

# Impression Change of a Female Character in Illustration by Shadow

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## ABSTRACT

In the present study, the impression changes of a female character by shadow expressions including the shadows physically incorrect were examined. In the video game CUSTOM ORDER MAID 3D2, a player created characters using a 3D model. Shadows were produced with the 26 different positions of the light sources. The physically incorrect shadows included the cases with the face, hair or eyes were lighten-up from a virtual source. Also, a stimulus with no shadow was prepared. Participants rated their impressions for the illustrations using semantic differential method. The results of the analysis showed that the impression space was spanned by friendliness, powerfulness and naturalness factors. The character was perceived as friendly when the shadow was produced with a light source set in foreground of the character, but the character was powerless for the background position. The character became powerless when the light source was on the median plane and powerful when the source was in the lateral position. Among the physically incorrect shadow expressions, the illustration with the eyes lighten-up in shadow was perceived as quite powerful and unnatural.

**Keywords:** Illustration, Anime, Shadow, Semantic differential method

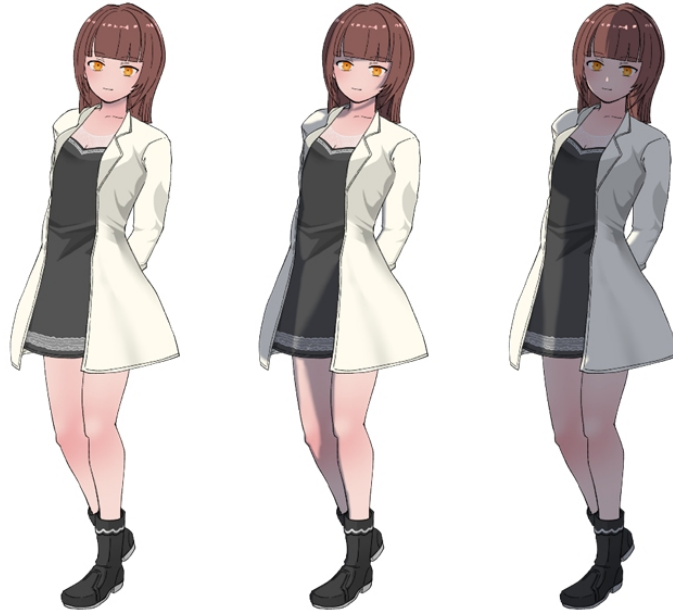
## INTRODUCTION

Recently, anime-touch illustrations became very popular as well as anime in Japan. In anime and anime-touch illustrations, shadows are used to express the emotions of characters and those which are not physically correct are frequently used. In the present study, it is examined that the impression changes of a female character by shadow expressions including the shadows physically incorrect.

## METHODS

A female character was created using 3D modelling in the video game CUSTOM ORDER MAID 3D2. The simplest clothes were selected from the pre-set ones the game provided, and had the character wear it. The game allows players to add a shadow on the character. Using this function, a light source was sat at 26 different positions around her and the character with 26 different shadows were produced. Then, the 26 2D anime-touch illustrations were traced out from the 3D model pictures and prepared as stimuli. In addition to the 26 illustrations, the illustration of the character with no shadow and three illustrations of the character with physically incorrect shadows were prepared. Original natural illustrations were selected from

the 26 illustrations and the face, the hair or the eyes were lighten-up to produce physically incorrect illustrations. In total 30 illustrations were used as stimuli in the perceptual experiment.



**Figure 1:** Examples of the illustrations used in the experiment.

Figure 1 shows examples of the illustrations used in the experiment. Twelve students of Kanazawa Institute of Technology participated in the experiment. Each participant sat on a chair in a darkroom and watched each stimulus presented on the display EIZO Flex Scan SX2462W. The participants were requested to rate their impressions for each stimulus, using 18 seven-step bipolar semantic differential (SD) scales shown in Table 1.

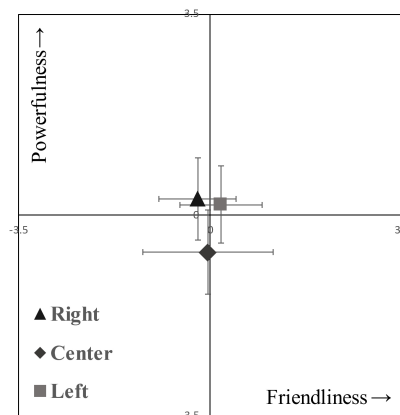
## RESULTS AND DISCUSSION

For each SD scale, the rated scores were averaged over the participants. Using the mean scores, factor analysis was performed. The results of the analysis showed a three-factor solution with the cumulative contribution rate of 85 %. Table 1 shows the factor loadings for each SD scale. The three factors were labeled as friendliness, powerfulness and naturalness, respectively, after the scales showed large loading values. The stimuli were plotted on the impression space spanned by friendliness, powerfulness and naturalness. The plots showed that the area covered by the shadow on the face was largely affected the impressions: Narrower the area became the friendliness and powerfulness increased. However, when no shadow covered the face, it was perceived as friendly but powerless. This suggested that the powerfulness related to the solidity made by the shadow. When only one eye was covered by the shadow, it was perceived as quite unnatural.

