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Senior Integrative Project Thesis

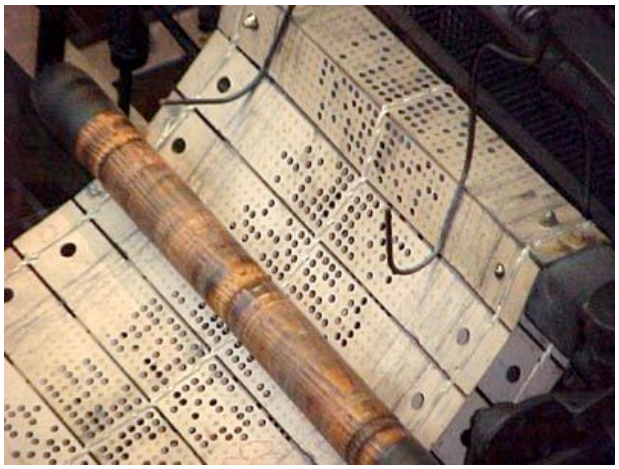
Rhythms in Twill: Interpreting Musical Patterns

My work seeks to translate the intangible into the tangible using the centuries-old traditions of classical music and weaving. Both share a fundamental similarity in that they are governed by rhythm. In music, rhythm relates to the measure of the time and variations of stress in a composition. Weaving relies on the physical movement of yarn interlacing, a rhythm experienced by the weaver. My project aims to connect the two art forms through another element: mimicking the process of a computer program. I set up a rule system to determine the effect the music has on the pattern of the weaving. This rule system is based on a musical score, such as the musical line direction of the notes, rests, and other characteristics that dictate exactly what I weave. The weaving pattern I chose is simple and variable in the direction, color, and thickness. In that way, I am using these variables just as a computer would, translating the different inputs of the score into the output of the weaving. As a result, my project combines the past and present, using music, art, and historical technology and logic. This combination makes apparent that technology can be used as a tool for creation but cannot entirely replace traditional creative methods such as weaving.

I knew I wanted to weave for my senior thesis, though the process and products were open to change. Weaving is a physical process. It draws me in because of the connection I feel with the materials: handling the yarn, the wooden shuttles, and using my feet to control the loom harnesses. My original plan was to use microscope images and measurements of earth activity and combine them with weaving techniques to create abstract biological work. I was interested in weaving without a plan and using my own

imagination to create the compositions. After awhile, the realization sunk in how much my project lacked direction, variation, and refinement. The weavings I had completed contained no sense of order or relationship to my original intention to describe the interconnection of nature. I had very little explanation for the final appearance, other than that I wove it without planning. Weaving is one art form that suffers from lack of planning. The process requires some math, and there is no way to view the entire weaving as it is being woven—it is rolled up out of the way, still connected to the loom. It is very difficult and time-consuming to change what has already been woven.

Taking note of these realizations, I returned to my original interest in rhythm. I began to look at other forms, such as speech, biorhythms, Morse Code, and music. Music offered me the most opportunities for variation. It also plays an important role in my life as entertainment, expression, and a means to connect with other people. Several of my past art pieces have been described as "musical"; it has been a constant, underlying theme in my work. My pieces are "musical" in the way that there is a flow to them—I provide ways for the eyes to follow particular connected forms through patterns and lines. In this way, the process of weaving is very much like the "musical" aspects I produce in my work. For reference, I looked at the history of weaving, specifically at the Jacquard loom. This particular loom was developed in the 1800s to create complexly patterned textiles in shorter amounts of



