

Individual Differences on Feature Recognition of Music

Kazuhiro YAMAWAKI* and Hisao SHIIZUKA**

**Informatics, Kogakuin University Graduate School,
Nishishinjuku1-24-2, Shinjuku, Tokyo, 163-8677 Japan*

**yamawaki@a3.ctktv.ne.jp*

***shizuka@cc.kogakuin.ac.jp*

Abstract: This paper discusses individual differences on feature recognition of the music with experience in the this field. We analyze feature recognition of the music with questionnaire survey of the music major students and students except for the music major. In questionnaire survey, we take care of musical element of music samples. We use the feature extraction of the music according to the adjective image chart, because it is superior than the feature extraction of the music by the factor analysis. It is shown that the music major students have more concentrate response than students except for the music major. Then, it is concluded that we can make a questionnaire survey only the musician, when we analyze the feature extraction of the music, so that it is the considerable factor that musician's response is represented of a human's response for the music.

Key words: *Integration of Knowledge, Kansei, Music, Individual Differences*

1. Introduction

It is general that the feature recognition of music gives the questionnaire by using the pairing adjective, and analyzes the result by using the technique of the factor analysis etc. However, a minute, musical feature is not obtained by the feature analysis by the factor analysis. For instance, the following questions are often done by using the pair of the adjective: "It is bright", "It is a little bright", "Even if it is bright, it cannot be said it is dark", "It is a little dark", and "It is dark". This demands to answer the listener own sense by the questionnaire gradually. Everyone will consent for this technique not to reflect a natural image easily. Therefore, it is necessary to clarify for the method of extracting a musical feature more in detail.

We have groped for the method for the extraction of the minute feature of music. We are clarifying that it is useful because it proposes the method analyzed from the result of the questionnaire that freely selects the adjective by the adjective image chart, and it extracts a minute feature of music, so we now propose the method for the improvement of the accuracy of the questionnaire based on the early research [1].

It is imaginable that the result changes into sensibility correspondence by the difference between understanding and a musical experience to listener's music when doing the questionnaire and easily imaginable of us. However, the relation between a musical experience and a sensibility reaction of the listener is hardly researched so far. Those researches are important because of the credibility of the data obtained by the questionnaire.

In this paper, it tries to do quite the same questionnaire as the student of this generation who is not majoring in music with the university student who majors in music, and to clarify the relation between an experience and sensibility correspondence to music. We made the sample music (which is composed by one of the authors) ask for 70 students of the music major and 53 without music major.

Hereafter, details were referred about the method of the questionnaire that we had developed in section 2. In section 3, the tendency to the answer of the music major life and the general subject life obtained because of the questionnaire is analyzed, and the relation between a difference of a musical experience and sensibility correspondence to music is referred as a result. And, a feature change in the reaction caused by the difference of the experience value of music in the questionnaire survey obtained for this research is described in section 4.

2. Method of our questionnaire survey

2.1 The technique of the questionnaire

We questioned according to the following procedures.

- (1) We prepared four sample tunes that we were composed and performed.
- (2) We made the adjective group to take the image of music into consideration.
- (3) Listeners are made to listen to the sample tune, and the image of the sample tune is made to be chosen from among the adjective group.

When the questionnaire is executed, we think that carefully selecting the adjective presented as choices is necessary. Because the adjective should be effective to take the image of music into consideration accurately. Therefore, we made efforts in the questionnaire to make the research succeed and it made efforts to the careful selection of the adjective. We referred to the color image chart for the careful selection of the adjective.

