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An Application of Music Technology:
An Analysis of an Original Musical Composition Created with Musical Instrument Digital Interface

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Honors Project

May 3, 1999
This paper analyzes a musical composition of mine, *3 flutes*, and discusses the musical technology used to create the piece, Musical Instrument Digital Interface (MIDI). This part of the paper will cover a brief history of music technology and then explain what MIDI is and what it does. As modern technology has grown over these past decades, it has changed the way modern music is written. Historically, music was written for live performers with instruments that did not require a cable to be played. In the 1950's, the idea of incorporating music with electronic sounds "became a tangible part of composing 'modern music,' and a number of European composers began to include electrically generated music in their musical scores" (Newquist, 14). In the 1970's, electronic music took the form of musical synthesizers, where digital devices eventually replaced analog devices. The analog devices manipulated electric currents and physically recorded music onto tapes and records, but the digital devices converted the music to binary code, which better preserved the quality of the performance. The biggest weakness of the analog devices was that they had no memory, but the digital devices could record live sounds and reproduce them.

The challenge was to create a way for the synthesizers to communicate music to each other, to synchronize clock times for performance and recording. In 1981, MIDI was produced by an American vendor, Sequential Circuits. MIDI was “a combined language/transmission protocol which would not only allow for the sending and receiving of information, but also for determining the structure of that information” (Newquist, 37). After the main international vendors worked out the primary specifications of MIDI, it was ready for the market in 1983. Two organizations arose to ensure that companies met
the specifications, the International MIDI Association (IMA) and the MIDI Manufacturers Association (MMA). The IMA monitored for conformity to MIDI standards, and the MMA served as a forum for the manufacturers to discuss MIDI compatibility (Newquist, 38).

Musical Instrument Digital Interface is an interface that “allow(s) for communication or networking between two or more electronic instruments” (Newquist, 40). In other words, MIDI converts input from the computer software into a “serial data stream” (Gurley & Pfeferle, 206), and can transmit the information to multiple instruments. Physically, MIDI is a card and a cable that ends in a 5-pin DIN plug. “Only pin 5 transmits data, which classifies this unit as a serial transmission” (Thomas, 127). If the synthesizer keyboard is used instead of the computer keyboard as the mode of input, MIDI transmits a pulse whenever a key is pressed, and another when the key is released (Thomas, 130). MIDI incorporates “a rhythm generator produces a fast, steady pulse train at its MIDI output” (Thomas, 130).

The cable connects the computer to the instrument, and/or two instruments by their ports. The three types of ports are MIDI OUT, which sends information, MIDI IN, which receives information, and MIDI THRU, which passes information from one synthesizer to the next, if needed. MIDI has the ability to transmit over sixteen different channels. MIDI keeps the musical sequences separate and distinct by assigning every patch (the sound program in a synthesizer) a MIDI channel (Hill, 98).

The information sent through the channel takes the form of a status or a data information byte. “There are two different kinds of MIDI messages: one that indicates status (what to do) and one that indicates data (the specifics of how)” (Newquist, 40).
A status byte is a signal that usually activates or de-activates a note. Each of the MIDI commands is an eight-bit message. The first bit is always a one to signal a new set of commands. The first four bits together transmit an 'on' or 'off' command. The second four bits signal the particular channel over which this command will take place. The status byte is followed by two data bytes. The first bit in a data byte is always a zero. The first data byte signals the pitch on which to execute the command, and the second byte signals how the note is to be played (i.e. attack velocity) (Newquist, 43 - 44). The bytes can signal events other than note changes, such as program changes and channel pressure (Gurley & Pfefeerle, 206).

MIDI has many applications in music, including changing the sound of live instruments such as drums, guitars and winds, sampling sounds to be manipulated, and music notation software. This is the application of MIDI in which I am involved. In the composition software, MIDI transmits the data from the computer to a synthesizer keyboard, which then allows the user to hear what is composed. I created my musical composition with the help of this technology.

