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# A STUDY ON EVALUATION OF A SENSE OF BEING ALIVE BY MOTION GRAPHIC

Ongon WITTHAYATHADA <sup>1a</sup>, Koichi NISHIO <sup>b</sup>, Youngil CHO <sup>a</sup>

<sup>1a</sup> *Fukui University of Technology, Japan, dd20003ou@edu.fukui-ut.ac.jp*

<sup>b</sup> *Nagoya University of Arts and Sciences, Japan, nishiok@nuas.ac.jp*

<sup>a</sup> *Fukui University of Technology, Japan, cho@fukui-ut.ac.jp*

## ABSTRACT

*Seimeikan*, the sense of being alive might enhances motion graphics, makes it an effective communication tool, and affects human emotions. However, there is a lack of studies in terms of expressing a sense of being alive that focuses on human decision. The present study aimed to investigate the motion factors and find how motion affects the evaluation of sense of being alive. Two sets of motion graphics, artifacts and natural creature were used in the evaluation. The artifact set was composed of three levels of displacement (Linear), sine curve, and noise factors. The natural creature set was composed of data from fish locomotion. The findings of the study presented that (1) motion graphics based on natural creature were rated more positively than those that are based on artifact, (2) the motion graphics based on artifact showed the importance of noise factors, which highly correlated with expressing the sense of being alive compared to other factors. Moreover, it was found that high and low noise factors positively influenced the evaluation of the sense of being alive more than those without noise.

**Keywords:** *Motion Graphics, Sense of being alive, Artifacts*

## 1 INTRODUCTION

With the growth of science and new technology in recent decades, many man-made objects refers to artifacts in this study, have been produced to have realistic expressions similar to that of actual living being and are being utilized for various purposes. An example is Paro, a therapeutic robot which is used to provide emotional support to patients in environments such as hospitals, similar to that of animal therapy. They can communicate using an adorable voice, move their bodies and blink their eyes like a living baby seal (Takanori & Kazuyoshi, 2012). Recent observation

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<sup>1</sup> Corresponding author.

shows the market of robot is growing and therefore there may be a possibility for a market of artifacts expressing a sense of being alive to grows in the future (“Robotics Growth Is about More than Technology”, 2021). However, research related to a sense of being alive in the artifacts is minimal, including the lack of suggestions on how to make the artifacts express a sense of being alive.

What is the sense of being alive? How do humans feel a sense of being alive from the artifacts? The present study aimed to clarify these questions by looking at the Japanese word *Seimeikan*, which is closely related to the meaning of the sense of being alive. *Seimeikan* is a noun which is an integration of the two Japanese words: *Seimei* which means life and *Kan* which means feeling.

*Seimeikan* appears in various aspects, such as robots, art, medicine, psychology, etc. In the aspects of psychology, it is related to human perceptions of being, in which humanity does not exist only within the individual, but also connects with external factors such as family, society, and the nature of the universe (Koyasu et al., 2012). In terms of art, *Seimeikan* refers to the feelings of irregularity and asymmetry, which reminds us of natural forms. For example, when artists draw the form of mechanical artifacts such as bicycles, the shape of these artifacts can be separated into geometric shapes. In contrast, a horse, a natural creature, is symmetrically indivisible (Tachihara, 1995). In addition, the Japanese art of arranging flowers, called *Ikebana*, brings out the feeling of naturalness and a sense of being alive to the spectator due to the flowers being arranged independently with different lengths and orientations (Averill, 1913; Korenaga & Hagiwara, 2004). Moreover, *Seimeikan* is also found to be related to a feeling of unpredictability, when humans see something change suddenly without expectation, for instance, when seeing a cockroach (Miura, 1996). These findings present multiple perspectives of *Seimeikan*. The present study proposes the implementation of *Seimeikan* as a scale to evaluate human judgment of objects or artifacts such as artworks or computer graphics, have lifelike expressions or are similar to living things in one way or another. This evaluation is based on a human feeling, recognition, or cognition about living things in their memory.