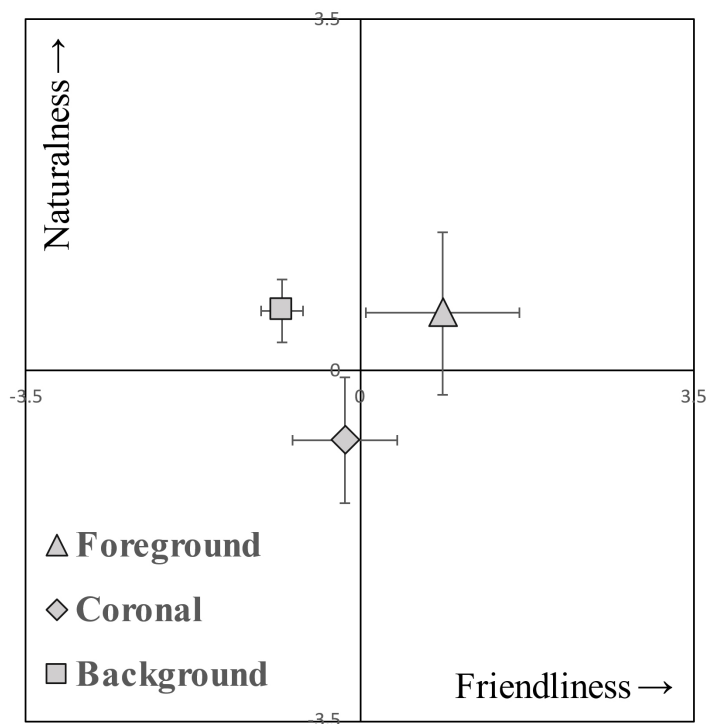
**Table 1.** SD scales and their factor loadings.

Scale	Factor loading		
	Friendliness	Powerfulness	Naturalness
Unpleasant - Pleasant	.730	.079	.616
Unfriendly - Friendly	.814	.135	.510
Unclear - Clear	.826	.457	.096
Cold - Warm	.924	.093	.294
Dark - Bright	.956	.180	.186
Shabby - Vivid	.708	.629	-.106
Quiet - Active	.921	.295	.055
Sleepy - Arousing	.708	.585	.257
Uncute - Cute	.804	-.040	.359
Light - Heavy	-.935	-.054	-.276
Childish - Mature	-.933	.170	.147
Unimpressive - Impressive	-.245	.782	-.035
Weak - Strong	.411	.736	-.011
Powerless - Powerful	.022	.820	-.303
Unnatural - Natural	.129	-.011	.913
Ubiquitous - Unique	-.552	.314	-.676
Rustic - Stylish	-.006	.408	.260
Unconfident - Confident	.316	.690	.025
Cumulative contribution rate	.475	.680	.821

Then, the 26 stimuli with natural shadows were classified into three groups by the positions of the light source; the left side of the body (left), on the median plane (center) and the right side of the body (right). Figure 2 shows the centroids of the impressions for the different positions of the light sources on the friendliness-powerfulness plane. Figure 2 showed that the illustration was perceived as powerless when the light source was set on the median plane (center), but the illustrations were powerful when the light source was set at the lateral positions (left, right). This suggested that the solidity of the character made by the shadow on the face and body largely affected the powerfulness, again.

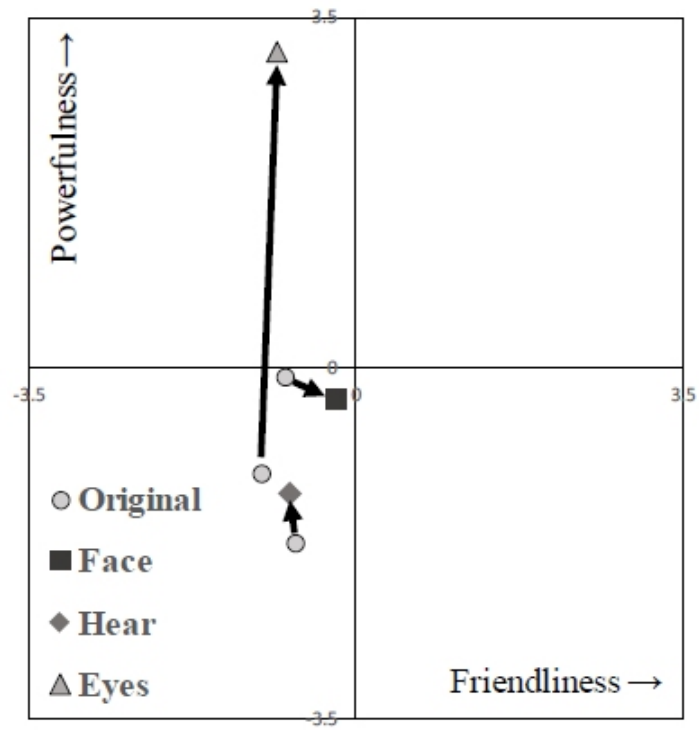
**Figure 2:** Impressions for different horizontal positions of the light source on the friendliness-powerfulness plane.

