VT Piano as Live Play Expression of Velocity and Tempo

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Abstract: - This report describes the VT Piano, which is an abbreviation of "Velocity and Tempo Piano". VT Piano makes sounds from the note numbers of a MIDI sequence stored in the computer and the velocity of live playing of a pianist. The sound of the note is generated when a pianist hits a key. As a result, in the VT Piano, a pianist can play the music by hitting any key, moreover he can make the musical expression of velocity and tempo in live play. The VT Piano gives the enjoyment of playing a piano to many people who do not have any special skills to play the piano.

Key-Words: - MIDI, Note number, Velocity, Tempo, Piano, Note on/off, Musical expression

1 Introduction

The composition of music and the playing of instruments are difficult skills for beginners, because both of these activities require advanced level skills or exercises over a long time. However, the digital computing and MIDI standard makes it easy for the beginners to produce music [1 2 3]. Recently, various instruments for music playing have been developed. For example, the Continuator [4] is a system that learns musical styles progressively, and pianists can play interactively. It records what they play, analyses it, and then they can play along. Toy Symphony [5] and Creatingmusic.com [6] are creative music environments for children to compose music and play with music toys. As a useful instrument for both beginners and professional musicians, CiP [7] is a given melody based musical instrument for performing musical pieces that require accurate reproduction of given scores, however a performer plays only melodies by one hand without accompaniment.

The VT Piano is one of the methods that make it easy to play an instrument. Additionally, the VT Piano makes it possible to enjoy the musical expression associated with live playing. The music composition is a musical expression by a composer. On the other hand, the piano live play is another musical expression by a pianist performing variety in power and pace, while maintaining a connection with the audience at a concert. In VT Piano, notes of music as the expression of a composer are feed into the system in advance. After that a pianist plays the VT Piano by hitting any key, and so he can concentrate his attention on the musical expression of volume and timing. In other words, the VT Piano is a piano specializing in the expression of the velocity and tempo by the key touch of the pianist.

2 Analysis of Piano Play

Keyboard instruments make a tone easily by only hitting keys. Furthermore, a piano is easy to control in terms of the volume of tone and timing of sound by adjusting finger touch. The key touch of a pianist is one of the most important elements of live play in the musical expression. It is difficult for a harpsichord to express the volume using the finger velocity. The piano play consists of three elements as shown in Table 1.

Table 1. Three elements of piano playing

Element	Description		Depend on
Note number	Pitch	Which key pushed	Composer
Velocity	Strength	How strong pushed	Pianist
Note on/off	Time	When pushed/released	Pianist

2.1 Note number

The first element is the note number. It is which key is pushed, and the pitch of tone is determined. A composer formerly composed melodies as sequences of notes and chords as a combination of notes.
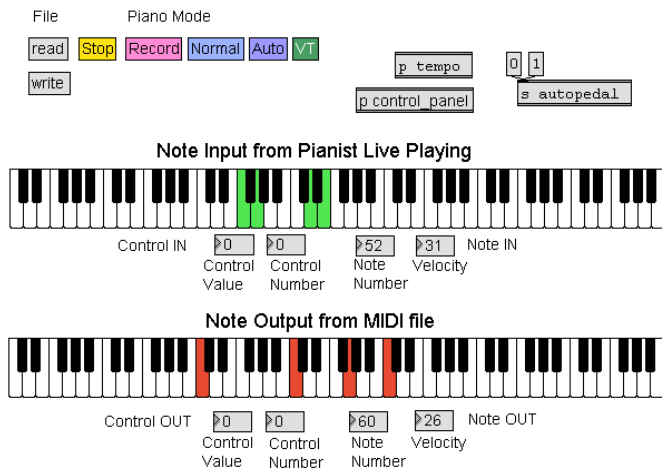
Figure 1. Max patch of VT Piano

3 Dynamics of VT Piano

3.1 Configuration
The VT Piano consists of a personal computer, Max/MSP Software [8], a MIDI tone generator, and a MIDI keyboard controller.

3.2 Flow of processing
In a VT Piano, note numbers are gotten from a standard MIDI file (SMF), but the velocity and timing of the note on/off are from the live play of a pianist. The main Max patch of a VT Piano is shown in Figure 1. The diagram of the VT Piano is shown in Figure 2, and the procedure of a VT Piano is described as follows.

Step 1) Note messages of MIDI sequence are feed to VT Piano.

Step 2) When a pianist pushes down any key, MIDI controller makes "Note on" message with a note number and velocity.

Step 3) A note message stored in step 1) is called sequentially, and the note number is gotten. And the note number of step 2) is replaced with the note obtained.

Step 4) A tone is generated with the pitch made from the note number of step 3) and the velocity of step 2). In other words, the note number is from MIDI sequences stored formerly, and the velocity is from a key touch of pianist's live play.

