What is the Essence of "Music?"
A Case Study on a Japanese Audience

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ABSTRACT

In this paper, we discuss what the essence of music is, based on an audience survey to evaluate musical performances with new interfaces. We composed ten pieces by introducing various types of uncertainty (chance operations), musical scores, and instruments, and performed them at a concert for a Japanese audience of 180. From the results of our survey, we concluded that the essential characteristics of music include the human element, or human-ness, and structure in addition to melody, rhythm and harmony. Moreover, we found that subjects with experience in music tend to be more open to new forms than subjects with little or no musical experience. They also are inclined to put much faith in human-ness when they estimate the worth of beauty, pleasure and liking as well as evaluating whether a piece is "music" or not.

1. Introduction

In the long history of music we have continuously sought more effective ways to express our musical emotion through trial and error, and that search continues today. Especially beginning in the 20th Century, we introduced the use of scientific technologies for music expression, and expanded the very concept of 'music.'

With modern technology the idea of "chance music" originated by John Cage et al., developed into algorithmic music composition using Max/MSP [1], and SONASPHERE [2] in varying degrees. In these systems, controlling the music just as the composer intended it to be is impossible; thus, it seems that they expand the concept of composition.

Musical instruments have changed dramatically, especially in terms of interfaces. For example, MINI BIO MUSE III developed by Nagashima [3] uses biological / physiological sensors for the input. In "Conversation" by Brouse [4], electroencephalographs were used to capture the brain waves of the 'player' and signals from a nearby plant. Generally speaking, it seems to be difficult to control these instruments as intended, and sometimes, we may have a basic doubt as to whether we can even call the performer a "player."

We developed the Thermoscore-display [7] as an 'output device' that conveys musical information to the performer via temperature (Fig. 1.) If we control the Thermoscore-display to make some keys so hot that the performer cannot hold them as *tenuto*, the sound tends to be short, or, a passing note toward some note that is not hot. In other words, Thermoscore conveys information to the performer after a key is hit, and has an influence on the next sound. Moreover, it conveys information related to note-off action, while conventional scores mainly describe note-on timing.

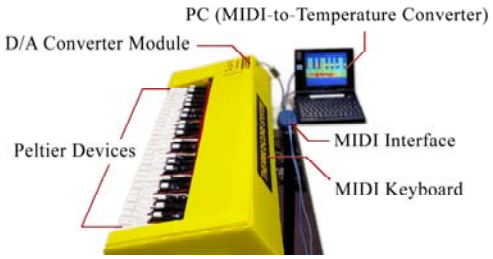

Fig. 1 The Thermoscore-display system

When we introduced this system at NIME04 [7] and SMC04 [8], it led to some arguments as to whether it was a score, or not. We believe that musical score is a set of minimum instructions and constraints to inspire the performer, however there are many other opinions about what constitutes a score.

At avant-garde musical performances, some people will say 'this is good new music!' and others will say "this isn't music at all!" The reason must be that for the latter, those performances do not meet the conditions that they think necessary for being "music," but it is

hard to clarify what those conditions are. Surely they differ from person to person, from culture to culture, and from period to period. However it is also true that 'music' exists across the world, so there must be some universal concept of "music."

For music expression that creates an intended effect, we should know what the audience thinks of as the essence of the music, even if our ultimate goal is to break away from the traditional path and create a new paradigm. But how we can know it?

From the experience of presenting Thermoscore, we discovered that introducing new interfaces for musical expression encourages a reconsideration of 'music' itself. New musical interfaces not only contribute to new expressions, but also throw light on the essence of music.

Accordingly, we planned an experiment to obtain an audience evaluation of musical pieces using new interfaces; in this paper, we discuss what the essence of music is, based on the results of that experiment. As an environment for the experiment, we choose a concert hall, realizing that the interpretation of some art works may depend on the environment. Imagine, for instance, viewing the "Fountain" by Duchamp [9] (a mere urinal) in an art museum, and in a bathroom. In a similar manner, just an ordinary sound can be recognized as 'music' in certain circumstances and not music in others.

