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EVALUATION OF FEELINGS INVOKED BY THE RHYTHM PATTERNS OF PERCUSSIVE COLOR

Yuta Kurotaki[*a], **Hisao Shiizuka**[b]

[a] *Graduate School of Informatics, Kogakuin University, Japan*
[b] *Department of Computer Science and Communication Engineering, Kogakuin University, Japan*

ABSTRACT

This paper discusses our listening evaluations of the affective values of different rhythm patterns produced by two types of MIDI sound. The results confirmed that affective values changed with changes in rhythm patterns. The applicability of this study to music therapy is also examined.

Keywords: *Rhythm pattern, Affect, Music therapy*

1. INTRODUCTION

Although studies of the relationships between music and human feeling (affect)[1][2] have been conducted for a long time, there have been few studies of the effects of musical rhythms on people[3]. If the affect generated by music rhythm patterns were to be evaluated, the results could be applied to therapy sessions consisting mainly of rhythm performance using percussion instruments or body percussion.

Music therapy has been drawing attention in recent years, partly because of the stress associated with today's society, but only a few studies are available on the characteristics of sounds and music in music therapy[4]. In music therapy, there is a principle called the ISO principle[5] that matches the state or mood of the patient to the music being played/or listened to. Measurement of the affect induced by different rhythm patterns would enable music

* **Yuta Kurotaki**: 1-24-2 Nishishinjuku, Shinjuku-ku, Tokyo 163-8677, em09008@ns.kogakuin.ac.jp
Hisao Shiizuka: 1-24-2 Nishishinjuku, Shinjuku-ku, Tokyo 163-8677, shiizuka@cc.kogakuin.ac.jp

therapists to provide rhythms that match the feeling of a particular client at a particular time in rhythm sessions.

This paper discusses our listening evaluations of the affective values of different rhythm patterns produced by two types of MIDI sound. The results confirmed that affective values changed with changes in rhythm patterns. The applicability of this study to music therapy is also examined.

2. EVALUATION OF AFFECT INDUCED BY RHYTHM PATTERNS

2.1. Test subjects

The subjects of the experiment were 21 individuals aged between 19 and 24 (11 men and 10 women).

2.2. Acoustic Stimulation

As acoustic stimuli, 15 kinds of rhythm pattern were created by using the GM Standard rhythm color Bass Drum 1 (C2) and Acoustic Snare (D2). For rhythm patterns, five kinds of pattern were selected from popular rhythms contained in Mousa,[6] which is used as a music textbook in high schools (Figure 1).

In order to also measure changes in affect due to differences in tempo for each rhythm pattern, the BPM (beats per minute) was set at 60, 120, or 180 as the rhythm-pattern rate.

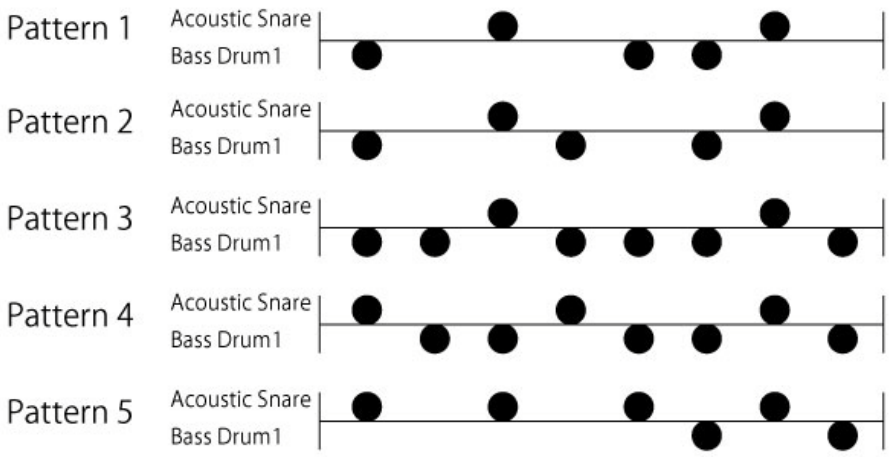

Figure 1: Rhythm Patterns Used in the Experiment

2.3. Questionnaire

We used the affective value scale of music (AVSM), created by Taniguchi (1998),[7][8] to create a questionnaire to evaluate the affect evoked by different rhythm patterns. AVSM is a scale used to evaluate the affective values of music works. The test subjects were asked to rate the rhythm patterns in terms of the 24 adjectives shown in Table 1 on a five-point scale: (1) does not fit their mood at all, (2) does not entirely fit their mood, (3) neutral, (4) fits a little, and (5) fits entirely (Table 1).

