Original Article

Choosing an Obi Suitable for Kimonos Eliciting a Sense of *Hannari*
- From a color-based perspective -

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Abstract

Purpose: Matching the color of a kimono with that of an obi is an important of creating a beautiful kimono arrangement. This experiment aims to clarify what particular "color" features of an obi fit with *hannari* eliciting kimono images. We used a thought algorithm based on a kimono-expert's selection process for suitable obi, and examined whether the instructions were effective for a person with no kimono knowledge.

Participants and Methods: One kimono expert and 12 graduate students with no kimono knowledge were asked to select whether two top and bottom images were suitable for five kimono images. Next, the specialist's thought algorithm was clarified by protocol analysis. And we instructed a student in specialist's algorithmic thought process, and evaluated whether it was effective. Finally, RGB and u'v' of obi images were requested, to clarify what kind of color characteristic there were in the obi that were considered to be suitable for the kimono images by discriminant analysis.

Results: Once RGB and u', v' characteristics of the colors of suitable obi were made clear, and the particular characteristics of the color was shown when a "suitable obi" was chosen by discriminant analysis. However, the instructions of the expert's thought algorithm were not effective.

Conclusions: About 80% of "suitable obi" selected by students without knowledge of kimono are identifiable by "color" on discriminant analysis. For experts this was about 50%. This suggests that students who do not have knowledge of kimono chose based on their color preference, while experts considered factors such as "status" and "season".

Key Words: Kansei, Color, Kimono, Obi, Discriminant analysis

Introduction

Originally the kimono was called *kosode* and used as the thermal layer which a noble wore in the Heian era. In the Warring States period, warriors and ordinary people also started wearing *kosode,* the beautiful color and design were added and eventually resulted in the present style. (Masuda, 2010). *Kyoyuzen*® is one of the dyeing techniques for kosode, established since the late 17th century in the mid-Edo period are the beautiful tone suitable for a season is the special feature, and is still well-loved by people. (Masaki,1977). At first, the obi was a thin belt selected out of consideration avoid spoiling the beauty of a kimono, after that, it became the present, more decorative style, this allowed for the kimono and obi to be united and express a style of beauty unique to the Japanese kimono. (Kawabata, 1971). In Japanese, "obi-awase" means matching an obit with a kimono, it's necessary to consider not just the color, but the texture, the pattern, the season, and the fabric as well. (Komizo, 2014). In recent years, people have enjoyed obi matching relatively freely until the middle of 1970's, during the golden age of

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kimono production, a guidebook about the Japanese dressing in kimono became a bestseller, and many complicated rules for wearing kimono were decided by the kimono industry. This led to a problem where people became unsure as to how to match their obi with a kimono and could no longer know whether it was good or not, some hold the opinion that this was a cause for a more general aversion from wearing kimono (Komizo, 2014; Ito, 2016). Therefore, in this study, we focus on color as the physical feature of kimono and obi. We studied modern kimono and obi arrangements. Not only color, but design, rank, season, etc. should be taken into consideration, however; we decided to leave those more complicated features for future research and focus on color first. Using, *Kyoyuzen*® kimono, characterized by a gorgeous, delicate color (Tabata, 2016), we aimed to make clear what particular characteristics the color of an obi has in a kimono arrangement that is praised as eliciting a sense of *hannari* (Komizo, 2013; Komizo, 2015). We used protocol analysis to make explicit the thought algorithm of a kimono expert at the time of choosing a obi, and evaluated whether it was possible to instruct persons without kimono knowledge how to select a suitable obi using the thought algorithm. In light of the increasing number of people who purchase kimonos and obi on the internet, this experiment was conducted using pictures.

Experiment Method

1. Selection of the obi picture stimulus suitable for a kimono

For five kimonos images A to E [image offer: Kyoyuzen Cooperative Liaison Council] (Figure1) that were evaluated as eliciting a sense of *hannari* in the previous study (Komizo, 2015; Komizo, 2018), the specialist studying dyeing and weaving as fine arts chose two obis each for a kimonos image, a total of ten obi (Figure 2)

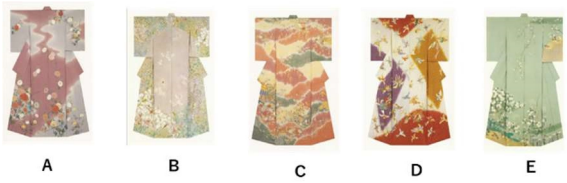


Figure 1: Kimono Images of *Kyoyuzen*® Eliciting a Sense of "Hannari"

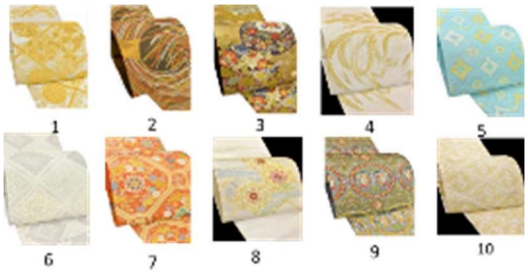


Figure 2: The Expert's Suitable Obi for *Kyoyuzen*® Kimono Images A through E

from 102 obi images [image offer Company Kyoto Kimono Ichiba]. In addition, an equal ten "non-suitable obi" were selected in total (Figure 3). The selection method had an expert choose

Figure 3: The Expert's Unsuitable Obi for *Kyoyuzen*® Kimono Images A through E

their top two "suitable obi" for *Kyoyuzen*® kimono images A through E in Figure 1, from 102 pieces of obi, the obi number in the Expert column of Table 1 shows the results. These ten pieces are displayed at random in Figure 2, these were used as the stimulus in this experiment. In addition, the expert's "unsuitable obi" for kimono images A through E were the bottom two ranked obi images from 102 pieces, these

are shown in the Expert column of Table 2. These ten obi images are randomly arranged in Figure 3 and were used as stimulus in this experiment. The experiment was conducted in darkrooms less than 3 lx, An experimental

