Study on the Degree of Memory of Facial Contents

Nobuhiko Sasaoka, Yukiya Horie, Hidetaka Masuda, Nobuji Tetsutani
Tokyo Denki University
Tokyo,Japan
E-mail:17fmi13@ms.dendai.ac.jp

***Abstract*— The sense of incongruity experienced by people is the feeling that "I understand something is different, but cannot explain it in concrete terms." This sense of incongruity may trigger the detection of fake works, such as paintings. In this paper, we focused on the size of the face of an unconsciously memorized person to clarify the relationship between unconscious memory and incongruity. Using the size as a parameter, subjective evaluation experiments were carried out by displaying the three contents of real persons, animated characters, and monsters in 2D (two-dimensional display) and 3D (stereoscopic display).**

Keywords— incongruity; memory; face

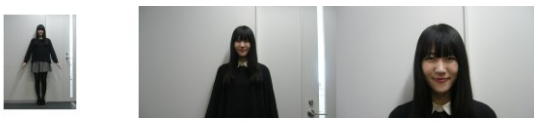
I. INTRODUCTION

The sense of incongruity experienced by people is the feeling that "I understand something is different, but cannot explain it in concrete terms". This sense of incongruity may trigger the detection of fake works, such as paintings. It is thought to have arisen from unconsciously comparing what you have memorized to what you are seeing now. In this paper, we attempt to measure the degree to which memory is unconsciously evoked by using sense of incongruity as an indicator. We focused on the size of the face of an unconsciously memorized person and conducted an evaluation experiment. The contents used in the experiment are a real person, an animated character, and a monster. For these three contents, evaluation experiments were further conducted with two displays of 2D (two-dimensional display) and 3D (three-dimensional display). Also, we evaluated the appearance of an animation character and an real person taking into consideration that they are potentially memorized.

II. EXPERIMENTAL CONDITION

We used three contents, a real person, an animated character, and a monster[1]. A 65-inch display was used. The sizes of the evaluation facial images were set at about 0.1 times to about 3 times. The size of the face displayed on the screen was about 0.1 times to about 3 times the actual size. The visual distance between the screen and the subject was 1 m. The images used in the evaluation experiment are shown in Fig. 1 to 3. Fig.1 shows the images of real person. Fig.2 shows the images of animated characters. Fig.3 shows the images of monster. Subjects saw 2D images and 3D images for the three types of content mentioned above and evaluated. The experimental landscape is shown in Fig.4.

The size of the face was subjectively evaluated on a scale of one to five, with "1 = No sense of incongruity", "2 = A little sense of incongruity", "3 = A sense of incongruity", "4 = Strange" and "5 = Very strange". The order of the sizes of the images to be displayed was random for each subject.

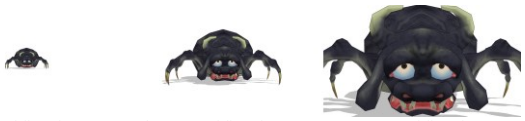


(a) magnification (0.11) (b) magnification (1.0) (c) magnification (2.9)

Fig.1. The images of actual person

(a) magnification (0.11) (b) magnification (1.0) (c) magnification (2.9)

Fig.2. The images of animated characters



(a) magnification (0.11) (b) magnification (1.0) (c) magnification (2.9)

Fig.3. The images of monster

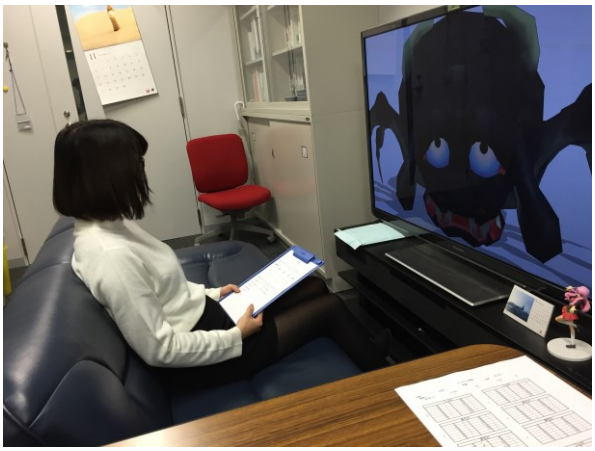


Fig.4. Experimental landscape

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III. Experimental Results and Discussion