A previous research on expressing a sense of being alive with the focus on rhythms of flashing light, sound, and changing form presented the influenced factors related to expressing a sense of being alive (Witthayathada & Nishio, 2021). However, the previous research did not focus on human decisions. Therefore, this research focused on both human decisions and motion graphics factors based on artifacts and natural creatures. Then we aim to investigate factors affecting the evaluation on a sense of being alive regarding artifacts composed of motion graphics. In this study, *Kansei* engineering was employed as the analysis methodology. This method focuses on the consumer-oriented methodology for effective product development and is defined as a system which characterizes individual personalities depending on each individual, including lifestyle, age, gender, and the environment. *Kansei* refers to humans' aroused sensations, perceptions, feelings, and emotions that respond to stimuli. This methodology has played an essential role in numerous Japanese industries for over twenty years (Nagasawa, 2002; Kato, 2010; Nagamachi, 1995).

## 2 OBJECTIVE

The purpose of this study was to investigate how motion is influenced the evaluation of sense of being alive. The research objectives are as follows: (1) to find the influenced factors of expressing a sense of being alive of the motion graphics based on the artifact, (2) to understand the differentiation in evaluation between the participants' decision making, and (3) to compare between the motion graphic based on artifact and the motion graphics based on natural creature.

## 3 METHOD

### 3.1 Participants

23 native Japanese students (14 males and 9 females, mean age: 19.21 ) from Fukui University of Technology participated in the experiment.

### 3.2 Motion graphics stimuli

18 motion graphics stimuli divided into two sets of motion graphics simulations namely, artifacts (9 simulations) and natural creature (9 simulations) were prepared and used in the experiment.

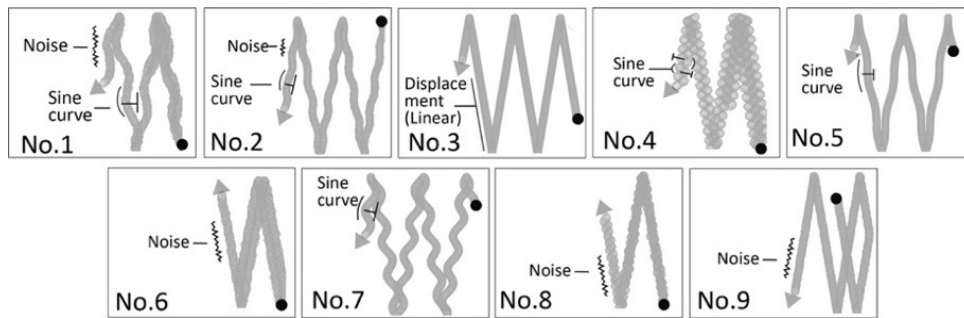
#### 3.2.1. Motion graphics based on the artifact

9 types of simulation of a 2D circle with three levels (without, low, high) of motion attributes such as displacement (Linear), sine curve and noise were prepared for the experiment. The design specifications of each attribute are as follows:

$$\text{Motion} = \text{Displacement (Linear)} + \text{Sine curve} + \text{Noise}$$

1) The displacement means the linear displacement was only set in the X-axis in a unit of time (1/60 seconds). Low values of the displacement make the circle move slowly, and high values of the displacement make the circle move fast. For the Y – axis, this displacement was set as constant displacement and speed . 2) Sine curve refers to a curve which caused by fluctuations and represents in the regular smooth repeating waveform, and 3) Noise employs the Perlin noise, which is a powerful algorithm used for creating virtual gaming environments with natural texture and model in animations (Lagae et al., 2010; Smelik et al., 2010). Each component consists of three different levels as low, high, and without the component (Table 1).

A total of nine experiments were carried out by using Taguchi's orthogonal array method L9 (9 tests, 3 variables, and 3 levels). This method used the process of decreasing the variation (Woolf, 2021). Figure 1 displays the simulations created by the processing software, and version 3.5.4 (MIT Media Laboratory, USA). The appearance of the simulations was designed in a white 2D circle with a size of 30 × 30 pixels (Width x height). The 2D circle appeared on a black background. The start points of the simulation were set at random and displayed in a size of 748 x 544 . The description of the attributes of each motion graphic is shown in Table 1.



