper1_fib8CCW_Ch1.wav'; %name of output
soundfile
numCircles = 8; % number of circles or 360 rotations in
fibonacci spiral
%%%%%%%%%%%%%%

fibNumIndex = 4*numCircles + 1; % required length of
fibonacci seq based on number of 360 rotations
samplesPerCircle = round(ss/numCircles);
samplesPerFibArc = round(samplesPerCircle/4);
lastFibArcStartIndex = 1; %sample index for beginning of
last fibonacci arc

%%%%%%%%%%%%%%%%%%%%%%
%initialization
fib = zeros(fibNumIndex, 1); %array of fibonacci numbers
theta = zeros(ss, 1); %angle of sound
R = zeros(ss, 1); % radius
unitDistance = zeros(ss, 1); % distance multiplier
sndC = zeros(ss, 1); %output sound array
time = 1:ss;
time = time./FS;

%%%%%fibonacci%%%%%%%%
fib(1) = 1;
fib(2) = 1;
```

```
for i = 3:fibNumIndex;
    fib(i) = fib(i-1) + fib(i-2);
end

R(1) = fib(fibNumIndex);
%%%%%%%%%%%%%%%%%%%%%%%

for i=1:ss;

    theta(i) = direction*round(((360*numCircles/ss)*i)) +
startdeg;

    if(mod(i, samplesPerFibArc) == 0 && i ~= ss) % (if
theta is a multiple of 90 degrees)
       fibNumIndex = fibNumIndex - 1;
       lastFibArcStartIndex = i;
       R(i) = fib(fibNumIndex); % R is a fibonacci number
       R(i)
    else
        if(i == 1)
            R(i) = fib(fibNumIndex); %initial R
        else
            if (fibNumIndex > 2)
                R(i) = fib(fibNumIndex) - (fib(fibNumIndex-
2) * (i-lastFibArcStartIndex)/(samplesPerFibArc));
            else
                R(i) = 1;
            end
        end
    end


     if(mod(i, 1000) == 0) %output samples processed (to
monitor processing)
          i
     end

end

    unitDistance = sqrt((cosd(theta) - cosd(Cdeg)).^2 +
(sind(theta) - sind(Cdeg)).^2);
    sndC(:, 1) = (1./sqrt(R)).*(1 -
0.5.*unitDistance).*snd(:, 1); %use for spiral
    %sndC(:, 1) = (1 - 0.5.*unitDistance).*snd(:, 1); % use
for circle
    wavwrite(sndC, FS, wavname); %write the wav file
```