A. Subjective Evaluation for the Sense of Incongruity

Fig.5 to 7 show the results of the evaluation experiment. Table 1 shows the relationship between the number of magnification and the magnification ratio. Fig.5 shows the subjective evaluation results of real persons for 2D and 3D. With reference to the real person images, subjects experienced nosense of incongruity at the same magnification ratio (8) in both the 2D image and the 3D. The large image (14) was evaluated as the most strange as compared to the other contents. In addition, even when a small image (1) was used, many answers that there was a sense of incongruity were observed. This indicates to be memorized the size of the human face strongly.

Fig.6 shows the subjective evaluation results of animated characters for 2D and 3D. The results of the animated character images were similar to those of the real person images. With reference to the animated characters images, subjects experienced no sense of incongruity at the same magnification ratio (8) in both the 2D image and the 3D. Many answered that there was a feeling of incongruity in the large image (14). When the small image (1) was used, many subjects responded that there was not much incongruity, because its size was close to that of the actual model figures.

Fig.7 shows the subjective evaluation results of monster for 2D and 3D. The monster condition revealed a sense of incongruity for small (1) and large images (13), but the overall difference in evaluation was small. This result seems to have occurred because the subjects had never seen this monster before, and therefore, they had no memory of the size. However, in 3D of a large image, a sense of strangeness was stronger than 2D. This reason is believed that the monster was displayed larger than the subject and on the full screen.

TABLE.I. The Relationship between the Number of Magnification and the Magnification Ratio

Magnification number	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Magnification ratio	0.11	0.16	0.23	0.33	0.48	0.69	0.83
Magnification number	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Magnification ratio	1	1.20	1.44	1.73	2.07	2.49	2.99

B. Comparison between Equal Size Images, Large and Small Images

In this section, the evaluation values of the equal images are used as a reference, and we discuss the evaluation results by the difference of these evaluation values of the equal images with the evaluation values of the images of anther sizes. Table 2 shows the difference value of the evaluation from the equal size images in the small images and the large images, for each 2D / 3D. For the large image, the evaluation value of No. 13 (magnification 2.49) is used. For the small image, the reciprocal (0.40) of No. 13 was used, and the evaluation value was the average value of No. 4 and No. 5. As a result, the real person images resulted in a large difference in evaluation than the other two contents at large and small magnification for 2D / 3D. For the monster, since the subjects had never seen this monster before and they had no memory to the standard of size, the difference from the equal magnification image was the smallest. The difference