2. EXPERIMENT

We set up the experiment as a concert in the Ishikawa Ongakudo Koryu Hall. We distributed a questionnaire to the audience. On the first page of the questionnaire, we asked respondents about their experience in learning music and playing musical instrument(s). Beginning on the next page of the questionnaire, we asked what they thought was the composer, score, player, and instrument for each piece of the performance. Next we asked them to evaluate the melody, rhythm, harmony, human-ness (human element), haphazardness, and structure of the piece on a scale of 1 to 5. Finally we asked for their judgment of beauty, pleasure, liking, and whether the piece was "music," similarly on a scale of 1 to 5. We fixed the time-limit for responses as 2 minutes, during intervals between the performances.

Referring to the works of media art and contemporary music in the 20th century, we introduced various types of scores, instruments, chance operation or other concepts, in 10 musical performance pieces. The digest movie of them is available on the Internet [10]. Following are details, in order of presentation.

(a) Dangomusic

This piece is, as it were, music created by pill bugs. There are 2 pill bugs in a box, and a camera captures their movements. The system makes the sounds of a Japanese harp in accordance with x-coordinates of the pill bugs, as if there were strings, as shown in Fig. 2. The pitches of these 'virtual strings' are set on a pentatonic scale, therefore the sounds tend to be consonant. We added two horizontal 'virtual strings' that trigger an arpeggio on the pentatonic scale, to make the sound more 'musical.' Some people may think of this work as a kind of chance music, based on biological random number generation. Others may regard the pill bugs as composers or performers. If so, we would like to know whether or not they consider a sound created by non-humans as 'music' or not.

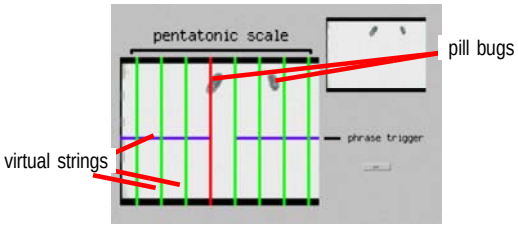

Fig. 2 Screen capture of "Dangomusic" (Music by pill bugs)

(b) Scan & Play

In this piece, software scans a linear drawing iteratively from top to bottom, and converts the scanned image to sound. The x-coordinate of the scanned image is mapped to the pitch. When the performer changes the shape of the drawing, it is reflected in the sounds. The interface allows the performer to draw the whole image intuitively, though it is difficult for him to specify the notes.

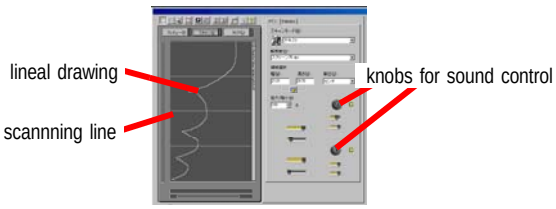

Fig. 3 Screen capture of "Scan & Play"

(c) WindChimer

The system here controls rotary fans via MIDI (Musical Instruments Digital Interface); the fans activate wind chimes that are set to certain chords. The MIDI Signals are sent from a MIDI sequencer, however the sound bears many uncertainties in terms of the on and off timing of the notes.

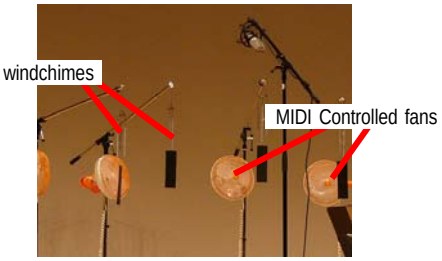

Fig. 4 The "WindChimer" system

(d) Sound Dust

In this piece, we use a vacuum cleaner as an instrument. The performer vacuums the floor of the stage, and changes the sound actively and 'musically.' We attached a CCD camera on the head of the cleaner, and the image captured from it is reflected as an effect parameter on the rhythm track.

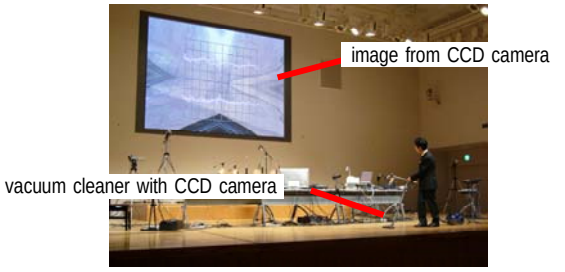

Fig. 5 The "Sound Dust" system

(e) Cellphone-Ensemble

There are ten cell phones on the stage, and we display their e-mail addresses on the front screen. Members of the audience voluntarily send e-mail from their cell phones. The ring tones of the cell phones on stage are set to altered dominant scale tones. We can say that the audience creates the music in a sense, but they have no way of knowing which sound they made. In the concert, the audience sent over 800 messages. However, most of those messages were delivered after the performance because of the heavy traffic on the network.