Table 1. The 56 adjectives of random selected

Pretty	Childlike	Cheerful	Carefree	Enjoyable
Pleasant	Lively	Flashy	Busy	Active
Bold	Passionate	Dynamic	Intense	Gorgeous
Amorous	Charming	Luxurious	Strong	Wild
Oldie	Gallant	Dignified	Tasteful	Sacred
Solemn	Mechanic	Precise	Urbane	Chic
Chick	Docile	Generous	Natural	Elegant
Graceful	Upper classes of	Feminine	Modest	Refined
Clearly	Youthful	Quickly	Modern	Nice
Healthy	Fresh.	Sensitive	Refined	Plain
Peaceful	Cute	Calm	Familiar	Romance
Refreshing				

2.2 The color image chart

The color image chart is the one settled on for the fixation of the image in the color and the design [2]. The color image chart understands the adjective as a chart that shows the approximation of the image, and adopts the method for overlapping the chart with the image of the color. In the chart, Y-axis corresponds to Soft-Hard and X-axis corresponds to Warm-Cool as the index, respectively.

We paid attention to the possibility concerning use to the feature extraction in music and the music of the adjective image chart from the synesthesia holder's existence in the color etc. that was called the-color-hearing-person, and did the early research [3].

As a result of the research, the domination of the feature extraction in music based on the adjective image chart was confirmed.

We strictly chose the adjective group that used it to question from the adjective used for the image chart. We analyzed it by plotting the adjective group that had been selected when data was analyzed in the image chart.

2.3 Adjectives used by questionnaire

We selected the adjective group according to the following conditions. The selected adjective group should exist evenly in all the areas in the graph in the adjective image chart. It is necessary to integrate adjectives of the same meaning. And, we were able to select 56 adjectives carefully. Of course, the selected

adjective is distributed almost evenly also on figure of the adjective image chart as shown in Figure 1. The adjective is enumerated to the questionnaire form presented to those who answer about the questionnaire in shape without the rule at random as shown in Table 1. After it listens to the sample tune, those who answer should select four one or less that agrees with the image of music from among the presented adjective group.

2.4 The sample tune

We adopted music that carefully controlled various elements that decided the feature of music like example 1-4 of the score of the appendix for the accuracy improvement of the questionnaire and composed. The following points were concretely noted.

- (1) To clear away a personal preconception to music, the sample tune was assumed to be all original tunes that one of the authors had composed. Moreover, the binary form, it composed, and eight bars it was assumed the one of about 20 seconds timewise. Because we wanted to avoid the diffusion of the image.
- (2) All sample tunes were played by piano. Because one of the authors took charge, the performance is the same to four condition. Of course, musical instruments and recorder materials are also the same.
- (3) The sample tune was assumed that it was same Tonality (Des dur : D Major) as four, and the progress of harmony was the same, and put together as follows.

D M D M7/C B m D M/A E m/G A 7 D M

- (4) The sample tune has the change in the image by progress, the number of bars of harmonies, and changes in the element other than the form. Concretely, the change in the image is given to the sample tune by the change in the structure and the compass of the rhythm, the rhythm, and the tune. Details are shown in Table 2

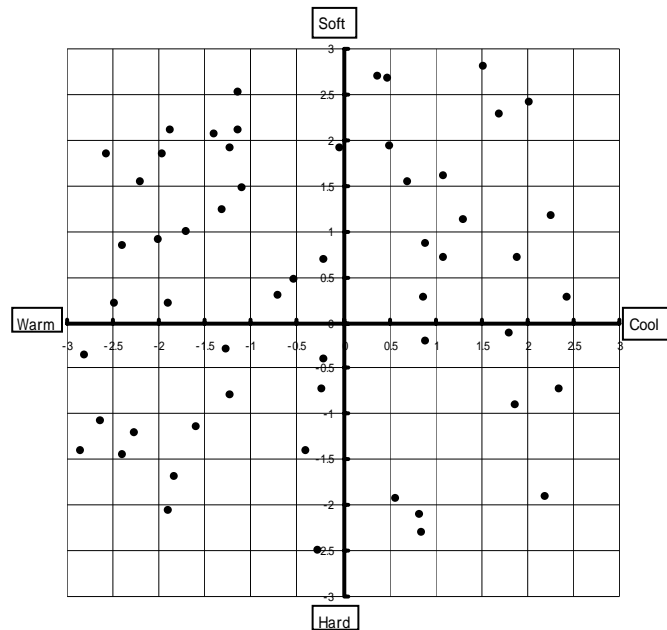


Fig.1 The plot of the 56 adjectives.