The 26 stimuli were re-classified into three groups by the positions of the light source; foreground of the body (foreground), on the coronal plane (coronal) and back ground of the body (background). Figure 3 shows the centroids of the impressions for the different positions of the light sources on the friendliness-naturalness plane. Figure 3 showed that the character was felt as friendly when the light source was set at foreground, but it was felt as unfriendly when the light source was set at background. The shadows for the foreground and background were perceived as natural, but the illustration was perceived as unnatural when the light source was sat on the coronal plane.

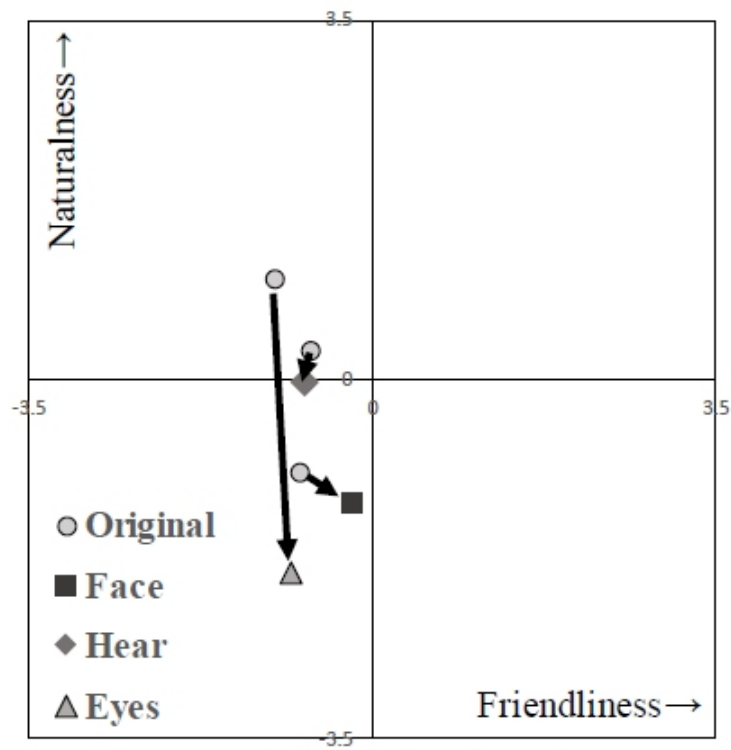


**Figure 3:** Impressions for different anteroposterior positions of the light source on the friendliness–naturalness plane.

In the final step of the present study, the illustrations with no shadow and physically incorrect shadows were focused on. The character was perceived as friendly like the illustrations which no shadow was covered on the face, but it was also perceived as unnatural because the situation where no shadow existed was physically unnatural. Then, the impressions of the three illustrations with physically incorrect shadows were plotted with the impressions of their original natural shadows in Figure 4. Figure 4 shows that when the eyes are lighten-up, the powerfulness significantly increases but the naturalness largely decreases from the original illustration.



(a) Friendliness – Powerfulness Plane



(b) Friendliness – Naturalness Plane

**Figure 4:** Impressions for physically incorrect shadows with lighten-up parts of the face with their original shadows.

## **CONCLUSION**

In the present study, impressions of anime-touch illustrations of a female character with various shadows were rated using SD method. The results of the factor analysis showed that the impression space was spanned by friendliness, powerfulness and naturalness. The plots of the illustrations showed that the area of the face the shadow covered affected largely to the friendliness and powerfulness. The illustration was perceived as powerless when the light source was set on the median plane, but they were powerful when the light source was set at the lateral positions. The female character was perceived as friendly when the shadow was produced by a light source set at foreground of the character, but it was perceived as unfriendly when the light source was set at the background. Moreover, when both eye were lighten-up in the shadow, the character was perceived as shadow was perceived as quite powerful and unnatural. The results of the present study will contribute to production of impressive illustrations and anime.

## **REFERENCES**

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