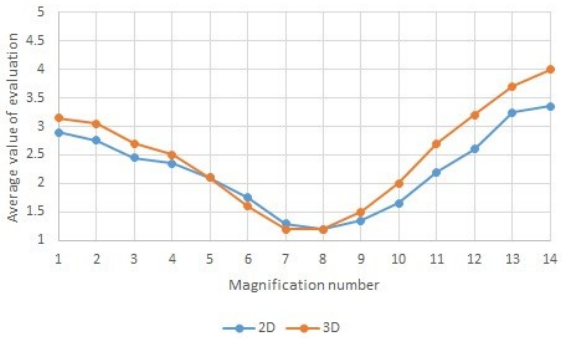

Fig.5. The subjective evaluation results of real persons for 2D and 3D

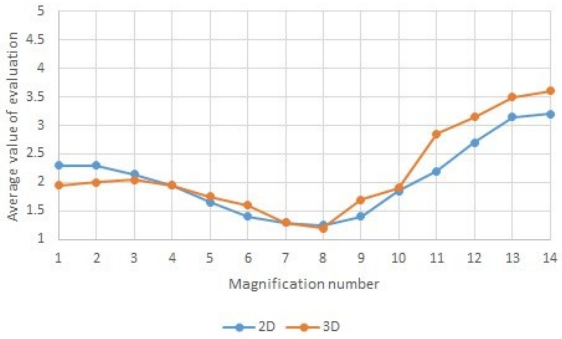

Fig.6. The subjective evaluation results of animated characters for 2D and 3D

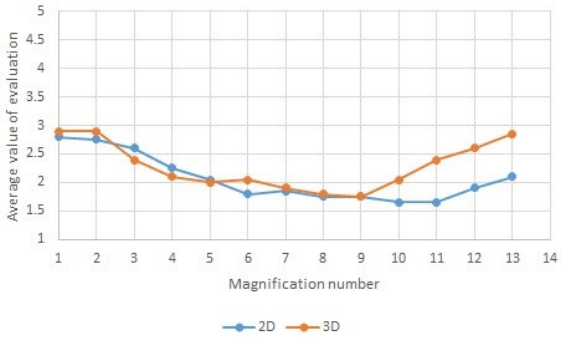

Fig.7. The subjective evaluation results of monster for 2D and 3D

TABLE.II. Difference Value of the Evaluation from the Equal Size Images

	2D			3D		
	Real	animated	monster	real	animated	monster
Small(0.40)	1.03	0.5	0.4	1.1	0.55	0.25
Large(2.49)	2.05	1.9	0.35	2.5	2.3	1.05

value of the animated character became the value between the two contents.

C. Standard Deviation of Evaluation

In this section, we compare the degree of variation in evaluation among subjects. Table 3 shows the standard deviation of the real person, animated character and monster's evaluation value for the 2D / 3D. The selected images are the same as in Section B.

As a result, in real life and animation, the standard deviation of the equal size image is small, the standard deviation of magnification 0.40 and magnification 2.49 is somewhat larger than that of the same magnification image. Overall, the value of the standard deviation was small. In the monster, the standard deviation was large in every image. From these facts, in real person and animated character, the size of the person's face in the memory of the subject is close to that of the equal magnification image, so the standard deviation values are small. Naturally, if the magnification of the equal magnification image greatly changes, the standard deviation becomes large. On the other hand, in monsters that have never been seen, there is no memory of the reference size, and since the feeling by individual differences is different, the standard deviation is considered to be larger overall.

TABLE.III. THE STANDARD DEVIATION OF THE EVALUATION VALUE FOR THE 2D / 3D

	2D			3D		
	real	animated	monster	real	animated	Monster
Small(0.40)	0.95	0.9	1.3	0.75	0.7	0.85
Equal	0.4	0.5	1.3	0.4	0.4	1.2
Large(2.49)	1.0	0.9	1.0	0.9	0.9	1.6

D. Evaluation Experiment Focused on How to Look

In this section, we discuss the appearance of animated characters and real persons on 2D and 3D. The conditions of the screen size, the viewing angle, and the viewing distance from the screen are the same as those in the sections A, B and C.

Subjects look at images (14 sheets) with different magnifications used in Section A for animated characters and live-actions. Experiments are performed on 2D images and 3D images. As an evaluation method, the subjects are asked to select from the following seven items. “Looks like a dwarf”, “Looks like a dwarf somewhat”, “Looks nature”, “Looks like a giant”, “Looks like a giant somewhat”, “Looks like a figure”, “looks like a figure somewhat”, “Looks large”, “Looks small”. The order of presentation of images is random for each subject. The number of subjects is 20.

Fig.8 shows the evaluation result of how the 3D animation character looks. Characteristic results are shown below. For magnification numbers (1) - (2), all subjects evaluated it as “figures”. In magnification number (14), 14 subjects evaluated it as “giant”. Fig.9 shows the evaluation result of how the 2D animation character looks.

