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Procedia Computer Science 225 (2023) 1776–1785

Procedia Computer Science

www.elsevier.com/locate/procedia

27th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems (KES 2023)

Do Appearances Represent Personality of Created Characters?

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Abstract

This paper studies the relations between outside properties and personalities of created characters in comics/anime. Fans of comics/animes can generally predict the personality of a character from how the character is expressed in the drawing. From this fact, it seems that people have some common unconscious senses for relationships between outside properties and the inside personality of characters. We propose a method to study the relationships between outside properties and personality by calculating the conditional probability for certain attributes. We analyze the dataset of Character Elements Kingdom, which is a fan site of characters appearing in comics and anime. Given the appearance or personality as the conditional attribute, the posterior probability distribution for a category of attributes is obtained. From the posterior probability distribution, we discuss the relationships between outside properties and personalities of created characters. Through the discussion, we confirmed that there were some tendencies for the relationships between appearance and personality, e.g., "black hair girls seemed to be relatively stable though blond hair girls seemed to be relatively active." These findings suggested typical patterns of designing created characters in Japanese comics/animes. We believe the knowledge obtained through our study can be referenced for creating new characters in some narrative content.

Keywords:
Analysis of created characters; Personality of created characters; Web Intelligence

1. Introduction

In narrative content, such as comics and animes, many created characters drive the story. Each individual character has a different physical appearance and clothing, as well as a variety of internal properties such as personality, skills, and occupation. For example, on the official website of the "*One Piece*" anime, the main character "*Monkey D. Luffy*" is described as an *optimistic* and *free-spirited* person. And, his companion "*Tony Tony Chopper*" is described as a

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10.1016/j.procs.2023.10.167

reindeer who is *curious* and *very honest*. The creativity and fun of the story are represented by the interaction among created characters with each different outside and inside attributes: clothes, appearances, profiles, and personalities.

We should have common sense for the relationships between a person's outside and inside attributes. An existing study [1] showed that these senses of mapping external and internal attributes are considered to be common. Another study [2] also has already shown that there is a relationship between faces and their impressions of real humans. Several studies have examined the relationship between internal attributes and the clothes of humans. A study [3] has examined the correlation between the Myers-Briggs Type Indicator as an indicator of personality and "clothing color," "pattern," and "silhouette." An existing study has shown inside attributes of humans are related to their clothes [4]. Another study has predicted a person's occupation from the "background" and "his/her clothing" in a picture [5]. Also, the recognition accuracy of individuals has been improved by associating human faces with clothing [6]. On the other hand, to the best of the authors' knowledge, there have been no reports on the relationship between the inside and outside attributes of created characters in comics/animes based on objective indices or data analysis. Even if we do not know much about a work of comics/animes, we often easily guess the personality of a created character somehow as we just see the pictures of her/him. For example, fans of Japanese comics/animes naturally imagine the characters wearing glasses should be serious and intelligent. The goal of our study is to figure out such common sense for the relationships between outside and inside attributes of created characters.

This paper studies the relationship among attributes of created characters in a computational manner. To analyze the relationships among attributes of created characters, we refer to a fan site for comics/animes *Character Elements Kingdom*[1] (hereafter, CEK) which is a fan site of created characters. On the site, so many fans input the attributes of their favorite created characters. That is to say, the site has a collective intelligence for created characters in comics/animes. As analyzing the data of the site, we investigate the probability bias for a certain attribute that tends to be related to other certain attributes. In this paper, we especially focus on the relationships between outside properties and personality, which are outside and inside attributes. Note, the CEK dataset is generally in the Japanese language, so the terms representing the attributes in this paper are translated into English by the authors.

2. Methodology

We statistically analyze the relationships between the outside and inside attributes of created characters. The method of analysis is based on conditional probabilities for the combination of attributes. The conditional probabilities are calculated from the CEK dataset, where fans freely submit information about the existing created characters.

2.1. CEK dataset

The CEK is a fan site for comic, anime, and other media arts, which allows users to register various created characters freely. Also, users can register their traits as attributes by selecting options, e.g., hair color and personality. The registered attributes are assumed as tags and can be used for the retrieval of characters with the tags. Later, it is able for users to add and change the attributes that have already been registered. The updating of attributes, thus, might happen so many times. The CEK shows the latest updated versions of the attributes for a character. The webmaster of CEK mentioned that "the adequate attributes should remain after several updating" should be their policy. Therefore, it is reasonable to say that the CEK stores information about created characters and their attributes through the collective intelligence of fans.