This part of the paper is an analysis of 3 flutes. This piece has some 20th century elements to it, but is basically a very conservative work by modern standards. There is some dissonance in this piece and it incorporates a lot of chromaticism, but it is unquestionably tonal. There is also a lot of mixed meter, but no complicated rhythms, at least not by 20th century standards. I used conventional musical notation and instructions; i.e. the dynamic markings are in Italian. The piece was not written for electronic instruments, but is meant for a live performance by three flutists. On the other hand, the convention is to write the 1st part with the most challenging line and the highest
hand, the convention is to write the 1st part with the most challenging line and the highest notes, but I often ignored this practice to preserve the linear ideas and to trade the motives evenly among the flutes. The attached chart provides a visual synopsis of the different sections and subsections of the piece, and a detailed account of the motives, meters, and the tempo and key changes.

This piece is through composed and divided into two major parts: A (ms.1 - 77) and B (ms.78 - 140). Part A opens with a statement of the main motive, but takes its time introducing the second, and, in general, has a slower tempo than Part B. Part B changes meter more often than Part A; this suits the more transitional nature of this section. The tempo changes divide each part into subparts: A is broken into I (ms.1 - 4), II (ms.5 - 41), and III (42 - 77); B is broken into IV (78 - 89) and V (90 - 140). Subpart I parallels III by using the same motivic material at a relatively slow tempo. This is the main motive and will be analyzed later in this paper. Subpart V is a combination of II and III and develops at a faster pace. These will also be explored in more detail later in the motivic analysis.

The dark tone of this piece persists especially in A, and almost throughout the entire work due to the relentless adherence to minor keys. It begins in the key of F minor (for the opening statement and the following developments) and changes to Eb minor, F minor, B minor, E minor and ends on B minor. The only instructions to play 'lightly' in this piece are in ms. 56 and 112, and then only for a few measures. In A, even the sequences within the key usually sequence at an interval of a minor third to arrive at a minor chord (see ms. 8 - 11, 14 - 17, 42 - 55). Part B has a slightly lighter tone than Part A. The sequencing is not always taken at the minor third interval and the music even
cadences on a major chord in m.31. The following paragraphs break the piece into its musical motives and give a measure by measure analysis of what the piece is doing.

The compositional techniques in this piece manipulate the motives by sequencing, alternating and overlapping the motives in the different voices, augmentation and diminution of the motives, and some use of ostinato patterns. This piece can be broken down into three motives. The main motive, $a$, is a arpeggiated seventh chord; the more melodic motive, $b$, is derived in part from the first motive and is sometimes used in transitions; and the chromatic motive, $c$ is always transitional.

The main motive begins the piece: it starts on the tonic, ascends a perfect fifth, visits the third, and ascends a perfect fifth to the natural seventh. In the next measure, the motive repeats, this time with a raised seventh. The pairing of perfect fifths, and the contrast between the natural and the raised seventh is repeated throughout the piece, both in this slow version, and in faster variants. The opening phrase ends with the repeated raised seventh of the chord. This technique, denoted by $R$, is used later in the score to signal climaxes in the music, or changes in tempo. Here, it concludes the main motive as the beat changes to a faster tempo.

Measures 5 - 7 introduce $a_1$, a faster variant of the main motive, that is a diminished version of $a$ in eighth notes. This variant of $a$ is often used as a transition between small sections in this piece. These measures also introduce $c$ as a transitional chromatic motive, which often bridges small and large sections of the music. The chromatic line may transition to the next idea by itself, or it may overlap one of the other two motives, or overlap another chromatic line moving in the opposing direction. Here,
the chromatic line descends while the new variant of the main motive ascends as the 1st and 2nd flutes trade motives.