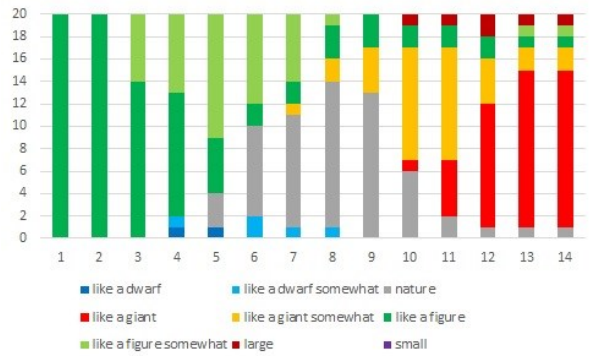

Fig.8. The evaluation result of how the 3D animation character looks

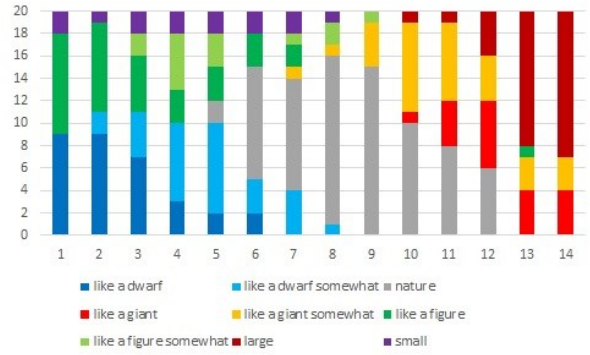

Fig.9. The evaluation result of how the 2D animation character looks

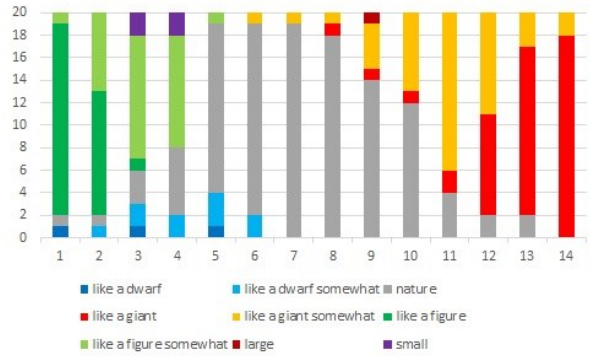

Fig.10. The evaluation result of how the 3D real person looks

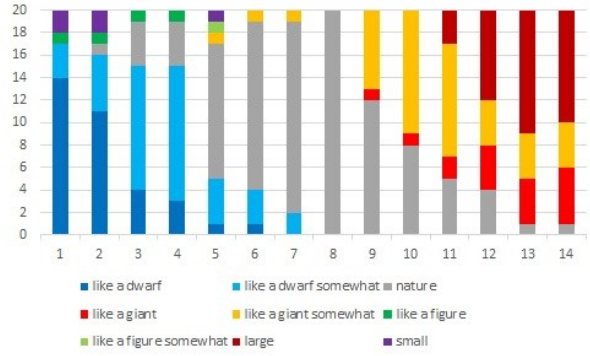

Fig.11. The evaluation results of how the 2D real person looks

Characteristic results are shown below. In magnification numbers (1) - (2), half of subjects evaluated it as “figures” and “dwarfs.” In magnification number (14), 13 subjects evaluated it as “giant.”

Fig.10 shows the evaluation result of how the 3D real person looks. Characteristic results are shown below. In magnification number (1), 17 subjects evaluated it as “figure.” In magnification number (14), 18 subjects evaluated it as “giant.”

Fig.11 shows the evaluation results of how the 2D real person looks. Characteristic results are shown below. In magnification number (1), 14 subjects evaluated it as “dwarf.” In magnification number (14), 10 subjects evaluated it as “big.”

From the above results, it turned out that the appearance of 2D, 3D display method and size was different for animated characters and real persons. Even on the same face, depending on the content, the appearance which is potentially memorized differs.

IV. Conclusion

In this paper, we focused on the size of the face of an unconsciously memorized person to clarify the relationship between unconscious memory and incongruity. Using the size as a parameter, subjective evaluation experiments were carried out by displaying the three contents of real persons, animated characters, and monsters in 2D (two-dimensional display) and 3D (stereoscopic display).

From evaluation experiments, with real persons and animated characters against people's size change, people feel a sense of incongruity with a slight change in size. It is thought that the influence by degree of unconscious memory is great. On the other hand, since the change in evaluation is small in monsters which people have not seen, the influence of unconscious memory is small and the degree of incongruity is greatly influenced by individual differences. Also, when comparing the difference in appearance between 2D and 3D images, we found that 3D images start to feel uncomfortable when larger than the actual face size. Furthermore, it turned out that the appearance of 2D, 3D display method and size was different for animated characters and real persons. Even on the same face, how it looks different differs, depending on the content, depending on the difference in potential memory.

References

[1] https://www6.atwiki.jp/vpvpwiki/pages/146.html