We use a dataset where 16,261 created characters are registered, which is collected from the CEK that the webmaster kindly allowed us to analyze for research use. We name the dataset the "CEK dataset" in this paper. In the CEK dataset, attributes of created characters are classified by categories and meta-attributes. A meta-attribute has multiple attributes, including "NULL." A created character may have at most one attribute within a meta-attribute. Further, meta-attributes are classified into categories according to the characteristics of the attributes within the meta-attribute. For example, category "basic personality" has meta-attributes "vitality" and "sociability," and meta-attribute "vitality" has attributes "active" and "stable." In the CEK, there are 11 categories of attributes including "item," "background,"

[1] https://chara-zokusei.jp/en/ (Retrieved on May 19, 2023)

Table 1. List of inside attributes concerning the personality of created characters. We selected some meta-attributes and attributes belonging to the meta-attributes to avoid a combinational explosion.

category	meta-attribute	attribute
basic personality	vitality	active
basic personality	vitality	stable
basic personality	vitality	unfussy
basic personality	sociability	outgoing
basic personality	sociability	friendly
basic personality	sociability	with leadership
basic personality	attitude	clownish
basic personality	attitude	clear
basic personality	attitude	gentle
basic personality	kindness	sweet
basic personality	kindness	officious
basic personality	honesty	serious
basic personality	honesty	pure
basic personality	honesty	innocent
basic personality	mental age	young mind
basic personality	mental age	old mind

and "skill." Each category has several meta attributes. The CEK has 101 meta attributes such as "equipment," "a club belonging to," "intelligence." Each meta attribute has several attributes. The CEK has 1,059 attributes, e.g., "having a spear," "belonging to a sports club," "genius." Each character in the CEK has 52.6 attributes on average.

2.2. Analysis method

First, we specify some attributes and meta-attributes as the precondition. The analysis target should have the specified attributes and some attributes within the specified meta-attributes. Next, we calculate the occupancy probability of attributes within the meta-attribute for the analysis target. The analysis is conducted several times while changing the setting of the preconditions. The probability distributions for each prior condition are relatively compared to each other. Let us show the example of analysis procedures below;

1. As "blond" hair is set as the precondition, the probability distribution for a meta-attribute "sociability" $PD(\textbf{sociability}|ma_{hair} = blond)$ is obtained.
2. As "black" hair is set as the precondition, the probability distribution for a meta-attribute "sociability" $PD(\textbf{sociability}|ma_{hair} = black)$ is obtained.
3. Comparing $PD(\textbf{sociability}|ma_{hair} = blond)$ and $PD(\textbf{sociability}|ma_{hair} = black)$, we study how the difference of "blond" and "black" in meta-attribute "hair" affect the meta-attribute "sociability."

where, *ma* indicates meta-attribute.

This paper sets the combination of precondition and postcondition as outside properties and personalities. Then, we study whether the appearance represents the personality of created characters. Note we set a maximum of three attributes from one meta-attribute so that we avoid the combinatorial explosion in the analysis. Also, we focus on only the attributes assigned to more than 1,000 created characters in the CEK dataset as the attribute for the precondition.

2.3. Analysis target

In this paper, we focus on 5,845 characters with the attribute "natural human" within the meta-attribute "race" of the "status" category from the 16,261 characters registered in the CEK data set. Table 1 lists the inside attributes concerning personalities, which are used as the precondition. We select some attributes to avoid combinational explosions in analysis. The selected attributes are related to the five indicators in Egograms [7]. The indicators are CP (Critical Parent), NP (Nurturing Parent), A (Adult), FC (Free Child), and AC (Adapted Child.) The first author of this paper subjectively selected the attributes that should be corresponded to these indicators for the analysis. For instance, the

Table 2. List of outside attributes concerning appearances of created characters. We selected some meta-attributes and attributes belonging to the meta-attributes to avoid a combinational explosion.

category	meta-attribute	attribute
appearance	skin color	fair
appearance	skin color	yellow
head(hair)	hair color	blond
head(hair)	hair color	brown
head(hair)	hair color	black
clothes (tops)	color	black tops
clothes (tops)	color	white tops
clothes (tops)	sub-color	white tops for sub-color
clothes (tops)	sub-color	black tops for sub-color
clothes (bottoms)	color	black bottoms
clothes (bottoms)	color	blue bottoms
clothes (bottoms)	color	white bottoms
clothes (bottoms)	sub-color	white bottoms for sub-color

meta-attribute "mental age" should relate to A (Adult) in Egograms, and the attributes "young mind" and "old mind" are selected as the attributes for personalities.

