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Changes of Impression in the Animation Characters with the Different Color and Thickness in Outlines

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Abstract: Recently the several colors such as brown and reddish brown are used as the outlines in animation characters in some TV animation. To examine the effects on impression in the animation characters by the differences of color and thickness in outlines, the impression in the original animation characters was measured using SD method with varying the colors and thickness in outlines. In the results, the effects with the outlines can be represented by the impression to “naturalness”, “potency”, and “activity” of three dimensions in the animation characters from factor analysis based on the subjects’ evaluation. It is found that the colors and thickness of outlines affect the impression to naturalness and potency in the animation characters.

Keywords: Animation character, outline, color, thickness, impression.

1. INTRODUCTION

Most of animation characters in TV animation (i.e. anime) are originally drawn by black outlines. On the other hand, in some anime, recently the several colors such as brown and reddish brown are used as the outlines in animation characters as well. Also, the thickness of outline in animation characters is changed in some of anime. From the survey of studies on animation characters, although there are some studies for investigating the effects in terms of eye and face [Kawatani et al. (2010) and Kawatani et al. (2008)], there is no study focused on the outline in animation characters.

In this paper, the purpose is to examine the effects on impression in the animation characters by the differences of color and thickness in outlines. It is necessary to investigate these effects to understand how to design animation characters from practical point of view.

2. METHODOLOGY

2.1. Animation characters

Figure 1 shows four animation characters used in this experiment. They are drawn so that they do not impress similarly. Figure 1 (a) and (b) represent the male animation characters (MA and MB), and Figure 1 (c) and (d) are the female animation characters (FA and FB), respectively. The background of the all is painted by white. The outlines of each character are drawn using the pen tool without the effect of pen pressure in the drawing software.

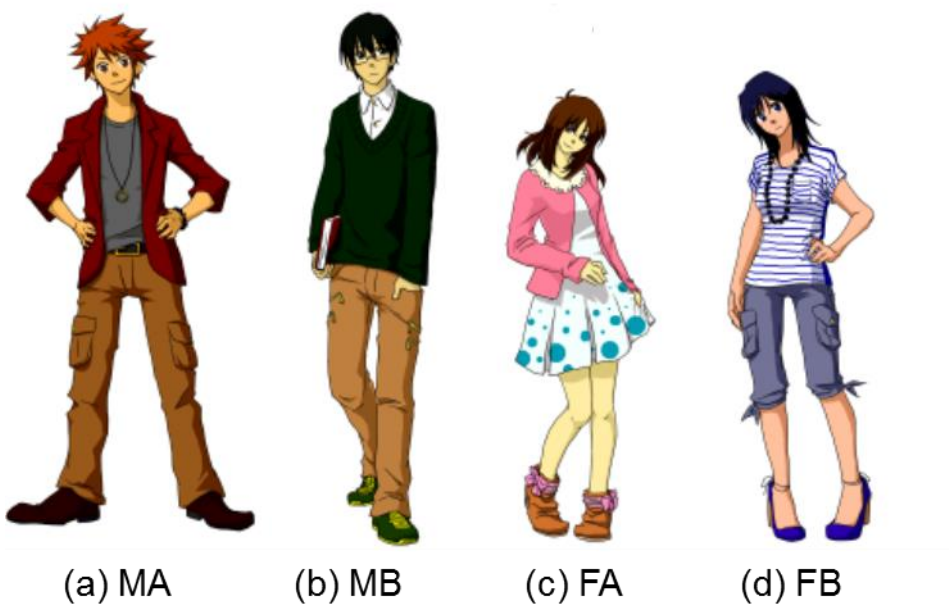


Figure 1: Animation characters used in this experiment.

2.2. Outlines

Table 1 shows luminance and chromaticities of colors and the pixels of thickness in the outlines of each animation character used in this experiment. Including without the outline, there were ten types of the outlines. In the black outlines, they consisted of four types with the different thickness at constant color. Five types of the outlines in chromatic colors were reddish brown, pale brown, green, blue, and red colors at constant thickness. The total of the stimuli was forty. Figure 2 show the examples of the stimuli of No.1 - No.5 in Table 1 for FA in Figure 1 (c).

Table 1: Luminance and chromaticities of colors and the pixels of thickness in the outlines.