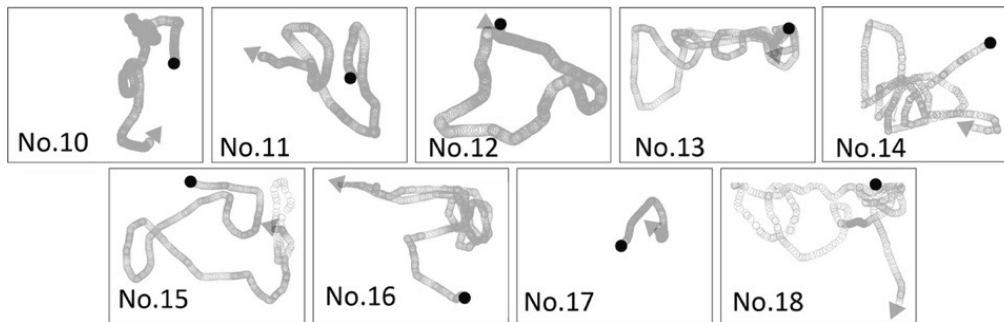
**Figure 1.** Example of the motion graphics based on the artifact with explanation of the motion attributes with the directional arrows

**Table 1.** The combination of attributes with different levels for making the motion graphics

No.	The attributes of the motion graphics		
	Displacement (Linear)	Sine curve	Noise
1	High	High	High
2	High	Low	Low
3	High	Without	Without
4	Low	High	Low
5	Low	Low	Without
6	Low	Without	High
7	Without	High	Without
8	Without	Low	High
9	Without	Without	Low

### 3.2.2. Motion graphics based on the natural creature

The motion graphics simulations for the natural creature set were created based on the data of fish locomotion (Figure2). In this study, the fish locomotion was selected because it is easier for the participants to observe the displacement, speed, and acceleration of motion of fishes compared to other living things. We used a camera to record the movement of Neon Tetra fish and used Image J (The National Institutes of Health, USA) to track the fish motion and export the two-dimensional (2-D) XY value to a .CSV file. Then, we used the processing software, which in version 3.5.4, to create nine samples of the motion. The appearance of motion graphics and the display size were produced the same as the simulation based on the artifact as described above in section 3.2.1 (The motion graphics based on the artifact). The path of motion graphics based on the natural creature showed that the dark color refers to slowly moving, and the light color refers to moving fast.



**Figure 2.** Example of the motion graphics based on natural creature with directional arrows

### 3.3 Procedure

The survey experiment was carried out for nine days from Oct 6th, 2021 to Oct 14th, 2021. This experiment performed the questionnaires to ask the participants to rate the score of how they feel a sense of being alive through motion, using the 5-point Likert scale (From 1 = “Not alive” to 5 = “Alive”), as shown in Figure 3. Before the experiment started, we introduced the experiment’s purpose, explained the function of the survey interface, and told the participants that there was no limitation time for the evaluation. The participants were asked to sit at a distance of approximately 40 cm from a 15-inch monitor (MacBook Pro, Intel Core i7, 2.2 GHz, 16 GB) and then rate the score after watching the motion graphics. The questionnaire was designed by the processing software, and version 3.5.4 (MIT Media Laboratory, USA). Processing software was employed to collect the evaluation score and response time of the participants to each motion graphics simulation.