Table 2 lists the outside attributes concerning the appearance of created characters, which are used as the preconditions. For outside attributes, we selected the color-related attributes as the analysis target. The impressions towards created characters should differ for colors. Several studies have shown that color has a strong influence on our perception and impression formation [8, 9, 10]. From another aspect, character colorization is one of the hot topics in multimedia computing for entertainment [11].

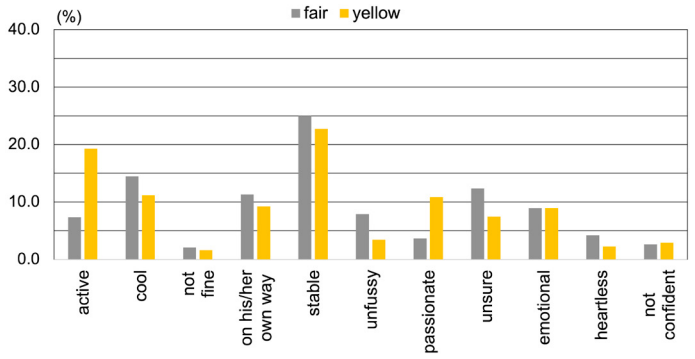
It seems that there should be some design tendencies applied to only created characters in narrative content, which are not seen for humans in the real world. Humans in the real world do not have vivid-colored hair like blue, green, and purple in nature. While it is natural that some created characters have vivid-colored hairs in narrative content, the color might be related to a personality, e.g., a character with blue hair has a personality "cool." Also, most of us in the real world do not wear the same clothes every day and change those for each day, though most of the created characters do not change their clothes in the story. To the best of our knowledge, there have been no reports on the relationships between personality and color attributes, which are based on data analysis. Therefore, this paper targets the tendencies related to color by utilizing the CEK. We study the relationships between personality and color-related appearance of created characters. Through the analysis, we try to figure out if there are some tendencies of combination between attributes of created characters; that might be considered as a kind of "stereotype" in comics/anime.

3. Analysis results where the outside attribute is given as the precondition

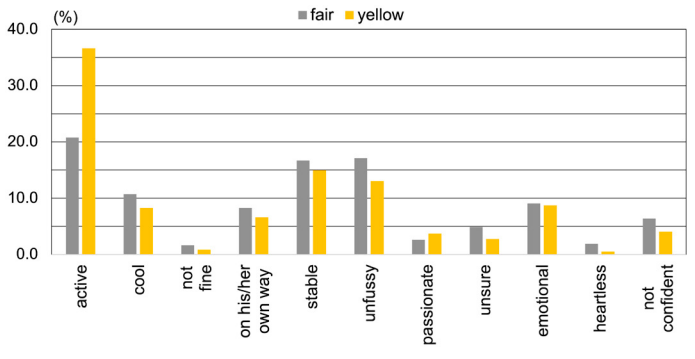
This section studies the probability distribution of inside attributes concerning personalities when the outside attribute concerning appearance is given as the precondition. The results are supposed to show what types of personality are imagined from the appearances of created characters.

3.1. "Vitality" by setting each "skin color" and "hair color" as the precondition

Figure 1 shows the probability distribution of "vitality" given "skin color" for each gender. In both males shown in Figure 1(a) and females shown in Figure 1(b), "fair"(7.4%) skin was less than "yelow" skin (19.3%) for "active" characters. For example, "*Nîno*" in "*ACCA 13-Territory Inspection Department*" and "*Mafuyu Asahina*" in "*HATSUNE MIKU: COLORFUL STAGE!*" have "fair" skins in the CEK. On the other hand, "fair" and "yellow" skins were almost the same rate for "not fine" characters. These results suggested that "active" characters tend not to have "fair" skins in the CEK. It was also confirmed that "passionate" male characters had "yellow" skins (10.9%) more than "fair"(3.7%) skins in the CEK. For example, "*Naruko Shoukichi*" in "*Yowamushi Pedal*" and "*Endou Mamoru*" in "*Inazuma Eleven*" are registered as "passionate" in the CEK.