(f) Theorist

Like other recently developed improvisation support systems[5][6] this system automatically changes input notes to theoretically correct notes based on the Berklee theory. Some acceptable melodies result whatever keys the player hits. However, the player is not allowed to use notes that the system has identified as incorrect, even though those notes might be acceptable to a certain degree.

(g) 52P8

In this work, the performer composes a rhythm loop with sequence software, based on the colors of 8 randomly dealt cards.

(h) Unstable CD Players

There are 5 CD Players on the stage, each containing an incompatible and damaged CD-ROM of a scratch loop sound in the same tempo; while playing them, the performer occasionally hits the body of the CD players so that the sound skips.

(i) AcceleLand

This work is intended to interpret the scenery seen from car window in music. In the video picture, we embedded sounds according to the patterns of the road, roadside trees and oncoming cars.

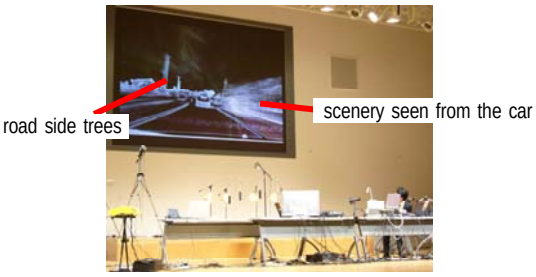

Fig. 6 Playing "Acceleland"

(j) A piece for Thermoscore

In this piece, we used the Thermoscore system that we described previously. We prepared a temperature sequence that sometimes heats keys to more than 70 ℃, and under those circumstances, the player improvises freely. We used a Thermographic camera on stage to visualize the effect of the system to the audience, though it is unnecessary for the player.

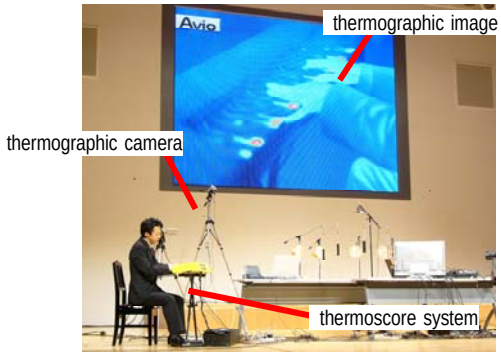

Fig. 7 Playing "A piece for Thermoscore"

3. Results

From the 180 subjects, who ranged in age from junior high school student to over 60, we collected 139 valid answers to the questionnaire. All of the subjects were Japanese.

Fig. 8.1 and Fig. 8.2 are the average evaluation of preferences (beauty, pleasure, liking, and whether each piece is music) and their standard deviation. Fig. 9.1 and Fig. 9.2 describe the average characteristics (melody, rhythm, harmony, human-ness, haphazardness, and structure) in each piece and the standard deviation. Fig. 10 is a rate of description for Composer, Score, Player, and Instrument.

From the information on the first page of the questionnaire, we categorized subjects into two groups; those with experience of music (n=83) and those with no experience of music (n=47). (The remaining 9 people revealed nothing about their musical experience.) Figs. 11.1 and 11.2 indicate the difference between subjects with experience of music and those with no experience of music in the average rate of description and preferences.

Tables 1.1, 1.2, and 1.3 are the results of stepwise multiple linear regression analysis in which beauty, pleasure, liking, and music are the dependent variables.