1. An example of the Jacquard cards

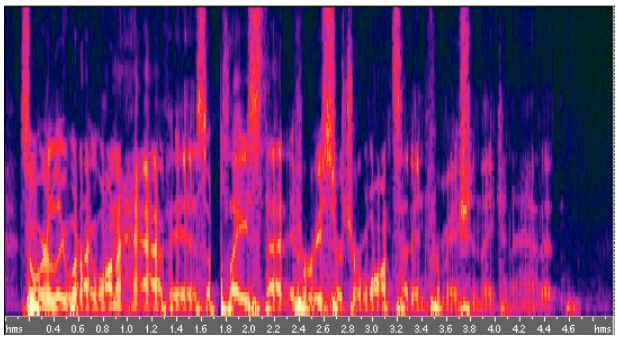
time, as a result becoming more cost-effective. It has been called one of the first computers, as it operated by reading punch cards. In the picture example, you see the wires traveling over the holes in the punch cards, sending a message to the rest of the loom to weave a certain way. I was interested in this process of reading an outside source to give me less control and more irregularity. By reading from a source and converting it to a textile, I understood that I would become the "brain" of the computer. I could translate a sequence of operations, guided by the music, into different variables of a woven pattern.

Following this principle of programming, the idea of automatic musical devices caught my attention in my research. These devices, such as the player piano and music box, were created to play music automatically using a programmed mechanism. The programmable mechanisms contained different visually interesting interpretations of music. These interpretations, such as the piano roll for the player piano, were set up in a way that allowed the pitch and time to be distinguished. The piano roll follows the same rule as the Jacquard cards—the music is represented by holes, which create a sound as a device moves over the hole. I began to study this reading of music, while researching more ways that music can be described besides in notation. On the piano roll, there is an axis of time and of pitch. The particular

2. The player piano reading the music

instrument limits the pitch axis, but the time axis can potentially go on forever. The time axis is the length of the roll inside the player piano. I also found these axes apparent in the spectrogram, which is another visually interesting interpretation of sound.

Spectrograms are results of spectrographs, which measure wave frequencies and organize them into a readable product. Spectrograms use the same axes of pitch and time as the piano roll, but also add a new dimension by describing the dynamics as well. They do this by producing lighter or darker tones of color. My weavings are following the setup of the piano roll and spectrogram—I have one axis that denotes the amount of time used for each note. My other axis refers to the pitch, using the twill direction to signify the direction the pitch is moving.



Y = time

3. The spectrogram has similar axes

Using carefully chosen classical music scores, I have set up a series of algorithms, or rules, in order to perform my operation of weaving. I chose the scores depending on length, instruments involved, and various elements from the music. The algorithms are based on key elements that distinguish the piece of music, such as the dynamic, or level of sound intensity; the direction the pitch is changing, the length of time of each note, and articulations like staccato and ties. Staccato and tied notes are variations to how the notes are played: staccato notes are short and choppy, while notes with ties transition smoothly to the next note. The algorithms based on these characteristics from the score are then

applied to a simple twill pattern, which can vary in direction and color. The twill pattern I selected because of its versatility and simplicity. It can easily be manipulated without becoming too disorderly. It is the music that breaks the pattern, reverses the pattern, and transforms the pattern into a new one. As I am following a musical score, there is an element of surprise to the outcome. Patterns begin to evolve from themes in the music, but there is a level of unpredictability as I weave—I am as surprised as everyone else at the final product. It can be compared to reading a map. The map appears a certain way to guide the traveler to a location, but as she follows the path, she is still surprised by the physical appearance of the area. For example, when I read that a series of 8th notes is moving up the music scale, I wove a certain amount of passes through the loom in a left diagonal. If I see a 16th note is next and down the scale, I will weave fewer passes (for less time used) in an opposite diagonal, reversing the twill pattern by stepping on pedals in opposite sequential order. The pedals correspond to which strings are being lifted, also called a "lift". These strings, called the warp, are the long ones going through the loom. These particular strings are lifted for each passage of weft yarn and determine what the pattern becomes. My choice of materials is based on my preference for natural, high quality yarn. I am using mercerized cotton, rayon, and wool yarns for my weavings. I wanted a blend of natural and bright colors, along with a combination of different yarn textures to depict the various aspects of the music.