(a) Male characters



(b) Female characters

Fig. 1. Probability distribution of "vitality" given "skin color" for each gender

Figure 2 shows the probability distribution of "vitality" given "hair color" for each gender. In both males shown in Figure 2(a) and females shown in Figure 2(b), "black" hair was less than "brown" and "blond" hair for "active" characters. These results suggested that "black" hair characters tend not to have "active" in the CEK.

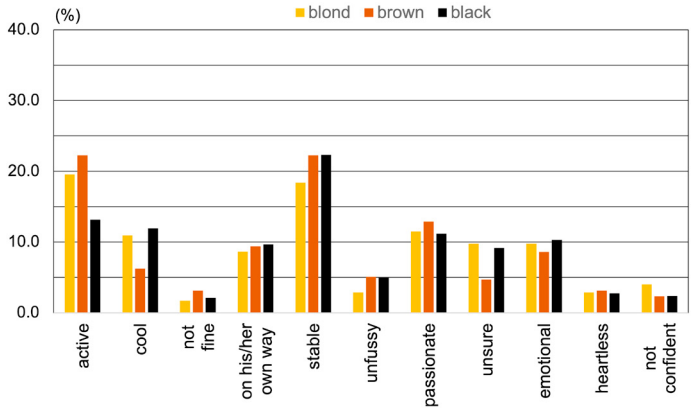
"Stable" female characters tended to have "black" hair(18.6%); that rate was higher than "brown" (12.7%) and "blond" (12.5%) hair in the CEK. However, for males, there was almost no difference in "hair color" for "stable" characters. It was suggested that the "stable" personality was not expressed by "hair colors" in the design of male characters.

3.2. "Sociability" by setting "hair color" as the precondition

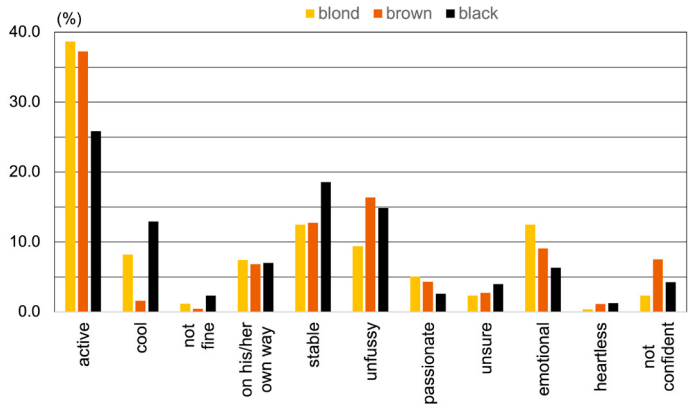
Figure 3 shows the probability distribution of "sociability" given "hair color" for each gender. "Shy" female characters shown in Figure 3(b) tended not to have "blond" hair (4.9%); that rate was less than "brown" (13.2%) and "black" (14.0%) hair in the CEK. On the other hand, for males shown in Figure 3(a), "blond" hair was slightly less than both "brown" and "black" hair for "shy" characters. Though we did not expect the relationships between "with leadership" and hair color, a certain tendency was found through the analysis. In both males and females shown in Figure 3, "brown" hair was lower than both "black" and "blond" hair for "with leadership" characters. For example, "Seto Kaiba" in "Yu-Gi-Oh! Duel Monsters" and "Maho Nishizumi" in "GIRLS und PANZER" have "brown" hair and "with leadership"' in the CEK; they appear in well-known narrative content. These results were unexpected but interesting facts we have discovered through the analysis.

3.3. "Attitude" by setting "hair color" as the precondition

Figure 4 shows the probability distribution of "attitude" given "hair color" for each gender. "Dreamer" female characters shown in Figure 4(b) tended to have "black" hair (13.2%); that rate was higher than "brown"(6.9%) and



(a) Male characters



(b) Female characters

Fig. 2. Probability distribution of "vitality" given "hair color" for each gender

