

Inspiring Viewers of Abstract Painting by a Gaze Based Music Generation

Tatsuya Ogusu¹, Jun Ohya¹, Jun Kurumisawa², and Shunichi Yonemura³

¹ Waseda University, Global Information and Telecommunication Institute
Bldg. 29-7, 1-3-10 Nishi-Waseda, Shinjuku-ku, Tokyo 169-0051, Japan

² Chiba University of Commerce, Faculty of Policy Informatics, Japan

³ Shibaura Institute of Technology, College of Engineering, Japan
tatsuyaogusu@akane.waseda.jp

Abstract. This paper explores the effectiveness of prompting abstract paintings' viewers' inspiration and imagination by the authors' gaze based music generation system. The authors' music generation system detects the viewer's gaze by a gaze detection equipment. At each of the gaze staying positions in the painting, the color of that point is converted to the sound so that as the gaze moves, music that consists of the converted time series sounds is generated. Experiments using six subjects and six abstract paintings were conducted for the three cases in which the subjects see the abstract paintings without hearing any music, while hearing pre-selected music and while hearing the viewers' gaze based music generated by the authors' system. The experimental results imply that "hearing gaze based music" could stimulate the viewers' inspiration and imagination best, "hearing pre-selected music" second best, and "without music" third best.

Keywords: Abstract Painting, Music, Gaze Behavior, Inspiration.

1 Introduction

In early times, one of the concepts of abstract paintings was to depict music on canvases. For example, Kandinsky left many works that depict the music (e.g. [1]). In recent years, many works that combine audio and visual media by computer have been presented, but there are not many representations that combine paintings and music. The authors have proposed a music generation system that utilizes viewers' gazes [2]. To generate music from paintings, temporal information needs to be extracted from the painting, because music consists of time series sounds. The gaze of a person who sees the painting corresponds to temporal changes in the position in the painting. This property is utilized by the authors' system.

Concerning music composition using still images such as drawings and/or paintings, Xenakis developed a system called UPIC [3], [4], which scans the still image so that lines and points in the image are converted to sounds using a computer. UPIC's algorithm assigns vertical coordinates of the image to pitch and horizontal coordinates to timeline. However, as temporal changes in the position in the still

image, the horizontal scan might not be very reasonable. Another example of combining paintings and music is Iura's work entitled "map" [5], in which the color pointed by the user's mouse, which is an alternative of the viewer's gaze, is converted to sound. However, to our knowledge, Iura did not implement the proposed system.

This paper explores the effectiveness of the authors' gaze based music generation system. In particular, whether the inspirations the viewers obtained from the abstract painting could be enhanced by this system is studied.

2 Approach

In the authors' music generation system, the gaze of a person who views an abstract painting is detected by a gaze detection equipment such as the Eye Tracker. The gaze tends to stay at certain points in the painting for certain durations. At each of such staying points, color information, specifically, hue, brightness and saturation, is obtained. The hue is converted to a tone row in an octave. The brightness determines the pitch of the octave determined by the hue. The frequency of the saw wave, which is generated by an oscillator, is determined by the pitch determined by the brightness, where the height of the saw wave is determined by the volume of the sound. Normally, saw waves are low-pass filtered; the saturation determines the cut off frequency of the low pass filter. As the gaze moves and stays at different positions, time series sounds, which could be a material of music, are generated.

In general, abstract paintings aim at stimulating viewers' inspiration and imagination, but it is not so easy for many people to interpret abstract paintings that most of those people cannot enjoy viewing abstract paintings. The authors' gaze based music generation system could be able to prompt abstract paintings' viewers to inspire and/or image something more from the paintings than the viewers just see the paintings. To verify this, this paper conducts some experiments as described in the following sections. More specifically, subjects are asked to see abstract paintings under the following three conditions: (1) just see the paintings (without hearing any music), (2) while hearing pre-selected music, and (3) while hearing the music generated by the authors' system; then, subjective tests are performed for the three conditions.

3 Experiment-1: Effect of Music

3.1 Method of the Experiment-1

As described in Section 2, when a person sees abstract paintings, his/her inspiration and imagination could be affected by whether music is played or not. The Experiment 1 compares the two cases in which the viewers see abstract paintings, while hearing pre-selected music and without hearing any music. We use six subjects, six abstract paintings, and one music: Stockhausen's "Studie 1 (1953)". The procedure of the Experiment-1 is as follows.

- 1. Before the experiment, we instruct each of the subjects to express what he/she thinks and how he/she feels, by uttering words so that we can record the words he/she utters.
- 2. Three of the six abstract paintings are presented to each subject without music, and then the subject’s utterances are recorded.
- 3. The other three paintings are presented to each subject while playing the pre-selected music, and then the subject’s utterances are recorded.

3.2 Results of the Experiment-1

As shown in Table 1, it turns out that the contents of the six subjects’ recorded uttered words can be classified into the three categories: Category A (concrete ideas), Category B (impression) and Category C (movements). The numbers of uttered words in each of the three categories are shown in Fig. 1, where the ratio of the number of uttered words in that category to the number of all the uttered words is presented. In case of “without music” and “Hearing pre-selected music”, there are many uttered words in Categories A and C, respectively.