4. Paganini Caprice #10 in process

My first piece in my weaving series is an interpretation of Paganini's Caprice #10. This piece of music was created specifically for students learning the violin. It is a challenging piece for violinists because it includes a range of difficult techniques consecutively. The piece suited my interests because it appeared relatively simple on paper but allowed for enough variation to be intriguing.

5. Paganini Caprice #10 completed

In this piece, I used vibrant green colored yarns for the *forte,* or loud, part of the music. The less obtrusive purple yarns are the *piano*, or soft, parts of the music. The brighter colored yarns mixed in with the darker yarns denote where there are staccato notes, while the heavy wool yarns in each color set signify a violin technique known as a trill. A trill is a quick alternation between a note and the note above it, sounding almost wavy. The heavy wool visually relates to this "wavy" sound by appearing wavy itself. I chose these bright colors for this specific piece of music because it is very lively and energetically played by the violinist. When played fast, the piece sounds almost dizzying. The colors in my weaving seem to do this to the viewer's vision—the diagonal lines and mix of greens and purples appear to dance to the music.

My second piece is a selection from Johannes Brahms' Double Concerto in A Minor for Violin and Cello, Op. 102. I chose this piece of music because I wanted to depict two major instruments and weave both of their note directions and distinctions at the same time, making it a more complicated weaving. The distinctions are in the sharp

and flat notes, which both instruments use frequently. I kept these notes the same colors throughout the piece, resulting in a continuous flow of color that ties the piece together. Each color of yarn I selected to describe the sound associated with it. For instance, the deep brown color relates to the deep, rich sound of the cello. The light blue relates to the higher pitched sound of the violin. The light brown, the dullest color of the set, signifies when either instrument is on a rest. The bright green yarn represents all sharp notes, while all flat notes are represented by the rich red color. The yarns for this piece are smaller than the ones used for Paganini. I decided to do this in order to make the weaving less decipherable and easy to follow. As a result, there is much more music condensed into this weaving.

6. Brahms' Op. 102 color selections

Another result of this weaving was the addition of new rules on top of the existing ones. I used the same algorithms of line direction and time as I did for the previous weaving. However, because I was dealing with two instruments that did not always act together, I found that the colors would cross directions. This means that I often dealt with both colors needing the same lift at the same time. I made a rule that the two colors could not both be doubled—instead, if the following color needed a lift already used, it would skip to the next lift. This is another reason why this weaving is more visually complex. There are skips all over the place. The skips also prevent similar music sections from resembling other ones in the concerto, because it all depends which lift was

needed when the section started. For example, the beginning of the piece was woven in a particular way because I was starting from lift #1 of the violin, alternating with the cello for the rest of the piece. The same selection is repeated later, but it began on different lifts for the violin and cello and thus appears much different.

MIDI file format and the digital audio workstation (DAW) also relate to my project in that they play roles in converting audio to and from computer programming. There are ways of electronically programming music to create visuals. However, I have a deeper interest in the physical devices of playing music than the electronic. The music box and player piano relate more to my own physical movement as a weaver. This is also why I chose classical music, as opposed to techno, or even rock or pop music. Classical music follows such a long tradition, just like weaving. They require physical movement to create art, which I associate with tradition and history. Building on and connecting these timeless art forms is important to me because I see these being valued less and less in the creative world. Tradition is something I value as a person but also as an artist who deeply appreciates handmade objects and physical processes. As such an artist, I want to assert the fact that there is still a place for handmade processes in our increasingly electronic society. Just as the music box physically moves in a rhythm, my hands and feet move and work together to pass yarn through the weaving.