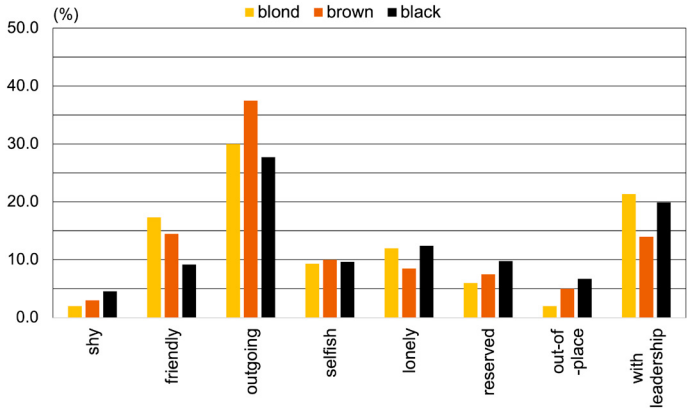
"blond"(6.6%) hair in the CEK. On the other hand, for males shown in Figure 4(a), there was almost no difference among "hair color" for "dreamer" characters. For example, "*Kotomi Komiyama*" in "*No Matter How I Look at It, It's You Guys' Fault I'm Not Popular!*" and "*Haruhi Suzumiya*" in "*The Melancholy of Haruhi Suzumiya*" have "dreamer" in the CEK. These results suggested that "black" hair characters tend to have "dreamer" in the CEK.

4. Analysis results where the inside attribute is given as the precondition

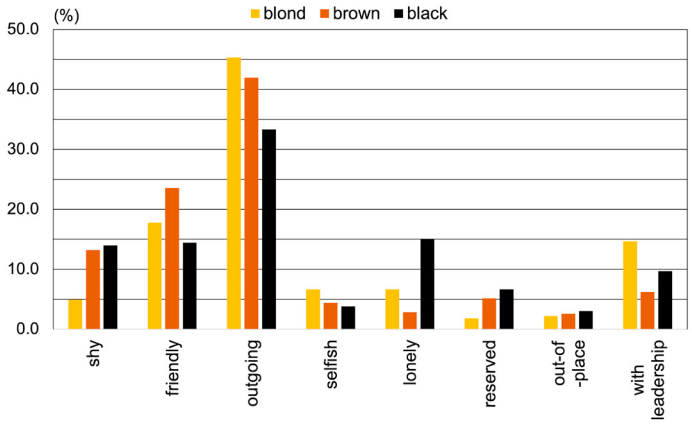
This section studies the probability distribution of outside attributes concerning appearance when the inside attribute concerning personality is given as the precondition. The results are supposed to show what types of appearances are imagined from the personality of created characters.

4.1. "Hair color" by setting "vitality" as the precondition

Figure 5 shows the probability distribution of "hair color" given "vitality" as the precondition for each gender. In both males shown in Figure 5(a) and females shown in Figure 5(b), "active" was higher than both "stable" and "unfussy" characters. In the case that a male character had "black" hair, the highest probability was "unfussy," followed in order by "stable" and "active." On the other hand, in the case that a female character had "black" hair, the highest probability was "stable," followed in order by "unfunny" and "active." In section 3.1, for both male and female characters, it has been confirmed that "active" characters had a lower chance of having "black" hair than "brown" and



(a) Male characters



(b) Female characters

Fig. 3. Probability distribution of "sociability" given "hair color" for each gender

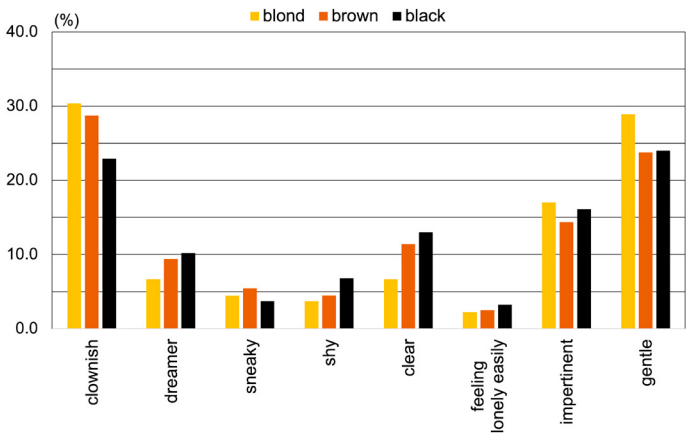
"blond" hair. Moreover, for the attribute "stable," male characters had "brown" and "black" hair slightly much more than "blond" while female characters had "black" hair much more than "brown" and "blond" hair. To sum up these facts, it should be reasonable to say that "active" characters seem not to have "black" hairs in the CEK; it seems that "active" characters tend not to have "black" hair.