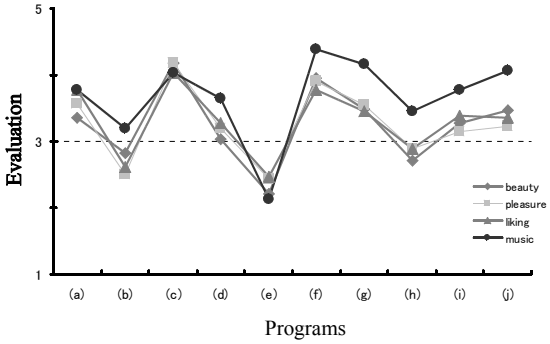

Fig. 8.1 Evaluation of preferences
beauty, pleasure, liking, music

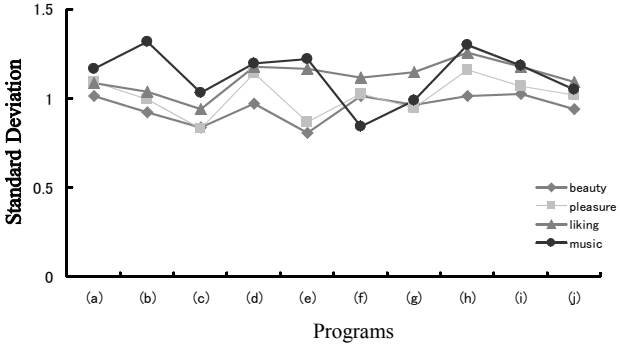

Fig. 8.2 Standard deviation in evaluation of preferences
beauty, pleasure, liking, music

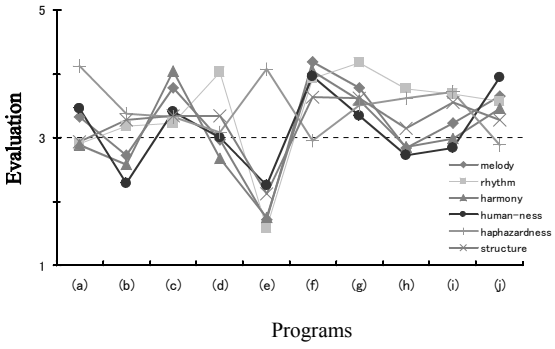

Fig. 9.1 Evaluation of characteristics
melody, *rhythm*, *harmony*, *human-ness*, *haphazardness*, *structure*

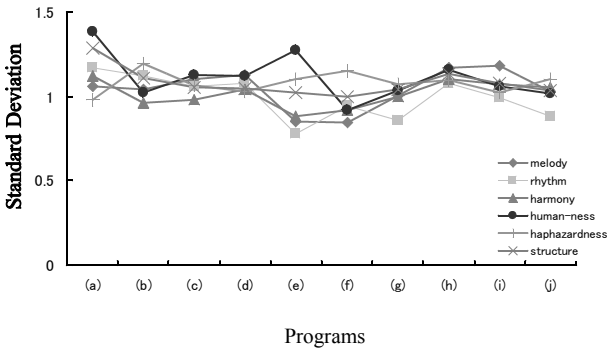

Fig. 9.2 Standard deviation in evaluation of characteristics
melody, *rhythm*, *harmony*, *human-ness*, *haphazardness*, *structure*

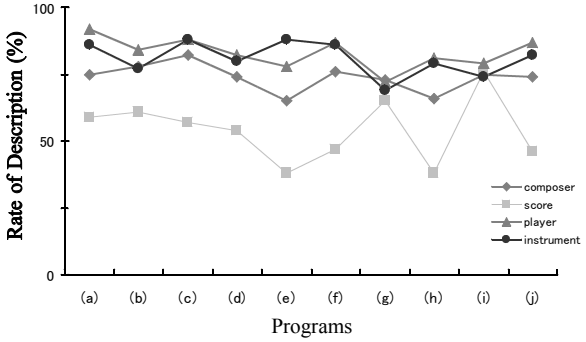

Fig. 10 Rate of description

Composer, Score, Player, Instrument

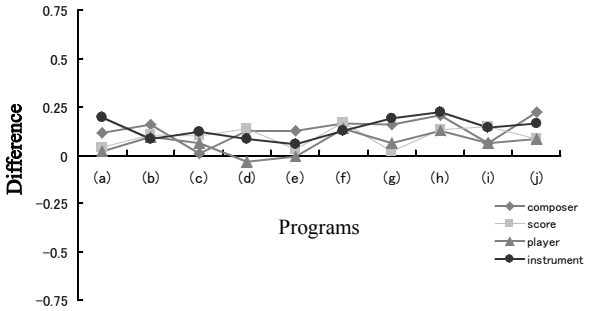

Fig. 11.1 Difference between subjects with and without musical experience

Composer, Score, Player, Instrument

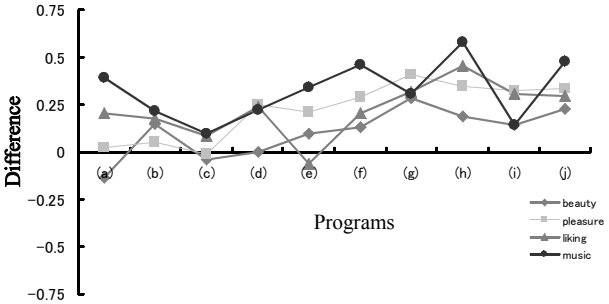

Fig. 11.2 Difference between subjects with and without musical experience

beauty, pleasure, liking, music

Table 1.1 Stepwise multiple linear regression analysis for all subjects

Beauty

	β	p
harmony	0.279	0.000
human-ness	0.223	0.000
melody	0.210	0.000
structure	0.170	0.000