**Question : How do you rate the lifelikeness of the object ?**

1    2    3    4    5

Not alive |-----| Alive

**Figure 3.** Questionnaire asking the participants to rate scores for 18 motion graphics

## 4 RESULTS

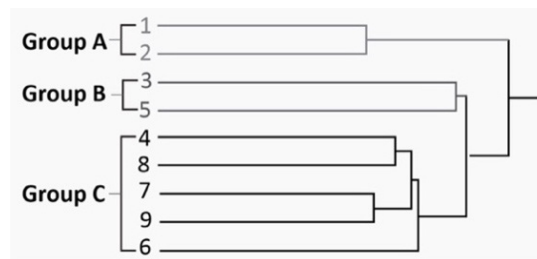
According to the objectives of this study, the experiment was performed to find how participants feel a sense of being alive in the motion graphics simulations. This study employed the analysis of variance (ANOVA) and a two-way ANOVA to investigate the evaluation of influential factors in expressing a sense of being alive. Then, the cluster analysis was employed to classify the motion graphic simulations into groups and to investigate the similarity and differentiation of the each group.

### 4.1 Data analysis results of the motion graphics simulations based on the artifact

For similarity in evaluation tendency, cluster analysis was used for grouping the motion graphics, and examining the similarity and differentiation of each cluster group. As a result, the 9 motion graphics simulations were classified into 3 clusters, which were A, B and C groups (Figure 4). The result showed group A consisted of the simulations with low and high noise. Group B

consisted of the simulations without noise. Group C consisted of the simulations with low and without displacement (Linear). The mean of score in group A was highest among the clusters (Group A = 3.59, Group B = 2.37, and Group C = 2.77 ).

The difference between the highest and lowest scoring groups was discussed as follows: group A with the highest score consisted of the simulations with low and high noise. On the other hand, group B with lowest score consisted of the simulations without noise factor. Therefore, noise was noticed as an influential factor on participants' evaluation of a sense of being alive. Motion accompanied by noise might enable participants to feel a sense of being alive compared with motion without noise, such as motion in repeated patterns as seen in machine operation. Natural creatures expressed themselves in irregular motion, for example the movement of breathing rhythms in the human body (Jerath, 2020).