No.	color				thickness (px)
	name	luminance (cd/m^2)	*x*	*y*	
1	without outline	-	-	-	-
2	black 1	0.30	0.2549	0.2646	0.5
3	black 2	0.30	0.2549	0.2646	1
4	black 3	0.30	0.2549	0.2646	3
5	black 4	0.30	0.2549	0.2646	5
6	reddish brown	11.39	0.5552	0.3405	1
7	pale brown	51.09	0.4320	0.3843	1
8	green	73.12	0.2141	0.4792	1
9	blue	30.08	0.1843	0.1055	1
10	red	65.71	0.6149	0.3111	1

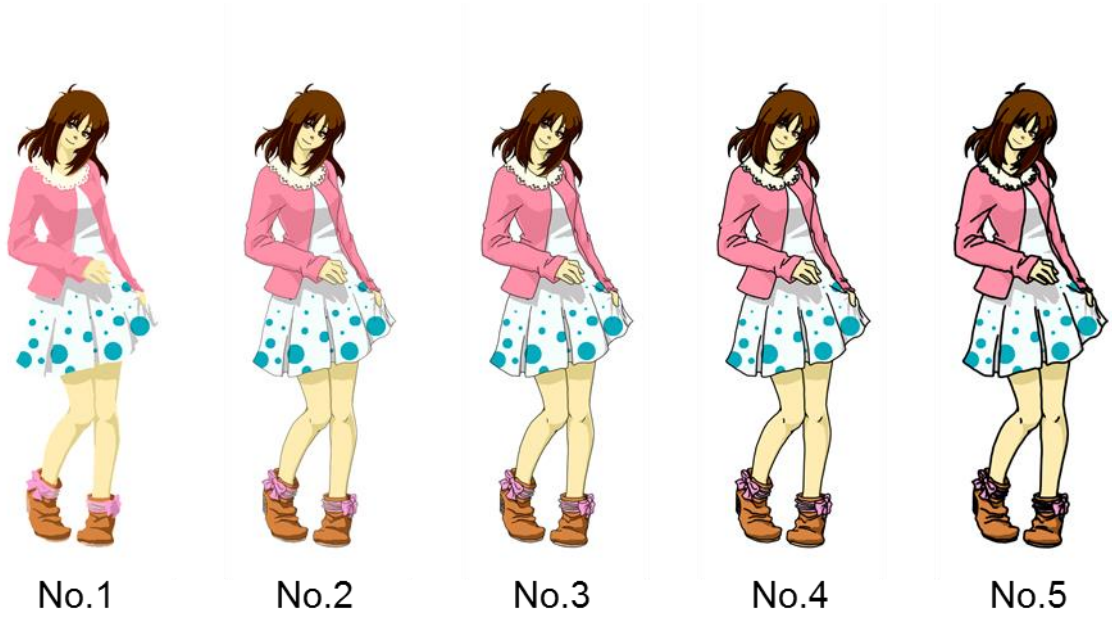


Figure 2: Examples of the stimuli of No.1 - No.5 in Table 1 for FA in Figure 1 (c).

2.3. Apparatus

Figure 3 shows the apparatus in this experiment. The stimuli were presented by the 24-inch display (EIZO, FlexScan SX2462W) placed on the table in the dark room. The subject sat on the chair in front of the display and the viewing distance was 900 mm. The subject was asked to evaluate the presented stimulus using the evaluation sheets placed on the table in the right side of the subject.

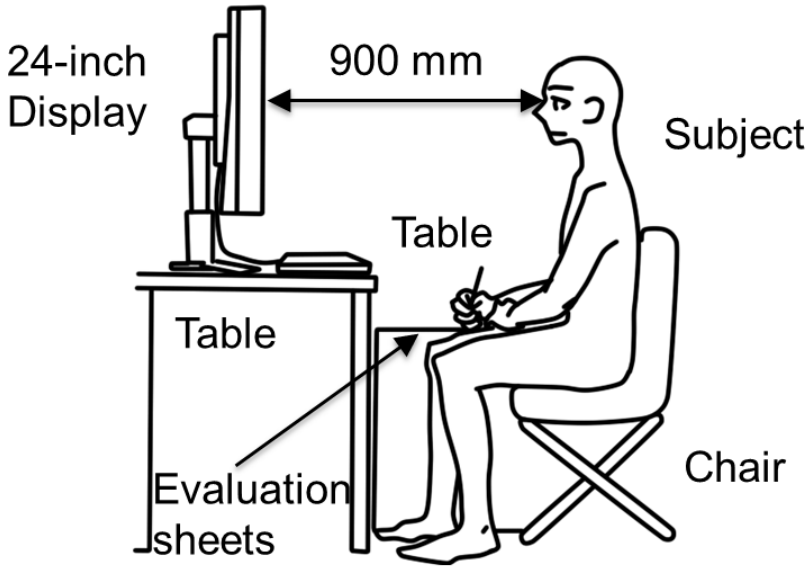


Figure 3: Apparatus.