R	R^2
0.703	0.494

Pleasure

	β	p
harmony	0.220	0.000
human-ness	0.213	0.000
melody	0.211	0.000
rhythm	0.091	0.000
structure	0.082	0.000
haphazardness	0.065	0.000

R	R^2
0.648	0.420

Liking

	β	p
human-ness	0.241	0.000
melody	0.203	0.000
structure	0.185	0.000
haphazardness	0.119	0.000
harmony	0.084	0.000
rhythm	0.060	0.000

R	R^2
0.618	0.382

Music

	β	p
melody	0.261	0.000
human-ness	0.192	0.000
rhythm	0.167	0.000
structure	0.143	0.000
harmony	0.127	0.000

R	R^2
0.695	0.483

Table 1.2 Stepwise multiple linear regression analysis for subjects with musical experience

Beauty

	β	p
humanness	0.242	0.000
harmony	0.235	0.000
melody	0.223	0.000
structure	0.197	0.000

R	R^2
0.713	0.508

Pleasure

	β	p
human-ness	0.256	0.000
harmony	0.198	0.000
melody	0.147	0.000
rhythm	0.127	0.001
structure	0.101	0.002
haphazardness	0.068	0.014

R	R^2
0.650	0.423

Liking

	β	p
human-ness	0.268	0.000
melody	0.186	0.000
harmony	0.148	0.000
haphazardness	0.135	0.000
structure	0.111	0.001
rhythm	0.111	0.002

R	R^2
0.653	0.427

Music

	β	p
melody	0.222	0.000
human-ness	0.201	0.000
rhythm	0.175	0.000
structure	0.151	0.000
harmony	0.141	0.000

R	R^2
0.692	0.479

Table 1.3 Stepwise multiple linear regression analysis for subjects with no experience of music

Beauty

	β	p
harmony	0.333	0.000
melody	0.203	0.000
human-ness	0.198	0.000
structure	0.136	0.001

R	R^2
0.695	0.483

Pleasure

	β	p
melody	0.342	0.000
harmony	0.275	0.000
human-ness	0.159	0.000

R	R^2
0.663	0.439

Liking

	β	p
melody	0.268	0.000
harmony	0.242	0.000
human-ness	0.189	0.000
haphazardness	0.088	0.029

R	R^2
0.593	0.352

Music

	β	p
melody	0.336	0.000
structure	0.174	0.000
human-ness	0.159	0.000
rhythm	0.152	0.001
harmony	0.120	0.013

R	R^2
0.736	0.542

4. Discussion

When we see the results in Fig. 8.1 and 8.2, (f) Theorist scores highest in musicality with the lowest standard deviation, although (c) WindChimer had the best score in terms of beauty, pleasure, and liking. Conversely, when we focus attention on (b) Scan & Play, (e) Cellphone Ensemble, and (h) Unstable CD Players, the rates of beauty, pleasure and liking are all lower than 3; in other words, these pieces are not beautiful, pleasant, or likeable. However, only (e) Cellphone Ensemble was rated lower than 3 for musicality, while the other pieces were rated higher, that is, (e) Cellphone Ensemble is not 'music,' while (b) Scan & Play and (h) Unstable CD Players are 'music.' For this reason, we can say that the essence of music must contain something that is not included in the essence of beauty, pleasure, or liking.

Comparing with Fig. 9.1, evaluation of music seems to correlate strongly with that of human-ness and melody. In fact, these factors have the highest contribution ratios to musicality in the multiple linear regression analysis results (Table 1.1.) Then can we evaluate musicality only by these 2 factors? In Table 1.1, the following factors are rhythm, structure, harmony, but are they merely factors that have low correlation with musicality?