Table 1: The 24 Adjectives used in the AVSM

Affective value	Adjective			
Elation	melancholic	pathetic	sad	gloomy
	cheerful	delighted	joyous	bright
Affinity	tender	longing	sweet	tranquil
Strength	robust	impetuous	stimulating	determined
Lightness	whimsical	buoyant	merry	restless
Solemnity	dignified	awesome	magnificent	lofty

2.4. Experimental Equipment

Headphones (Audio-Technica ATH-A500) and laptop computers (Panasonic Let's note CF-W8) were used for the experiment.

2.5. Methodology

The rhythm patterns were presented one by one at random. Subjects were asked to listen to each pattern of music through the headphones and evaluate it by using the questionnaire. The experiment lasted about 20 to 30 minutes. A total of 15 patterns were played. The experiment was completed when the last piece was played and evaluated. At the end, subjects were asked to give feedback about the experiment.

3. EXPERIMENTAL RESULTS

The experimental results are shown in Table 2. The upper column shows the averages of the affective values, whereas the lower one shows standard deviations. Figures 2 to 4 compare the average affective values for different patterns at the same BPM. The horizontal axis shows the affective values and the vertical axis shows the average of affective values.

In order to investigate the effects of BPM and rhythm patterns on affective values, the affective value was assumed to be a dependent variable and BPM (3) and rhythm patterns (5) to be independent variables. Analysis of variance was carried out for the two factors.

3.1. Effects on Elation

For elation, the main effect of BPM was significant (F (2, 40) = 132.455, p < .001). Because the interaction was significant (F (8, 160) = 5.236, p < .001), a simple main effect test was performed. A simple main effect of rhythm patterns was observed at BPM60 and BPM180 (BPM60: F (4, 240) = 6.1556, p < .001; BPM180: F (4,240) = 2.8035, p < .05).

3.2. Effects on Affinity

For affinity, the main effects of BPM (F (2, 40) = 18.937, p < .001) and rhythm patterns (F (4, 80) = 7.561, p < .001) were significant. No interaction was observed (F (8, 160) = 1.171, *n.s.*).

3.3. Effects on Strength

For strength, the main effects of BPM (F (2, 40) = 83.866, p < .001) and rhythm patterns (F (4, 80) = 11.652, p < .001) were observed. Interaction was also significant (F (8, 160) = 2.445, p < .05). The simple main effect test indicated that there was a simple main effect of rhythm patterns at BPM120 and BPM180 (BPM120: F (4, 240) = 8.2219, p < .001; BPM180: F (4, 240) = 7.0756, p < .001).

3.4. Effects on Lightness

For lightness, the main effects of BPM (F (2, 40) = 28.288, p < .001) and rhythm patterns (F (4, 80) = 4.559, p < .01) were significant. Interaction was also significant (F (8, 160) = 2.851, p < .05). The simple main effect test indicated that there was a simple main effect of rhythm patterns at BPM60 and BPM120 (BPM60: F (4, 240) = 5.0659, p < .001; BPM120: F (4, 240) = 3.6856, p < .01).

3.5. Effects on Solemnity

For solemnity, the main effect of BPM was significant (F (2, 40) = 18.461, p < .001). No interaction was observed (F (8, 160) = 1.477, *n.s.*).

Table 2: Experimental Results

BPM	Pattern	Elation	Affinity	Strength	Lightness	Solemnity
60	1	7.07	10.14	8.95	6.38	11.05
		0.97	1.36	1.27	0.96	1.33
	2	7.81	10.19	8.33	7.19	11.00
		1.35	1.32	1.20	1.40	1.14
	3	9.55	9.90	8.76	8.67	10.48
		0.65	0.99	1.18	1.38	0.93
	4	10.76	8.95	8.90	10.38	9.38
		1.15	1.30	1.19	1.22	1.27
	5	9.48	9.95	8.81	9.24	9.48
		1.22	1.31	1.34	1.38	1.07
120	1	13.43	10.48	8.29	9.76	8.62
		0.88	1.05	1.25	1.34	0.97
	2	14.88	10.14	10.05	11.00	7.24
		1.27	1.30	1.29	1.33	1.24
	3	15.36	8.14	11.86	10.62	7.67
		1.27	1.12	1.34	1.38	1.07
	4	15.62	6.81	12.43	13.33	6.90
		1.17	0.75	1.21	1.46	1.20
	5	14.19	9.52	10.57	10.43	8.33
		1.30	1.24	1.29	1.52	1.22
180	1	18.60	7.71	12.86	12.95	6.71
		1.13	1.00	1.24	1.22	1.02
	2	18.05	7.71	13.71	13.05	6.33
		1.24	1.01	1.12	1.57	1.01
	3	16.62	6.05	15.52	12.81	7.76
		1.34	1.40	1.27	1.41	1.33
	4	16.17	6.38	16.71	11.86	6.90
		1.36	1.33	1.33	1.41	1.33
	5	17.24	6.90	14.71	14.14	6.10
		1.04	1.08	1.13	1.29	0.95