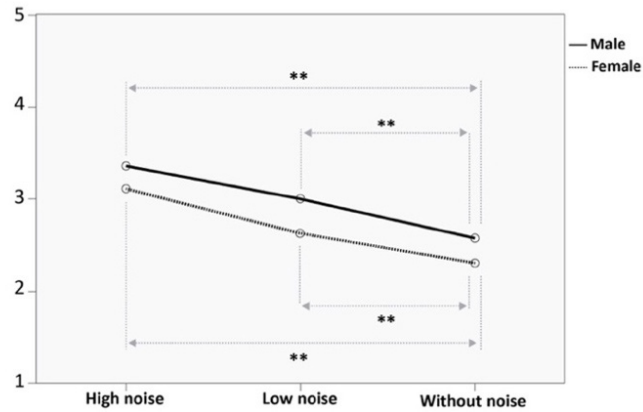


**Figure 4.** Result of the cluster analysis generated the motion graphics in three groups

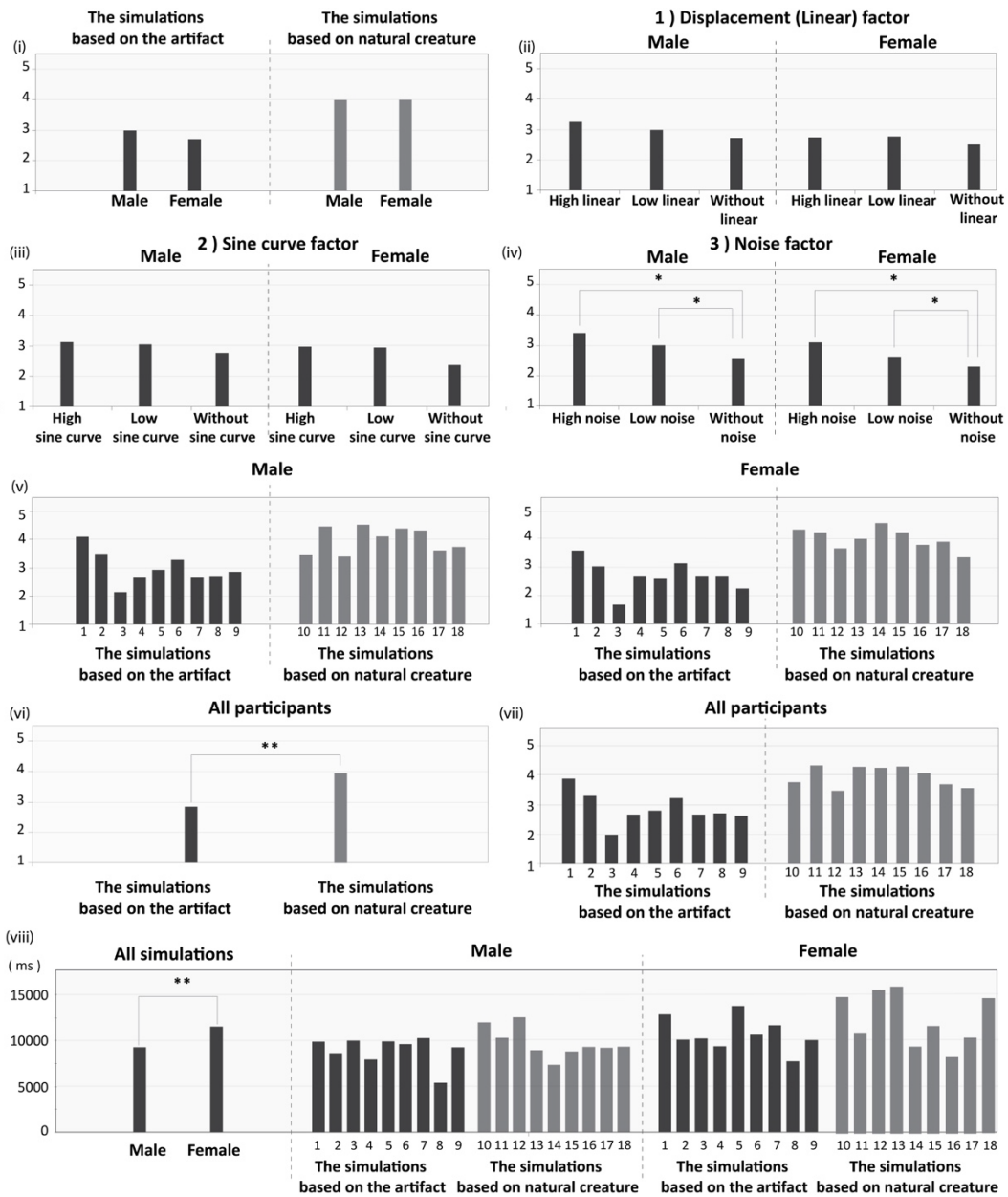
For the difference in evaluation tendency, there are no significant differences between males and females with the feeling of expressing a sense of being alive regarding stimuli based on artifact (The left side of Figure 6, (i)). The mean of the evaluation score of the simulations and the standard deviation by gender were shown as follows: Male (2.97), and female (2.68).

For the three factors of the simulations (Displacement (Linear), Sine curve, and Noise), the result of the analysis of variance (ANOVA) showed that the significant differences were detected between without noise, low and high noise from the males ( $p < 0.05^*$ ), and females ( $p < 0.05^*$ ) as shown in Figure 6, (iv). The finding in both genders indicated that without noise factor was the lowest mean of score more than high and low. Moreover, the results showed that without noise have a lower variation than low and high noise in the both male and female group as follows: Male (Without noise: Mean = 2.57, SD = 1.1716, low noise: Mean = 3, SD = 1.3614, and high noise: Mean = 3.36, SD = 1.3937), and female (Without noise: Mean = 2.30, SD = 1.0675, low noise: Mean = 2.63, SD = 1.2136, and high noise: Mean = 3.11, SD = 1.1208).

