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Impressions of Face of Female Character Produced in Computer Graphics

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ABSTRACT

In the present study, various faces of female characters were synthesized using two CG models. The faces were constructed by four factors; maturity of the character, angle of eyes and eyebrows, texture of the face and hairstyle. Thirty-six synthesized faces were used as stimuli in a perceptual experiment. Ten participants rated the impressions of the faces using SD method. The results of the factor analysis showed three perceptual factors; activity, potency and evaluation. The three perceptual factors were largely correlated with different factors of constructing the face. The activity was largely determined by the maturity: A mature female was perceived as inactive and a young girl was perceived as active. The potency was largely determined by the angle of the eyes and eyebrows: slanted eyes and eyebrows were perceived as powerful and droopy eyes and eyebrows were perceived as powerless. The evaluation was largely affected by the texture of the face. An anime-touch face was perceived as pleasant but a realistic face tended to be perceived as unpleasant.

Keywords: Female character, Face, Impression, Semantic differential method, Factor analysis

INTRODUCTION

In recent decades, Japanese video games and anime, called Cool Japan Content, became very popular in the world. In the content, cute female characters, called “moe” or “kawaii” characters, frequently appear as well as beautiful mature females. Recently, the cases where the characters are produced using Computer Graphics (CG) increased. Especially, the facial parts are important to determine the impressions of the characters. Using CG models, it is easy to change the parameters of the parts of the face. The models allow production of various faces including the faces with extreme balances. Many researchers investigated the relations between the parts of the face and the impressions in terms of real faces, but the perception of the faces was rarely investigated in terms of CG models. Wada et al. (2014) determined the best proportions of the width to the length of the face, the width between the two cheeks to the length of the face, the width of the eye to the width of the face and the eye opening to the width of the eye, for the female faces which was perceived as “moe” and “beautiful” respectively, using a CG model. The results showed that the face of the female characters with the best “moe” and “beautiful” proportions looked like young girl and mature woman, respectively. Tachi (2020) showed that the angle of the eyes and

eyebrows is an important factor for determining the impressions of the female characters. In the present study, various female faces with different maturity levels and different levels of angle of eyes and eyebrows were synthesized in two CG models, and the impressions of them were rated. Then, the relations between the factors of the face and the impressions were investigated.

EXPERIMENTAL METHOD

In the present study, two CG models, VRoid and Phantasy Star Online 2 New Genesis (PSO2) were used for synthesizing the female faces. The two models produce quite different textures of the faces: VRoid allows to designate female characters in anime-touch, while PSO2 designate realistic female faces. The angle of the eyes and eyebrows were set at three levels; slanted, intermediate or droopy eyes, according to the study of Tachi (2020). The maturity was set at two levels; young girl intermediate or mature female: Young girl had the best proportions for "moe" and mature female had the best proportions for "beautiful", according to the study of Wada et al. (2014). The intermediate level had just the intermediate proportions between the young girl and the mature female. The hair style was set at two levels; long hair or short hair. The color of the skin was fixed at Mongoloid type, the hair and irises were colored black, and the other parameters were fixed at the pre-set values for a female character in the CG models. In these way, two textures X three angles of eyes and eyebrows X three maturities X two hair styles = 36 faces synthesized. The 36 synthesized female faces were used as stimuli in the perceptual experiment. Each of the stimuli was presented on the screen of Eizo Flex Scan EV2785. Ten participants from Kanazawa Institute of Technology watched the stimulus and rated impressions for the stimulus using 21 bipolar seven-step SD (semantic differential) scales listed in Table 1. The experiment was conducted in a dark room. The order of the stimuli was randomized for each participant to minimize the effects of the order.

RESULTS AND DISCUSSION

The rated scores were averaged over the participants, and factor analysis with the principal factor method and varimax rotation was performed using the mean scores. The results of the factor analysis showed three factors with the cumulative contribution rate of 89 %. Table 1 shows the factor loadings. The three factors were labelled as activity, potency and evaluation, respectively, after the scales which showed large loadings for the factors.