In addition, the case in which multiple uttered words correspond to a same meaning can be seen; that is, the multiple uttered words are the repetition of the same meaning. Table 2 shows the number of the repetition for the words that were repeated at least once (uttered at least twice) in either “without music” or “hearing pre-selected music”. As can be seen in Table 2, the number of the repetition in “hearing music” is much less than “without music”. This implies that due to “music”, the number of uttered words with independent meanings is increased. In other words, “music” could stimulate viewers’ inspiration and imagination.

Table 1. Category of Viewers’ Uttered words

Category	Meaning	Example
A	Concrete Idea	This looks like the sun.
B	Impression	Scary. Strange feeling.
C	Movement	Something is falling. Something is bulging

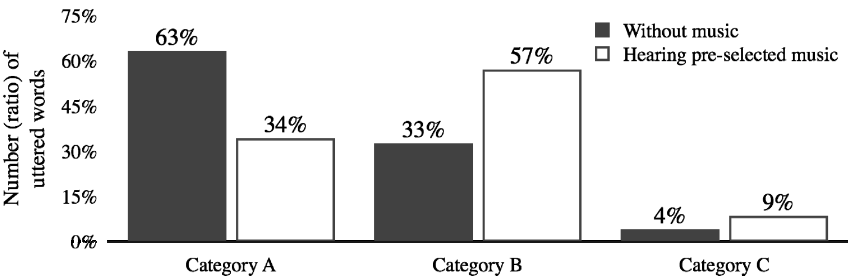


Fig. 1. Number (ratio) of uttered words in each category in “without music” and “with music”

Table 2. Number of repeated uttered words in the Experiment-1

Word	Without music	Hearing pre-selected music
Sun	3	0
Moon	2	0
Hot, Warm	3	0
Heavy, So heavy	1	0
Steps	1	0
City, Concrete jungle	2	0
Cloth's pattern, Curtain's pattern	0	1

4 Experiment-2: Effect of Music Generated by the Authors' Gaze Based System

4.1 Method of the Experiment-2

Similar to the Experiment 1, we compare the two cases in which the viewers see abstract paintings while hearing pre-selected music and while hearing the music generated by the authors' system. We use six subjects, six abstract paintings that are different from the ones used for the Experiment-1, the same music as the one used for the Experiment-1, and the gaze based music generated by the authors' system. The procedure of the Experiment-2 is as follows.

1. Before the experiment, we instruct each of the subjects to express what he/she thinks and how he/she feels, by uttering words so that we can record the words he/she utters.
2. Three of the six abstract paintings are presented to each subject while playing the pre-selected music, and then the subject's utterances are recorded.
3. The other three paintings are presented to each subject while detecting the gaze of the subject and playing the music generated based on the detected gaze.

4.2 Results of the Experiment-2

The contents of the six subjects' recorded uttered words are classified into the three categories defined by Table 1. As opposed to the Experiment-1, the number (ratio) of the uttered words in each category is not significantly different between "hearing pre-selected music" and "hearing gaze based music".

Then, similar to the Experiment-1, the numbers of the repetitions of the same meanings in case of "hearing pre-defined music" and "hearing gaze based music" are listed in Table 3. As can be seen in Table 3, the number of the repetition in "hearing gaze based music" is much less than "hearing pre-selected music". This implies that due to the gaze based music, the number of uttered words with independent meanings is increased. In other words, "gaze based music" could stimulate viewers' inspiration and imagination.

Through the results of the Experiment-1 and Experiment-2, “hearing gaze based music” could stimulate viewers’ inspiration and imagination best, “hearing pre-selected music” second best, and “without music” third best.

Table 3. Number of repeated uttered words in the Experiment-2

Word	Hearing pre-selected music	Hearing gaze based music
Bug	1	0
Stationery	2	0
Face, Part of face	7	0
Monster	2	0
Neo-futuristic	1	0
Sun	1	2

5 Conclusion

This paper has explored the effectiveness of prompting abstract paintings’ viewers’ inspiration and imagination by the authors’ gaze based music generation system. Experiments using six subjects and six abstract paintings were conducted for the three cases in which the subjects see the abstract paintings without hearing any music, while hearing pre-selected music and while hearing the viewers’ gaze based music generated by the authors’ system. The experimental results imply that “hearing gaze based music” could stimulate the viewers’ inspiration and imagination best, “hearing pre-selected music” second best, and “without music” third best.

Remaining issues include that we conduct experiments using more subjects and abstract paints so that more solid results can be obtained.

References

1. Wassily Kandinsky - Compositions, <http://www.wassilykandinsky.net/compositions.php>
2. Ogusu, T., et al.: Analysis of Gaze Behaviors of Viewers Who See Abstract Paintings and Proposal of its Application to Music Composition. In: IEICE General Conference, vol. A, p. 254 (March 2012) (in Japanese)
3. Centre Iannis Xenakis, <http://www.centre-iannis-xenakis.org>
4. Nagashima, Y.: Discussion for PGS (Polyagogic Graphic Synthesizer), Information Processing Society of Japan, SIG Technical Report, 2005-MUS-59 (7) (2005) (in Japanese)
5. Iura, T.: New Creative for Imagery and Music in Digital Media - Expressive Effect through Audio and Visual Interaction. Journal of Kansai University Faculty of Informatics (34) (2011) (in Japanese)