For Interaction effect of noise levels and evaluation on evaluation tendency, Figure 5 presents a significant difference that can be seen between interaction effect of noise levels and evaluation. The result of two-way ANOVA indicated a main effect of noise ( $p < 0.01^{**}$ ) and no significant interaction effect between noise and gender, which was reported for the evaluation of the sense of being alive as can be seen in Figure 5. According to the obtained results, the high and low levels of noise positively correlated to the high evaluation score more than those without noise. Furthermore, there was no significant interaction between displacement (Linear) and sine curve displacement factors with the evaluation of both genders. From the finding, the noise factor was considered as positive affected to participants feeling a sense of being alive.



**Figure 5.** Two-way analysis of variance was used to analyze the three levels of noise and the evaluation scores for males and females. A significant difference was found as  $** p < 0.01$ .



- (i) Two set of motion graphics simulations and mean rating score of male and female
- (ii-iv) Mean rating of male and female with three factors of motion graphics simulations based on the artifact
- (v) Mean rating of male and female with two set of motion graphics simulations
- (vi) Mean rating score of all participants with two set of motion graphics simulations
- (vii) Mean rating score of all participants with the motion graphics simulations from no.1 to no.18
- (viii) Mean response times of all participants, and male and female with two set of motion graphics simulations

Figure 6. Results of evaluation. A significant difference was found as \*  $p < 0.05$  and \*\*  $p < 0.01$

#### 4.2 Data analysis results of the motion graphics simulations based on the artifact and natural

For comparison between two sets of the simulations, the result of the analysis of variance(ANOVA) shows the significant difference between the artifacts simulations and the simulations based on natural creature ( $p < 0.01^{**}$ ) (Figure 6, (vi)). We considered that the motions of artifacts simulations were in repeated paths. On the contrary, the simulations based on nature were moved in irregular paths. The repeated path might be affected by the participant's ease of memorizing and predicting, but the irregular path might cause the participants to have unexpected feelings.



For difference in evaluation tendency, the finding shows no significant differences between males and females with the evaluation of motion graphics simulations based on the natural creature (The right side of Figure 6, (i)). The result of artifacts simulations shows that the average of male evaluation scores were higher than females (Male =2.97, and female =2.68 ). In contrast, male evaluation scores were lower than females in the simulations based on the natural creature. The mean for each gender and the simulations based on natural creature (Male =3.97, and female =4 ).

This study investigated the variation in participants' rating score, the finding of the simulations based on the artifact and natural creature was shown that differentiation of the variation between males and females. The finding showed that males 'evaluation was more varied than females as follows: The evaluation of simulations based on the artifact: Male (SD = 1.3414 ), and female (SD = 1.1707). In addition, the evaluation of simulation based on natural creature: Male (SD = 1.1861 ), and female (SD = 1.1067). This results indicated that the female evaluation score was more cohesive than males. It could be considered that male may be more confused in their decision-making than females.

For comparing between gender response times, females' response time to all simulations was longer than males ( $p < 0.01^{**}$ ) as can be seen in the left side of Figure 6, (viii). The results presented that female participants tend to take longer to rate than male participants. According to the obtained data, we looked at the differentiation between males and females and found that males do not think as complexly as females. Females are superior in carefulness and thoughtfulness more than male (Lewis, 2013; Mawaddah et al., 2018).

### 4.3 Cluster analysis of all motion graphics simulations

The cluster analysis was conducted. As a result, the 18 motion graphic simulations were divided into 2 clusters, A and B groups (Figure 7). The result indicated that group A mostly consisted of the simulations based on the natural creature. Two artifact simulations in this group were simulation no.1, and no.2. The attributes of simulation no.1 were high displacement (Linear), high sine curve and high noise. Simulation no.2 consisted of high displacement (Linear), low sine curve, and low noise. Group B contained only the simulations based on the artifact. The mean score in group A was higher than group B (Group A = 3.91, and Group B = 2.65 ).