Each stimulus was plotted on the three-dimensional space spanned by activity, potency and evaluation factors. The plots showed that the three perceptual factors were correlated with the different factors of construction of the face, respectively.

The stimuli were divided into three levels of the maturity; mature female, intermediate and young girl. Figure 1 show the centroids for the different levels of the maturity with standard deviations. Figure 1 shows that the activity is largely determined by the maturity: A mature female was perceived

as inactive and a young girl was perceived as active. A female with an intermediate level of maturity showed an intermediate level of activity.

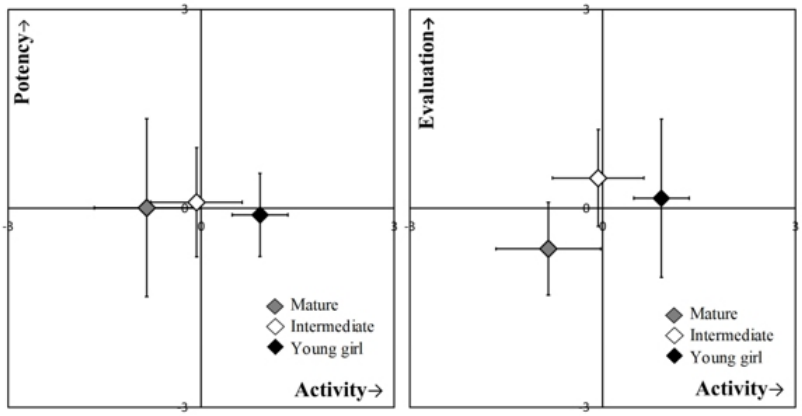
Then, the stimuli were divided into three levels of the angles of eyes and eyebrows. Figure 2 shows the centroids for different levels of the angle with standard deviations. Figure 2 shows that the potency is largely determined by the angle: A stimulus with slanted eyes and eyebrows was perceived as powerful and a stimulus with droopy eyes and eyebrows was perceived as powerless. A stimulus in the intermediate level showed an intermediate level of potency.

Figure 3 shows the impressions for the stimuli produced by VRoid and PSO2 respectively, with different marks. The distributions in Figure 3 show that the evaluation factor is largely affected by the texture: A female face produced by VRoid tends to be perceived as pleasant and a face produced by PSO2 tends to be unpleasant.

Figure 4 shows the impressions for the stimuli with long hair and short hair respectively. Fig. 4 show that the plots for long hair and short hair both distribute over wide areas in the impression space. This suggests that the hairstyle is not the important factor for determining any perceptual factors.

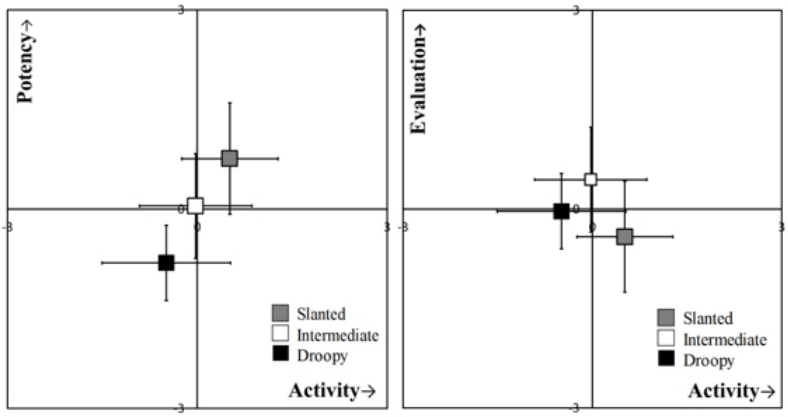
Table 1: Semantic differential scales and their factor loadings.