2.4. Procedure

Prior to the experiment, it had an enough time to practice. The stimulus was randomly presented then the subject evaluated the impression of the presented stimulus using semantic differential method (SD method). In SD method, eighteen bipolar adjective-pair were used as shown in Table 2. It was the seven-rank scales for each bipolar adjective-pair (i.e. for example, 1: extremely dark, 2: very dark, 3: dark, 4: neither bright nor dark, 5: bright, 6: very bright, 7: extremely bright).

Table 2: Eighteen bipolar adjective-pair in SD method.

No.	bipolar adjective-pair			No.	bipolar adjective-pair		
1	darty	-	clean	10	quiet	-	active
2	unfriendly	-	friendly	11	fidgety	-	calm
3	unnatural	-	natural	12	cool	-	hot
4	complicate	-	simple	13	dark	-	bright
5	burly	-	stylish	14	roundish	-	sharp
6	flaccid	-	magnificent	15	dislike	-	like
7	weakly	-	powerful	16	common	-	unique
8	heavy	-	light	17	realistic	-	fantastic
9	burrly	-	clear	18	unimpressive	-	impressive

2.5. Subjects

Sixteen subjects participated in this experiment. They were thirteen males and three females. The average age was 22.6 years old (S.D. 3.8).

3. RESULTS AND DISCUSSIONS

3.1. Factors from factor analysis

In the results of factor analysis from the evaluation values in all the subjects, cumulative contribution ratio is 81% with three factors. Table 3 shows the results of factor loading in these factors. The row and column indicate eighteen adjective-pair and the values from the first to third factor loading, respectively. As shown this table, the value of the first factor loading is that the value of “unnatural vs. natural” is highly positive and that of “common vs. unique” is highly negative, mainly. In the second factor loading, “weakly vs. powerful” is highly positive and “heavy vs. light” is highly negative as well. The third factor loading represents highly positive value of “dark vs. bright”. In this paper, the first, second, and third factors are called “naturalness”, “potency”, and “activity”, respectively.

3.2. Naturalness, potency, and activity on animation characters

Figure 4 shows the distribution of factor score for each stimulus on the planes from two of factors. Figure 4 (a) and (b) represent its distribution on the naturalness-potency and naturalness-activity planes, respectively. Each symbol indicates each animation character in Figure 1. In Figure 4 (a), each ellipse represents the distribution of each outline in Table 1. In Figure 4 (b), each ellipse represents the distribution of MA and MB in Figure 1.

As shown in Figure 4 (a), each ellipse is distributed with the different outlines regardless of the animation characters. It means that the impressions to naturalness and potency are affected by the colors and thickness of the outlines rather than the design of animation characters. On the other hand, in Figure 4 (b), two ellipses are obtained on the upper and bottom regions, respectively. It means that the impression to activity is related to the design of the animation characters without the effects of outlines.

In Figure 4 (a), for the impression to naturalness, the colors of black, reddish brown and pale brown in the outlines are mainly distributed on positive value region and others are negative one. It is considered that the use of color close to human skin color in the outline give animation characters natural impression, as well as the use of black. Also, the impression to potency increases with an