From the finding of group A and group B, we discussed the differentiation between the high and low scoring groups. Group A with higher score mostly consisted of the simulations based on natural creature, and group B with lower score consisted only of the simulations based on artifact. According to the obtained result of group A, it is considered that simulations no. 1 and 2 were classified in this group because their attributes were similar to the simulations based on nature. Both simulations no. 1 and 2 consisted of low and high noise and this noise factor was found to positively affect participants feeling a sense of being alive. Therefore, it might be possible to make the artifact simulations express a sense of being alive similar to the simulations based on nature by employing the noise factor.

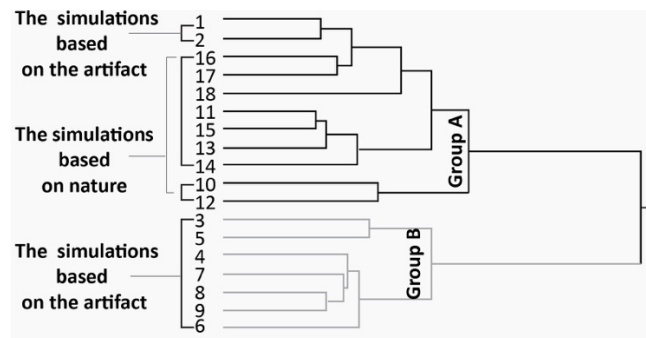


Figure 7. Result of the cluster analysis generated all motion graphics in two group

## 5 DISCUSSION AND CONCLUDING REMARKS

The present study aimed to investigate how motion is influenced the evaluation of sense of being alive. The findings of the study presented that the noise factor affected the feeling of a sense of being alive of participants according to the result of simulations based on artifacts (Figure 5). The simulations with low and high noise were significantly found to be different from those without noise (Figure 6, (iv)). High and low noise factors were found as correlated with the positive feeling of a sense of being alive. On the other hand, the motion without noise factor correlated to the negative evaluation scores. The importance of noise factors in expressing a sense of being alive is found in this study and may benefits future researches relating to a sense of being alive. Displacement(Linear) and sine curve factors had no influence on the participants' evaluation. Comparing between the simulations based on artifact and natural creature, there were significant differences between the two sets of simulations as can be seen in Figure 6, (vi). The simulations based on natural creature got the highest-rated scores more than the simulations based on the artifact. However, two artifact simulations were classified in the same group with the simulations based on natural creature from the cluster analysis (Figure 7). These two simulations consisted of low and high noise. For gender factors, there was no relationship between gender and expressing a sense of being alive in the artifacts. Furthermore, it was observed that female participants tend to take longer to rate than male participants (Figure 6, (viii)). Understanding the differentiation of participant background might impact developing the artifacts that can express a sense of being alive in the further study. Implementing *Seimeikan*, the sense of being alive might give the audients get the new experiences of motion graphics.

## 6 LIMITATIONS AND FUTURE STUDY

1) Future study will examine the differentiation of the noise level effects on expressing a sense of being alive of motion and increasing the wide-ranging of the motion attributes. For example, we consider adding different noise levels in the more diverse motion, such as linear motion or circular motion with various kinds of noise, etc. In this current study, we produced the simulations based on the natural creature, which did not show the variables. The future study aims to produce all of the simulations with the variable for finding the differentiation and similarity of the each variable. 2) Performing the various simulations shape, such as the shape were in small, medium, and large size. 3) The size of the participants needs to increase. Moreover, we will consider balancing the numbers of male and female participants for efficiency in finding gender differences

in decision making. In addition, we plan to ask the participants from different backgrounds—for example, the participants who had any experience working in the design field compared to the participant who never had the experience, including asking the participants from different nationality backgrounds. 4) This study has only one evaluation asking whether the participants felt a sense of being alive or not. The future study will increase the number of evaluations and explore the words that have similar meanings with *Seimeikan* for considering more evaluations in the experiment. 5) Employing the Self-Assessment Manikin (SAM) to measure the participants' emotional state. This study is also supposed to ask participants from different nationalities due to the Self-Assessment Manikin is a non-verbal pictorial assessment technique (Bradley & Lang, 1994).

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