Scale	Activity	Potency	Evaluation
Vigorless - Vigorous	.959	.143	.011
Gloomy - Cheerful	.957	.113	.120
Dark - Bright	.922	–.015	.270
Dormant - Active	.898	.339	–.188
Timid - Daring	.877	.375	–.252
Lethargic - Energetic	.844	.457	–.027
Sleepy - Arousing	.841	.472	–.169
Shabby - Vivid	.834	.366	–.140
Humble - Arrogant	.710	.461	–.461
Calm - Wild	.701	.522	–.440
Uncool - Cool	.078	.954	.111
Loose - Tight	.303	.909	–.034
Irresponsible - Responsible	.589	.756	–.104
Weak - Strong	.614	.745	–.173
Modest - Confident	.641	.704	–.085
Unpleasant - Pleasant	.050	.074	.981
Dirty - Clean	–.235	.169	.905
Uncute - Cute	.170	–.319	.756
Powerless - Powerful	.676	.632	–.140
Unfriendly - Warm	.585	–.537	.472
Neat - Mixed	.435	.114	–.467
Cumulative contribution rate	.460	.720	.890



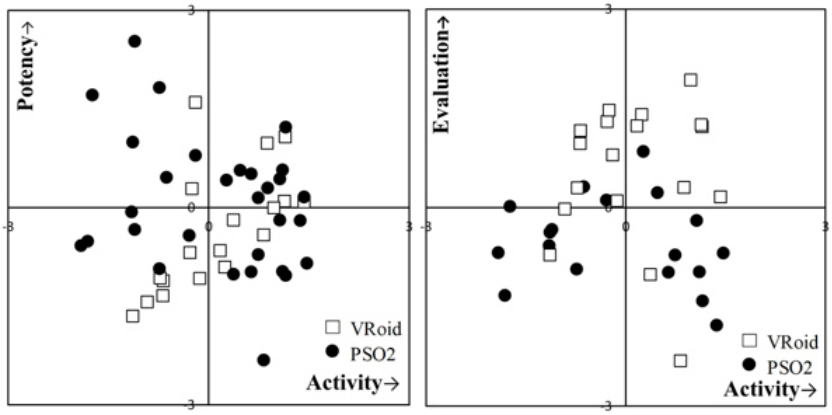
(a) Activity – Potency plane (b) Activity – Evaluation plane

Figure 1: Impressions for the different levels of maturity of the character.



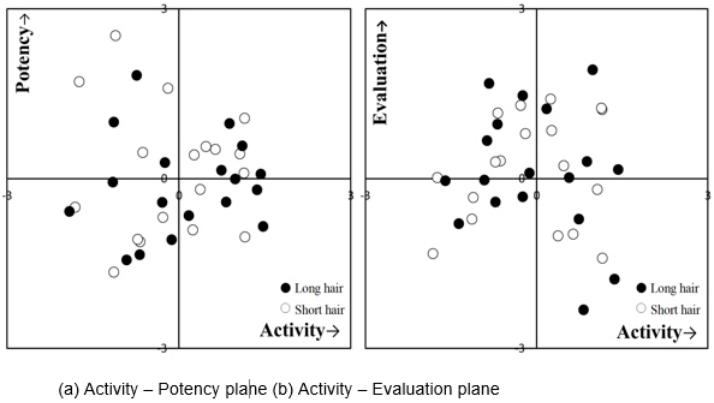
(a) Activity – Potency plane (b) Activity – Evaluation plane

Figure 2: Impressions for different levels of angle of eyes and eyebrows.



(a) Activity – Potency plane (b) Activity – Evaluation plane

Figure 3: Impressions for the different textures produced by two CG models.



(a) Activity – Potency plane (b) Activity – Evaluation plane

Figure 4: Impressions for females with long hair and short hair.

CONCLUSION

In the present study, various faces of female characters were synthesized using two CG models. The faces were constructed by four factors; maturity of the character, angle of eyes and eyebrows, texture of the face and hairstyle. Ten participants rated the impressions of the synthesized faces, using SD method. The results of the factor analysis showed three perceptual factors; activity, potency and evaluation. The three perceptual factors were largely correlated with different factors of constructing the face: The activity was largely determined by the maturity and the potency was largely determined by the angle of eye and eyebrows, respectively. The evaluation was largely affected by the texture. The hairstyle did not affect any perceptual factor largely.

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