The next measures introduce a fragment of a more melodic motive $b$. The full motive does not appear until later: it is encapsulated in measure 42 and ends with the first eighth note of measure 43. Like the main motive, it starts with the interval of a perfect fifth. The fragment in measure 8, $b_1$, is a rhythmic variant that includes the pitches from the first, the third, and the last beat of $b$. This fragment sequences at the minor third above the tonic, and then repeats this two-measure sequence up an octave. Measures 12 and 13 transition with ascending and descending statements of $c$, denoted by $cc$ in the 1st and 3rd flutes. Measures 14 - 17 introduce the second variant of $b$: $b_2$. This fragment is sequenced the same way as the first fragment. In measure 18, $a_1$ alternates and ascends in pitch with $cc$, as they provide the transition to the next section at measure 22.

This section, m.22 - 28, overlaps the different versions of $b$, without yet introducing $b$ in full. A syncopated version of $b_2$ appears in ms.23 and 24 of the 3rd flute, in m.25 of the 1st flute, and in m.26 of the 2nd flute. A third variant, $b_3$, appears in ms.26 - 27 of the first flute. Almost a full statement of $b$, it includes the pitches of the first beat through the beginning of the fourth beat of $b$. The next transition echoes ms.18 - 21, except with long tones in the interval of a perfect fifth being traded off between the flutes. The following measures overlap $a_2$ and $c$, and $c$ is used in the acceleration passage to the first full statement of $b$ in m.42.

The fragment $b_2$ and its syncopated variant are played in the 1st and 2nd flutes, while the full motive is played as an ostinato pattern in the 3rd flute. In m.48, the motive is augmented in the second flute part as it is taken up an octave. In m.52, $b$ is augmented
again, this time sequenced up a minor third. In ms.56 - 61, the flutes play tag with $a_I$ and in m.61, the motive becomes an ostinato pattern. Meanwhile, the 1st flute plays chromatic fragments that eventually descend in pitch to m.67, where $cc$ occurs in the 1st and 2nd flutes. In the uppermost register, the 3rd flute plays an accented $a_I$ that climaxes at the half cadence with $R$.

The next major section is a statement of $a$ in B minor. In the following measures, the motives $c$ and $b_2$ overlap with $a$. An echo of $R$ softly and rhythmically transitions this section to the fast tempo and the change in meter starting in m.90. Flute 2 plays a version of $a_I$ while the 1st flute plays a rhythmically altered version of $b$. In flute 3, $b$ is augmented and raised up an octave, but dissolves in a descending chromatic line which leads to some transitional measures in which the flutes trade off playing a diminished version of $a_I$. Measures 102 - 107 overlap $a_I$ with $c$ as the chromatic line descends again. In ms.108- 111, $b_2$ overlaps $c$, and in ms.112 - 118, $a_I$ overlaps fragments of $c$. In ms.119 - 124, $b_3$ overlaps $c$ until ms. 125 and 126, where $cc$ occurs in flutes 1 and 2. Measures 127 - 130 echo the penultimate statements of section A as the 3rd flute plays a version of $a_I$ over the chromatic lines. The motive is then diminished and passed along the flutes until the final measures where $a_I$ is played as eighths in flute 1, while the other flutes play lines in opposing motion, and flute 3 is playing a version of $c$. The piece ends on the tonic chord with $R$.

As powerful as MIDI is, I used it only as an aid for composition. I had chosen live performers because the quality of synthesized instruments poorly imitate the sound of live instruments. In this piece, I chose to not explore the areas that many composers of electronic music have, such as microtonality, the use of sampled sounds, or
the practice of electro-acoustic effects with live instruments. I have some experience
with music made of sampled sounds, but I do hope to explore the other areas of electronic
and electro-acoustic music.
Works Cited


Section: A
Subsection: i
Motives: a R a1 b1 cc b2 a1, cc b and b variants a1 cc c b variants 3/4
Meter: 9/8 3/4
Tempo: j=60 j=108
Key: f eb

Section: B
Subsection: iv
Motives: a b2 R a1 b c a1 c b2, c a1 b3, c cc a1 cc a1, cc c a1 c a1 R
Meter: 9/8 3/4 2/4 3/4 3/4
Tempo: j=70 j=126
Key: b e b