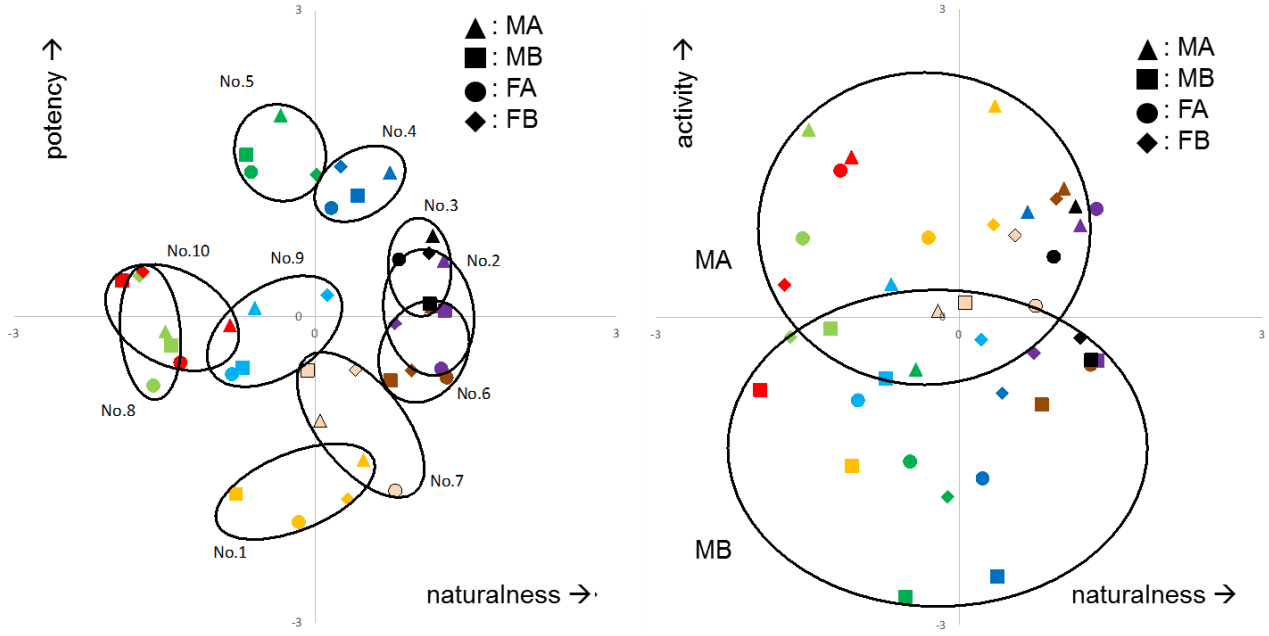
increasing with the thickness in the outline. And the use of colors of reddish and pale brown decreases the impression to potency compared with that of black despite the same thickness in the outline. It is suggested that the thickness of outline affects the impression to potency and its impression increases with the thickness of outline in animation characters. The use of brown colors gives animation characters usual impression. Thus, it is suggested that this is a reason why the brown color of outline is used in animation characters recently. It seems to give animation character more natural and usual impression reducing that to potency by using the brown color of outline. Although it decreases usual and natural impression for them, the impression to potency increases with the thickness of outline in animation characters.

Table 3: Results of factor loading in these factors from Factor Analysis.

bipolar adjective-pair	factor loading		
	first	second	third
unnatural - natural	**0.972**	0.151	-0.100
dislike - like	**0.969**	0.027	0.016
unfriendly - friendly	**0.945**	0.225	0.022
complicate - simple	**0.838**	-0.271	0.031
darly - clean	**0.887**	-0.237	0.143
common - unique	**-0.909**	-0.144	0.278
realistic - fantastic	**-0.833**	-0.320	0.346
unimpressive - impressive	-0.405	**0.720**	-0.087
weakly - powerful	0.043	**0.968**	-0.061
flaccid - magnificent	0.201	**0.932**	0.001
quiet - active	-0.109	**0.755**	0.609
heavy - light	-0.143	**-0.742**	0.640
dark - bright	-0.131	-0.046	**0.853**
fidgety - calm	0.655	-0.343	-0.612
burrly - clear	0.356	0.664	-0.309
roundish - sharp	0.070	0.016	0.288
cool - hot	-0.147	0.649	0.539
burly - stylish	-0.111	-0.392	0.667

4. CONCLUSION

To examine the effects on impression in the animation characters by the differences of color and thickness in outlines, the impression in the original animation characters was measured using SD method with varying the colors and thickness in outlines. In the results, the effects with the outlines can be represented by the impression to naturalness, potency, and activity of three dimensions in the animation characters from factor analysis based on the subjects' evaluation. It is found that the colors and thickness of outlines affect the impression to naturalness and potency in the animation characters. It is suggested that it gives animation characters more natural and usual impressions by using the brown color of outline in animation characters of recent anime.



(a) Naturalness - potency plane. (b) Naturalness - activity plane.

Figure 4: Distribution of factor scores for each stimulus on the planes from two of factors. (a) Naturalness - potency plane, (b) Naturalness - activity plane.

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BIOGRAPHY

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