4.2. "Clothes (tops)" color by setting "vitality" as the precondition

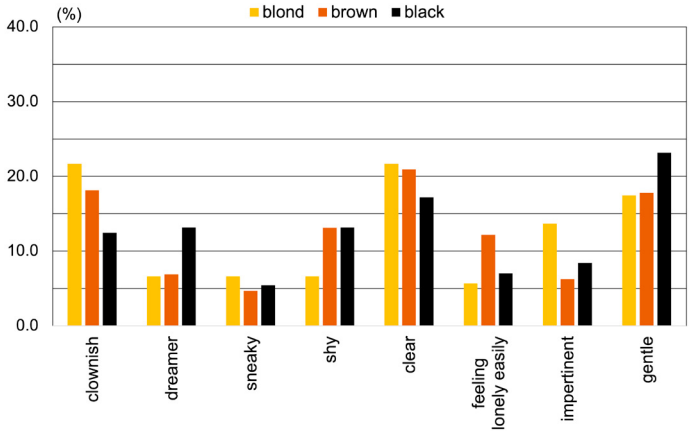
Figure 6 shows the probability distribution of "clothes (tops) color" given "vitality" as the precondition for each gender. For male characters shown in Figure 6(a), they tended to be "unfussy" much more than both "active" and "stable" if they wore "Green tops" color or "light blue tops" in the CEK. On the other hand, for females shown in Figure 6(b), the probability that a character was "stable" was slightly less than the one that she was "active" or "unfussy" when she wore "pink tops." It was confirmed that there were some outside attributes concerning appearances related to inside attributes concerning personality other than "skin color" and "hair color" described in previous sections.

5. Future direction

The findings of this research are expected to be utilized in various ways. For example, when drawing a character with a specific inside attribute concerning personality, creators might be able to verify if the appearances are com-



(a) Male characters



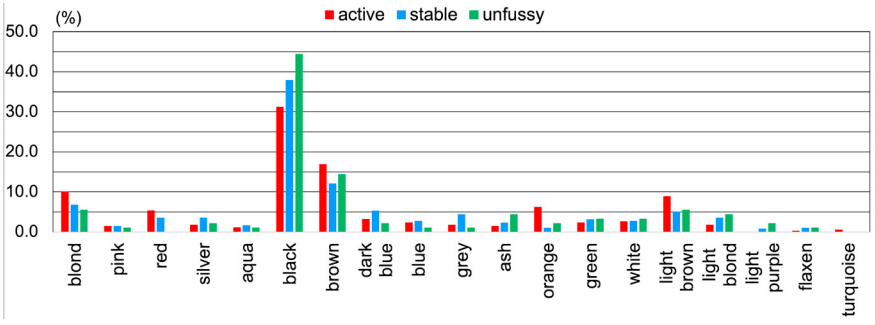
(b) Female characters

Fig. 4. Probability distribution of "attitude" given "hair color" for each gender

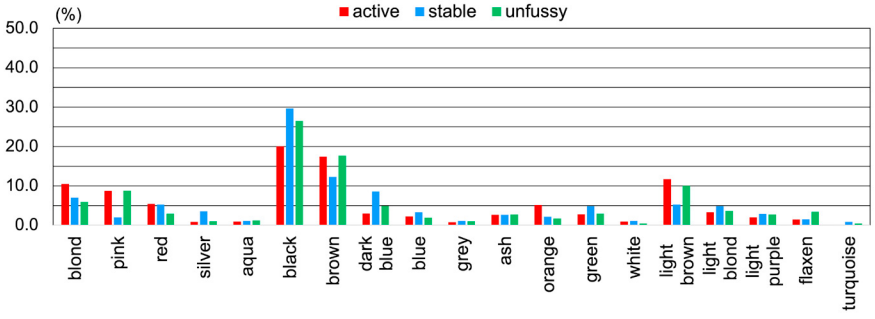
patible with his/her personality. Conversely, these findings can also be applied to design unexpected appearances intentionally. It can also be a helpful reference when estimating personality from appearances. From the aspect of storytelling, it is expected that these findings improve the analysis of the story to be based on the appearances of created characters. Roles, speeches, and the relationships among the characters might be analyzed with their appearances.