Step 5) If a pianist releases off the key of step 2), "Note off" message is issued, and the tone of step 4) is stopped.
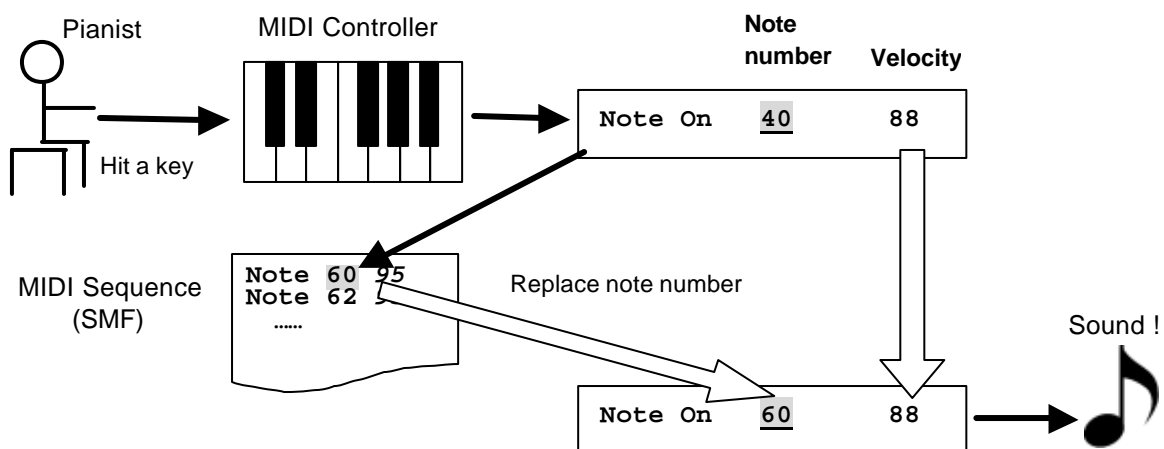
2.2 Velocity
The second element is the velocity. It is how strong a key is pushed down. A composer indicated some strength of the music with score marks, but a pianist can express the volume with his own personal feeling.

2.3 Note on/off
The third element is the timing of the note on and off, it means when a key is pushed down and released off. Basically, it is the length of note, and additionally it is the musical expression of time like "staccato" as a short tone or "tenuto" as a long tone, which is indicated with score marks.

Even if playing the same music and using the same score, the expression is very different by each pianist. The difference is derived from the velocity and note on/off. In a VT Piano, a computer plays the note number, and a pianist plays the velocity and the timing of note on/off.

Figure 2. Diagram of VT Piano

Figure 3. Examples of Piano Score

In Figure 1, the upper keyboard indicates which keys a pianist pushes down at that time. The lower keyboard indicates the keys that are the note numbers obtained from the stored MIDI message.

One key touch corresponds to one note message. Therefore, if one key is pushed, it calls one note message. If multiple keys are pushed at a time, the same number of note messages is called, and it caused to sound a chord.

All MIDI control change messages, for example, hold pedal, modulation, etc. are obtained from the live playing of a pianist, and they are applied to the sound.

A pianist can concentrate his attention on how strong keys are touched, when keys are pushed on and released off, and how many keys are touched at a time. In addition, he does not mind which keys should be pushed, and he can push any key, because the information regarding the note numbers is already stored in a MIDI file.

4   Examples of Piano Piece
For example, we discuss two pieces of piano music, "Fantasie Impromptu" by Chopin, and "La Campanella" by Liszt. The examples of the scores [9] are shown in Figure 3. Both of them are very difficult for most beginners to play, and it requires much time and exercises in order to hit the keys accurately.

However, using a VT Piano, it is easier to play because a pianist can hit any key, and make the musical expression of velocity and timing as he feels.

4.1   Fantasie Impromptu
This piece is shown in the upper score in Figure 3. Most of the chords are arpeggios separated to a single tone at a time in each of the right and left hand part. The VT Piano pianist hits any key repeatedly with two fingers of each hand. He can concentrate his attention on the musical expression of strength and pace.

4.2   La Campanella
This piece is shown in the lower score in Figure 3, and is more difficult to play. In contrast, most of the chords are composed of multiple notes. The VT Piano pianist can hit any key, but he must hit the proper number of keys at a proper time according to the score, for example, hitting a single key, two keys, or three keys.

This original piece is so difficult to play on the normal piano because the range of note number is very wide, and so large hands are needed to play. However, the VT Piano makes it possible for person with small hands to play this piece.

5   Experiments in Exhibition
The prototype of the VT Piano was exhibited in the Atsugi Science Carnival [10] as shown in Figure 4. During the summer vacation, many children came there and tried to play the VT Piano. They enjoyed it, though the pieces are classical piano music like Beethoven, Chopin, or Liszt, not really aimed at children. Moreover, many adults also enjoyed playing them.

The VT Piano is more interesting for those who have experience in piano playing rather than no experienced at all. People can always play a piece of music better if they know it well, because they know when the keys should be hit, and how many keys should be hit at a time.

Of course, the score of music helps to play better. A pianist looks at the number of notes that should be hit at a time, and plays them.

6   Conclusion
In a VT Piano, a pianist can play the piano by hitting any key and can make the musical expression of velocity and tempo. It helps to play the difficult piano

pieces without loosing the musical expression. In the near future, we hope that some new instruments will be developed, which are easy to play and express the player's feeling and emotion.

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Figure 4. VT Piano in Atsugi Science Carnival