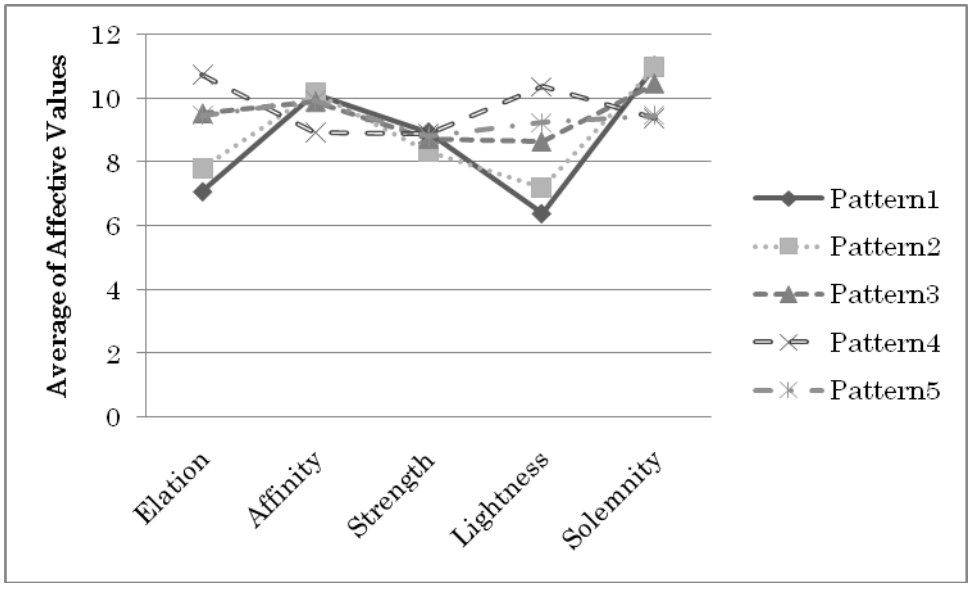

Figure 2: Comparison of Rhythm Patterns at BPM60

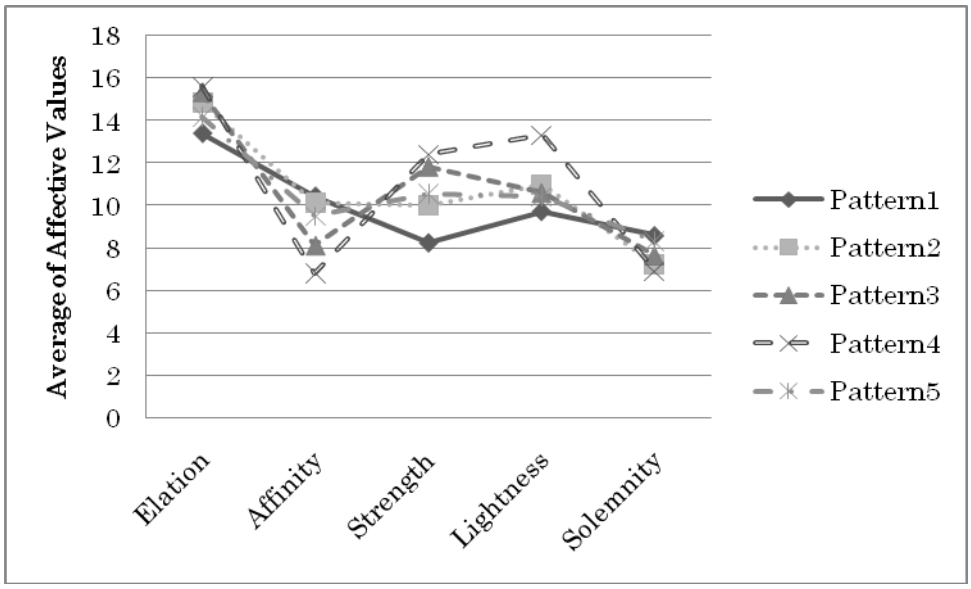

Figure 3: Comparison of Rhythm Patterns at BPM120

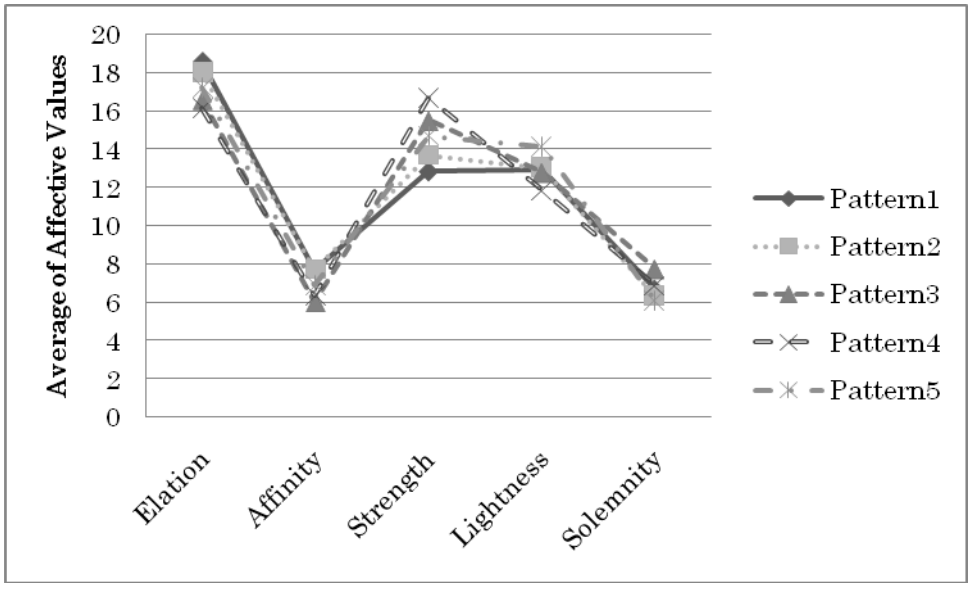

Figure 4: Comparison of Rhythm Patterns at BPM180

4. CONSIDERATION

Figures 2 to 4 are examined first. Figure 2 compares the affective values of five patterns at BPM60 and shows differences, especially for elation and lightness. This means that the affect changed with the pattern, even though the tempo, magnitude of the sound, and beat were the same. Figure 3 compares rhythm patterns at BPM120, revealing differences in affective values for strength and lightness. No differences are shown for elation, unlike at BPM60. Figure 4, at BPM180, shows no difference for elation and affinity but differences for strength and lightness. The results of the analysis of variance indicated that, for elation, affective values increased with the increase in BPM. The simple main effect test demonstrated the influence of rhythm patterns at BPM60 and 180.

For affinity, the main effects of BPM and rhythm patterns were significant. The results of the multiple comparisons revealed significant differences between patterns 1 and 3, and 2 and 3, in terms of BPM. No differences in affective value were observed at BPM60 and BPM120, but the value dropped at BPM180. Among the rhythm patterns, significant differences were observed between patterns 1 and 3, 1 and 4, 2 and 3, 2 and 4, and 4 and 5.

For strength, as BPM increased, the affective value also went up. The results of the simple main effect test suggested the influence of rhythm patterns at BPM120 and BPM180.

For lightness, the results of the simple main effect test suggested the influence of rhythm patterns at BPM60 and BPM120.