Table 2 Feature comparisons of sample music.

	The 1 st Sample	The 2 nd Sample	The 3 rd Sample	The 4 th Sample
Time	6/8	4/4	4/4	4/4
Register	High register	Wide	Middle register	Middle/low register
Tempo mark	Allegretto	Adadio	Allegro	Moderato
Expression symbol	Leggiero	Maestoso	Vivace	Affetuoso
Others	• Waltz style	• with overture. • Many dispersion chord	• syncopation.	• Country style

2.5 The questionnaire numerical value criterion

When we have the evaluation of a questionnaire, we set up the data of one listener with 10 points. We evaluated the result of a questionnaire with the method like the following. A listener selected 4 words. Therefore we thought four cases as follows.

- (1) If a listener selected the adjective of 1 word, 1 adjective possesses 10 points.
- (2) If a listener selected the adjective of 2 words, each 2 pieces of adjectives possess 5 points.
- (3) If a listener selected the adjective of 3 words, each 3 pieces of adjectives possess 3.3 points.
- (4) If a listener selected the adjective of 4 words, each 4 pieces of adjectives possess 2.5 points.

We do the analysis of data by this numerical value evaluation. Each adjective has the coordinate position in the color image chart. Then, we put the numerical value data that each adjective has in each coordinate position.

3. Result of questionnaire consideration

3.1 Opinion of the overall tendency to question

We decided to try to understand the feature of the sample tune. First of all, we integrated all questionnaire data, plotted in the adjective image chart, and analyzed it.

The result is shown as follows.

(1) Result of first

Data has concentrated on the second image limit. The selection rate of seven high-ranking adjectives is also very high with 75% or more. It is music that the image of music has concentrated on the narrow sense.

(2) Result of second

It concentrates gradually on the third image limit. The selection rate of seven high-ranking adjectives has concentrated moderately by about 55%, too. The image has not concentrated secondarily from the first.

(3) Result of third

Two big flows were discovered in positive and a negative area on X axis. The selection rate of seven high-ranking adjectives has not necessarily concentrated by about 50%, too. The third is music where two big elements exist.

(4) Result of fourth

Data diffuses gradually based on the second image limit. The selection rate of seven high-ranking adjectives has not necessarily concentrated by about 50%, too. The fourth is music that the image is various.

We understood there was an image of music from the above-mentioned result when it concentrated when diffusing. It distinguishes in data and when the set diffusion can be discovered, we cannot distinguish by the

change in a sensibility reaction by a musical experience of the listener etc. whether the cause is imaged diffusion of music

In a conventional technique, it is impossible to express the change in personal correspondence of the listener numerically. For instance, it is impossible to classify imaged diffusion of music and the listener's sensibility reaction by the technique of standard deviation etc.

3.2 Result of sample first

Table 3 shows the adjective with a high selection ratio of the student group of the music major and the student group of without music major. Table 3 described the adjective to the seventh selection rate place. % is a proportion of each adjective in the total score. Moreover, the first sample adjective selection situation was plotted in an adjective easy scale. Figure 2 showed music major student's data. Figure 3 showed without music major student's data. The graph makes the selected score of each adjective an image as a size of circle and is the one.

The size of circle is the one to show a relative ratio in each graph, and no one to show an absolute size.