Creativity should be supported by the development of technology. The faces of characters in games are automatically generated [12]. Image generation technologies such as Stable Diffusion [13] enable even users without drawing skills to make some media and art. However, it is still difficult for users to design and objectively evaluate the outside and inside attributes and the affinity between those attributes. We believe that not only "just generate" but also knowledge revealed in this paper, i.e., common sense for created characters, should improve the support in creation.

It seems that there are differences in design tendencies between major and minor characters. We will define major and minor created characters with some metrics, such as comics' total circulation, and analyze the differences. The discussions will be helpful in studying which attributes can make created characters attractive. Also, the tendencies for characteristics of created characters might change over the years for each genre of comics/animes. We will investigate the relationships between inside and outside attributes considering the year of the character's appearance in our future.



(a) Male characters



(b) Female characters

Fig. 5. Probability distribution of "hair color" given "vitality" for each gender

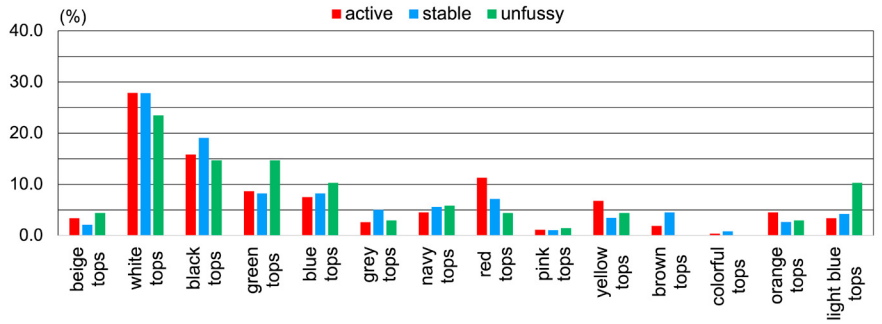
6. Conclusion

This paper has conducted a basic analysis of the relationship between inside and outside attributes (i.e., appearances and personalities) in the design of created characters. The analysis has been objectively conducted based on the collective intelligence from a dataset collected from a fan site. The results of the analysis have shown that there were some relationships between the inside and outside attributes of created characters. It should be a sort of bias for created characters in comics/animes. It was also suggested that data-driven approaches might explain the impressions and other aspects of created characters from their designs.

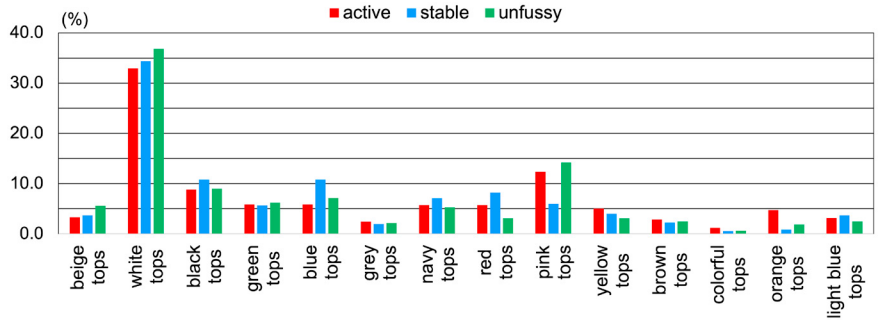
There are some other tasks in our future. We will study the relations among clothes, e.g., the combination of tops and bottoms. Humans in the real world have some tendencies [14], we expect that created characters may have some relations among clothes as well. In this paper, we targeted the created characters with the "natural human" attribute in the CEK dataset. In the CEK dataset, 76.99% of "natural person" characters also had the "student" attribute. The CEK dataset registered mainly the created characters in Japanese comics/animes. It should be caused by the fact that a large number of created characters in Japanese comics/animes were students; that is, also a bias for the characters in Japanese comics/animes. We will take this characteristic into consideration for our future analysis. Moreover, some investigations for other varieties of combinations of attributes will also be our future work.

Acknowledgements

This work is, in part, supported by JSPS KAKENHI JP22K12338 and JP20K12130. The dataset of the CEK is kindly provided by the webmaster of the Character Element Kingdom. This paper is partly supported by Ms. Yokoi, R. and Mr. Nishiaki, K. at the Faculty of Informatics, Kansai University. We show the most appreciation.



(a) Male characters



(b) Female characters

Fig. 6. Probability distribution of "clothes(tops) color" given "vitality" for each gender

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