For solemnity, the main effect of BPM was significant. The affective value of solemnity changed with the effect of BPM. The multiple comparisons showed significant differences at different BPM. The results suggested that the affective value of solemnity decreased as BPM increased.

5. SUMMARY AND FUTURE PROSPECTS

We used AVSM to conduct experiments to evaluate feelings, with a focus on the affect evoked by rhythm patterns created by two sounds. We then identified and examined the characteristics of the feelings. Although the rhythm patterns used in the experiments were simple, the results confirmed that the feelings we perceive from percussive color change with the rhythm patterns. On the basis of the ISO principle in music therapy, the results of the experiments can be used to allow for the selection of rhythm patterns that match the state of the patient. For example, if a patient is "melancholic" or "gloomy," a rhythm pattern that has low affective value for elation can be used, whereas a rhythm pattern with high affective value for lightness can be used for a "restless" patient.

Rhythms in general have much to do with activities of daily life such as conversation and walking. Therefore, in addition to performing psychological measurements, in the future we will also measure physiological features such as heart rate or brain blood flow.

Just as with the evaluation of the affect we perceive from rhythm patterns, evaluation of the affect arising within ourselves while we listen to rhythm patterns will also become important. Music therapy can be broadly divided into passive and active. If the affect arising within persons who are playing, and not just listening to, rhythms can be measured, then the measurement results will be able to be applied to the percussion sessions of active music therapy.

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