Table 3 Selection rate of the more high position adjective in the 1st sample

	Music major students	General subject students
1st	Pretty 219.5 Pt./ 31.36%	Childlike 121.2 Pt./ 22.87%
2nd	Childlike 154.6 Pt. / 22.09%	Pretty 115.4 Pt./ 21.77%
3rd	Cute 59.8 Pt. / 8.54%	Enjoyable 43.1 Pt. / 8.13%
4th	Pleasant 35.8 / 5.11%	Pleasant 39.8 Pt. / 7.51%
5th	Enjoyable 33.3 / 4.76%	Carefree 26.6 Pt./ 5.02%
6th	Fresh.28.2 Pt. / 4.03%	Cheerful 21.6 Pt./ 4.08% (Same place ratio 6)
7th	Docile 21.6 Pt. / 3.09%	Cute 21.6 Pt./ 4.08% (Same place ratio 6)
Total	700 Pt.	530 Pt.

3.3 Consideration of sample the first

The image of music has comparatively concentrated on the second image limit the first according to the consideration of 3.1 as for the sample. This can be read from Figure 2 and Figure 3. Some tendencies to the selection of the adjective of the without music major students are different from the music major students according to the data of Table 2. However, the distribution of data looks like well in the analysis by the adjective image chart shown in Figure 2 and Figure 3.

Moreover, we verified it by another aspect. We considered the adjective selected very uncommonly. We paid attention to the adjective that was the point 2.5 points or less. Only person Especially, we selected the one that data doesn't exist in the circumference carefully in the plot chart. Because it is thought that the image of the selected adjective is very isolated.

We selected the adjective that agreed with the above-mentioned condition carefully. Consequently, it turned out that the frequency of the data of the without music major student's data was higher than that of music major

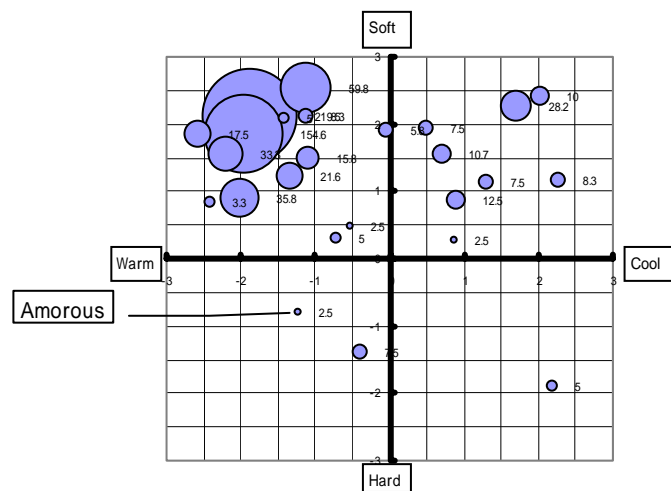


Fig.2 The plot on the image scale of the 1st music sample by music major students

student's data. Here, we bring the above-mentioned result together.

(a) Imaged approximation of the adjective is replaced with the approximation of the coordinates point on the graph for the analysis by the adjective image chart. Therefore, the appearance looks like well as a graph when the image of the adjective is near even when a different adjective has been selected.

(b) The tendency to the adjective selection of the student of the music major and the without music major student looks like well for the analysis by the adjective image chart.

Therefore, the tendency to the grasp of the feature to music doesn't turn even if the experience value to music is different.

(c) The student of without music major of the appearance frequency of a scarce adjective is higher. In a word, the individual variation is reflected in the student of aithout music major whose experience of music is less than the music major student with a deep experience of music more.