Inspiration from other artists has been one source resulting in my project's concept. Kirsten Nissen's work fascinates me. Nissen is a Dutch textile artist who uses a digital Jacquard loom, which translates patterns that are generated from life going on around her into physical weavings. In this work, called Manual Work, Nissen used medical technology to monitor her body while she wove. It monitored her physical

movements as well as her breathing and heart rate, which changed as she altered the pattern. The outcome is a piece of cloth controlled entirely by her body's pulse and brain activity. The result gives her a complex mix of patterns that she could not foresee or replicate. My visual outcome in the Brahms' weaving was very similar to Nissen's Manual Work in that patterns were varied and unpredictable. Because of the variability in pattern, both of our weavings create new forms or ideas—Nissen mentioned hers representing natural phenomena such as clouds, while my weavings invoke more technological images, like pixels on a computer.

7. Nissen's Manual Work, 2004

This idea of using external elements to guide the creative process has been used by various influential creators in history, such as Ramon Llull, John Cage, and even Mozart. In the 13th century, Ramon Llull used a systematic approach, called the *Ars Magna*, to prove Divine truths in a format of revolving wheels, letters, and symbols. The mechanism used chance to match up the symbols and demonstrate truths, similar to what Mozart did in the 18th century. Mozart was known for using dice games and chance procedures to reorganize his music

8. A part of Llull's *Ars Magna*

and create new compositions, known as *musikalisches Würfenspiel*. Cage used what he called chance procedures and used the setup of the *I Ching* to systematically create sounds. The *I Ching* was an ancient method of divination set up in a format that relied on chance procedures and a binary number system.[i] I am using similar techniques as these historic figures in that I am applying systematic procedures to my music in order to produce outcomes, in my case the form of a textile. The only difference is that I did not use a mechanical approach to the system, relying on written procedures instead of dice games and wheels. My process and the process of these creators is also related to the idea of the computer, as we are both running an input through a systematic format to create an output.

While I am not using chance to create my weavings, I am removing a sense of control over events in a similar way. It is up to the music to guide my weaving through my series of algorithms. Another artist that uses sound to create textiles is Christy Matson. Matson uses the spectrograph and DAWs to record the sounds of her own weaving on a traditional loom, and then weaves images of the spectrograms from the sounds on the digital Jacquard loom. She seeks to comment on the nature of our digital world by using it as a tool to create traditional objects, a process similar to my own. To me this says that digital processes are only a mechanism to create something real and concrete. The double layer of using the actual sound of her

9. Matson's Soundw(e)ave, 2004

weaving rhythm and creating a visual product from that rhythm also parallels my own process. I am using weaving as a tool because of its inherent rhythm, and while I am taking part in my own rhythm of weaving, I am studying an external rhythm that is the classical music.

My intention is to combine traditional art forms of classical music and weaving and update them to our technological world. The weavings are constructed by modeling early programming methods similar to how a computer runs. These methods have been used for centuries in different ways, from the *I Ching* and the *Ars Magna* to the player piano and Jacquard loom. My role as the creator is to model these methods as a computer would, analyzing the musical scores and interpreting their characteristics in various ways through a pattern. The use of the computer as a model and tool makes a statement that even though our world is becoming digitized, traditions in creating will not be lost. Artists who use physical processes to create can use modern technology as a model and tool to enrich their work.

Image Sources

1. Jacquard cards: http://www.sscnet.ucla.edu/geog/gessler/topics/jacquard.htm

2. Piano Roll:

http://www.happycowmusic.co.uk/pianola___player_piano_music_rolls.html

3. Spectrogram: http://www.icsi.berkeley.edu/Speech/mr/nearfar.html

4,5,6 –own images

7. Kirsten Nissen's Manual Work:

www.designskolenkolding.dk/fileadmin/PDF/Forskning/Publikationer/KN_ moreinfo.pdf

8. Llull's Ars Magna: www.cs.bham.ac.uk/ %7Emmk/Teaching/AI/l1.html

9. Christy Matson's work: http://www.cmatson.com/soundweave.html

[i] Zwieg, Janet. *Ars Combinatoria*. Art Journal, Fall 2007. P 22-25.