Let us go back to Fig. 9.1, and compare (c) WindChimer and (f) Theorist. Here, the evaluation of melody, rhythm, human-ness, structure are highest in (f) Theorist, and the differences in human-ness and rhythm are especially pronounced. Thus it can be said that these factors have a definitive effect when the piece holds comparatively high musicality.

On the other hand, when we compare (e) Cellphone Ensemble with (b) Scan & Play and (h) Unstable CD Players, some characteristics such as rhythm or structure, aside from haphazardness, are rated higher than 3 in (b) Scan & Play and (h) Unstable CD Players, while almost all characteristics in (e) Cellphone Ensemble are rated lower than 3. In other words, even if the piece is not beautiful, pleasant, and likeable, it could be 'music' as long as it has enough rhythm and structure; thus, whether the piece holds some sense of rhythm or structure acts as a benchmark for 'music.' Because rhythm is related to both cases above, we assume the sense of rhythm plays a crucial role in conclusive determination of 'music.'

However, (e) Cellphone Ensemble has other dimensions. As we see Fig. 10, the definitions of composer and score for this piece are the lowest. Namely, subjects seem to think that there is no composer or score, or that it is difficult to point them out in this piece. In fact, even if they were written, they are extremely varied. When we checked descriptions of this piece in the questionnaire, we found a huge variety of interpretations of score that say "The score exists as our general will," "The score is a screen that gives instructions for us to send e-mails," along side comments like, "no score exists," or "I have no idea."

After weighing up all the variables, it would still be unwise to draw firm conclusions about the essence of music from the data of only 10 pieces. This work is merely a prelude, a mere hypothesis. However, we can say that as a rule, it seems to be acceptable that 'musical' pieces must have a strong sense of rhythm and humane-ness, and that those senses have an influence on final judgment as to whether some 'unmusical' pieces are "music" or not. We would like to test this hypothesis by doing additional experiments and further investigation into details.

In Figs. 11.1 and 11.2, it should be noted that the average scores of musicality from subjects with experience of music are higher than those from subjects with no experience of music, for all pieces, without exception. We can thus say that subjects with musical experi-

ence are more open to new kinds of music than subjects with no musical experience. Their scores in beauty, pleasure, liking, and descriptions in composer, score, player, and instrument are also higher. One of the main reasons for this may be that they have had more opportunities to be exposed to avant-garde music. It is also possible to associate this phenomenon with a sympathetic understanding that comes from their experience of making music.

From the results of multiple linear regression analysis (Tables 1.1, 1.2, 1.3), we notice that human-ness and structure factors are main independent variables for musicality, in addition to "The three factors of music," i.e., melody, rhythm, and harmony. When we compare the results between subjects with musical experience and subjects with no experience of music, we notice that subjects with musical experience attach great importance to the human-ness factor. It is the most important factor in beauty, pleasure, and liking, especially pleasure and liking, and is the second most important factor in music. On the other hand, people with no musical experience do not have this tendency; they place greater emphasis on melody and harmony.

Why do subjects with musical experience think that the human element, human-ness, is important? We believe it is because they have experienced making music as a 'human,' thus music without a human performer makes them somewhat uneasy.

5. Concluding Remarks

From the analysis of this experiment, we found that the essence of music for Japanese people includes a human element and structure in addition to melody, rhythm and harmony. Moreover, we discovered that subjects with musical experience tend to give more favorable evaluations than subjects with no musical experience. They are inclined to put more faith in human-ness when they estimate the value of beauty, pleasure and liking as well as evaluating whether a piece is "music" or not.

Needless to say, these tendencies may be unique to Japan, especially in the relative importance of human-ness. However we think it is universal that today we evaluate 'music' in a different light, and also that experience in music affects that evaluation.

The experiment we conducted here was a bit odd as a concert, in that we urged the audience to answer the questionnaire between the numbers. However, many of the subjects said that the very process strengthened their sense of unity and solidarity to the "concert." Listening to the works and considering of their 'meaning' by filling in the questionnaire changed their passive appreciation to more active participation.

Today, some conceptual music works have been created to raise questions about something rather than to express genuine musical emotion. The new interfaces mentioned in Section 1 may have similar aims, and may represent the 'new expression' of music. If we intend to make the audience think about something through a live performance, the method we used for this experiment serves a useful purpose.

Finally, we would like to quote a passage from the marginalia of one questionnaire in the experiment.

> "There are many artists who create something under their go-it-alone mentality. In any form of art, what is important is a stance of humility toward the feedback from the audience. "

Acknowledgements

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