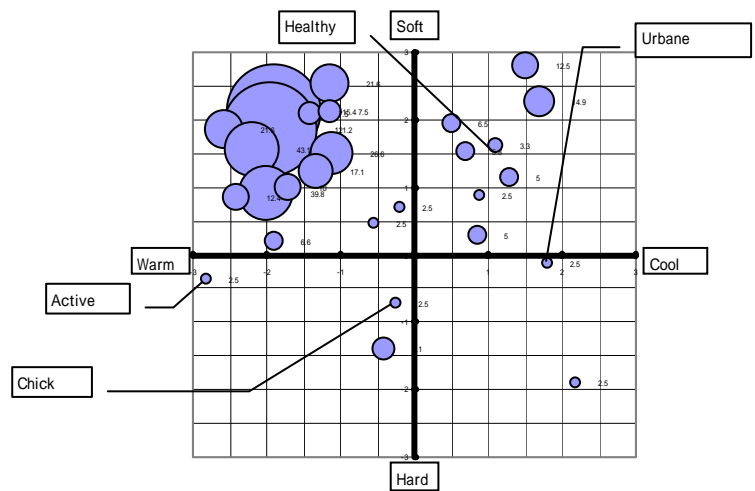


Fig. 3 The plot on the image scale of the 1st music sample by without music major students

3.4 Result of sample third

Then, we assume that we try analyzing based on the plot chart of the adjective image chart. We decided to examine the 1st and the 3rd closely. The image has concentrated very much the first, and because three diffuses and has the image. As for us, the sample thirdly tried analyzing to the sample by the same technique to the first.

Table 4 shows the adjective with a high selection ratio of the student group of the music major and the student group of a general subject. Table 4 described the adjective to the seventh selection rate place. Moreover, the third sample adjective selection situation was plotted in an adjective easy scale. Figure 4 showed the data of the student of the music major. Figure 5 showed without music major student's data.

Table 4 Selection rates of the more high position adjective in the 3rd sample tune.

	Music major students	General subject students
1st	Pleasant 71.4 Pt / 10.34%	Active 57.3 Pt / 11.23%
2nd	Lively 67.2 Pt / 9.73%	Lively 43.2 Pt / 8.47%
3rd	Enjoyable 55.8 Pt / 8.08%	Enjoyable 29.8 Pt / 5.69%
4th	Active 50.8 Pt / 7.36%	Pleasant 29 Pt / 5.68%
5th	Carefree 48.3 Pt / 7%	Plain 20.8 Pt / 4.07%
6th	Healthy 47.4 Pt / 6.87%	Carefree 19.9 Pt / 3.90% (Same place ratio 6)
7th	Childlike 38.3 Pt / 5.55%	Youthful 19.9 Pt / 3.90% (Same place ratio 6)
Total	690Pt	510 Pt

References

1. Kazuhiro Yamawaki and Hisao Shiizuka. Feature Extraction of Music with Adjective Image Chart, the data processing academy research report, 2002-MUS-47-17, pp. 105 ~ 109 (2002)
2. Japanese color design research institute Co. Ltd.(ed.). Color image dictionaries, p. 96, Kodansha Ltd. Publishers, Tokyo (1993)
3. Richard E Sidohwick. (translated by Atsuo Yamashita). The common sense person are everyday should be surprised, Shisosha ,Tokyo (2002)

Appendix

• The 1st sample tune

Musical score for the 1st sample tune, marked *Alllegretto*. The score is in 3/4 time and consists of two systems of piano accompaniment. The first system includes a dynamic marking of *mp* and the instruction *« Maggiore*. The music features a steady eighth-note accompaniment in the right hand and a more active bass line in the left hand.

• The 3rd sample tune

Musical score for the 3rd sample tune, marked *Allegro vivace*. The score is in 3/4 time and consists of two systems of piano accompaniment. The music is characterized by a fast, rhythmic eighth-note accompaniment in both hands, with a dynamic marking of *p*.

• The 2nd sample tune

Musical score for the 2nd sample tune, marked *Adagio Moderato*. The score is in 3/4 time and consists of three systems of piano accompaniment. The music features a slow, melodic line in the right hand and a steady eighth-note accompaniment in the left hand. The score includes dynamic markings of *mf* and *f*, and the instruction *« Maggiore*.

• The 4th sample tune

Musical score for the 4th sample tune, marked *Moderato*. The score is in 3/4 time and consists of two systems of piano accompaniment. The music features a steady eighth-note accompaniment in both hands, with a dynamic marking of *mf* and the instruction *« Maggiore e Coricinese*.