Table 1: The Top Two of the Suitable Obi for *Kyoyuzen*® Kimono Chosen by the Expert and the Graduate Students without Kimono Knowledge

	Expert		Non Expert	
Kimono Image	1	2	1	2
A	1	6	4	1
B	5	10	7	4
C	4	8	10	4
D	2	9	1	10
E	3	7	3	5

Table 2: The Top Two of the Unsuitable Obi for *Kyoyuzen*® Kimono Chosen by the Expert and the Graduate Students without Kimono Knowledge

	Expert		Non Expert	
Kimono Image	1	2	1	2
A	4	7	9	1,5
B	5	8	4	7
C	9	10	3	1.9
D	1	6	9	1
E	2	3	9	1

subject observed 50 cm of the obi and kimon image shown on a 32-model display (32 inches,69.8×39.2 cm) (NEC MultiSync LCD-V323). Therefore, the field angles were about 70 deg. width by about 42 deg. length. It is important that one's kimono and obi arrangement coincide with one's "status", which changes by situation, such as location and whether one is on the inviting side or the visiting side of an interaction. Because the *houmongi* used in the previous study are associated with formal dress, we used the appropriate double-woven obi in this experiment. Furthermore, it's necessary to consider age when choosing kimonos and obis, subjects were instructed to choose an obi appropriate for "a married woman in her 40's who is attending a wedding". (Motoji, 2011).

2. Protocol analysis

Protocol analysis is a method to have people verbalize the mental process for their actions, and to clarify their thinking and cognitive processes from the results (Fukuda, 2004). In this research, when the specialist were choosing their top two "suitable obi" (Table 1) and "unsuitable obi" (Table 2), we had them explain why they were chosen, the situation was captured by video. After that, the utterance was divided into segments (clauses), and the thought process for the obi selection of the expert was clarified by the think-aloud method (Fukuda, 2004) and analyzed by the occurrence frequency of the symbol which had been subdivided by the category. The differences between the obis chosen by experimental collaborators with no kimono knowledge were compared.

3. Validity of the instructions to people without knowledge of kimonos

Experimental subjects were 12 graduate students who had no knowledge of how to dress in kimono (8 men and 4 women), they selected their top two "matching obi" for kimonos A through E from the 10 obi images in Figure 2 using the same obi images as the expert, it was added up, and the top 2 band image numbers with the highest number of votes were shown in the Non-Expert column of Table 1. The experiment was performed by projecting an image on a 100-inch (100 inch, 150 × 200 cm) screen using a projector (EPSON EB 1915) in a lecture room of 3 lx or less. The experimental subjects observed the images from 5.8 to 7.9 m apart. Therefore, the field angle is lengthwise

about 11-15º and width about 14-20º. They chose "unsuitable obi" from ten pieces of obi images of Figure 3 in the same way and Table 2 shows the lower two obi numbers, which had many votes, in the Non Expert column of Table 2. Regarding the “unsuitable obi”, the lower second position of the kimono image A and E were described two image numbers because they were ranked the same. From this result, we compared the obi which the experimental subjects, without kimono knowledge selected, with those chosen by of a kimono expert. Next, using six elements from the protocol analysis of the kimono expert’s thought algorithm for choosing suitable obi instructions were given to the same 12 graduate students from section 2, (Table 3). The instructions were explained while the lecturer showed slides with pictures for each of the six items, taking about 15 minutes total. Then, under the same conditions, the participants selected obi. The results before and after the instruction are shown in the graph for each of the kimono images A through E (Figure 4). The expert’s answer was taken to be correct and is shown in the Expert column of Table 1, we evaluated whether the instructions were effective by comparing the ratio of correct answers from participants without kimono knowledge before and after the instructions were given.

4. Abstraction of physical features of obi images

Color, which is the physical feature of the obi images, was abstracted. In the previous study (Komizo, 2018), our analysis of kimono images eliciting a sense of *hannari* showed that a peak appeared in the vicinity of 200 in the pixel value hierarchy of the RGB R histogram. In the present research, the color’s physical characteristics were analyzed using the three primary colors RGB and based on the CIELUV color system used when representing the difference in the color reproduction range of a display in a chromaticity diagram, performed a color analysis of the u’v’ results (Komizo, 2015; Komizo, 2018). The suitable obi for kimonos A through E selected by an expert, and ten obi images (Figure 2) and ten unsuitable obi images, total 20 images were abstracted for the average RGB and u'v', a standard deviation, skewness, kurtosis, the maximum, and the minimum were calculated. RGB represents R(red), G (green), B (blue) each with 8 bits that is, a value of 0-255. The RGB of each of the obi images were calculated and the number of pixels in each RGB was represented as a histogram. At that time, the background colors black and white, 0 and 255, were excluded. Furthermore, in order to know the feature of the histogram according to RGB of the suitable obi, the number of pixels was totaled for the belt pictures 1-10 as selected by the expert, Figure 2, according to RGB, and the histogram was created for every RGB.

5. Discriminant analysis of RGB and u'v'

Discrimination analysis is to predict and explain 1 dependent variable from more than

Table 3: The Protocol Analysis of the Kimono Expert’s Thought Algorithm for Choosing Suitable Obi

	Instruction Contents
1	Consider the suitable season judging from the pattern of kimono and obi
2	Consider kimono and obi colors. Light colors and deep colors do not match
3	Do not make a strong cContrast between of a kimono and aan obi
4	Consider meaning of animals and plants
5	Choose an obi that is relatively easy to match with other kimonos
6	Choose large-patterned obi with small-patterned kimono

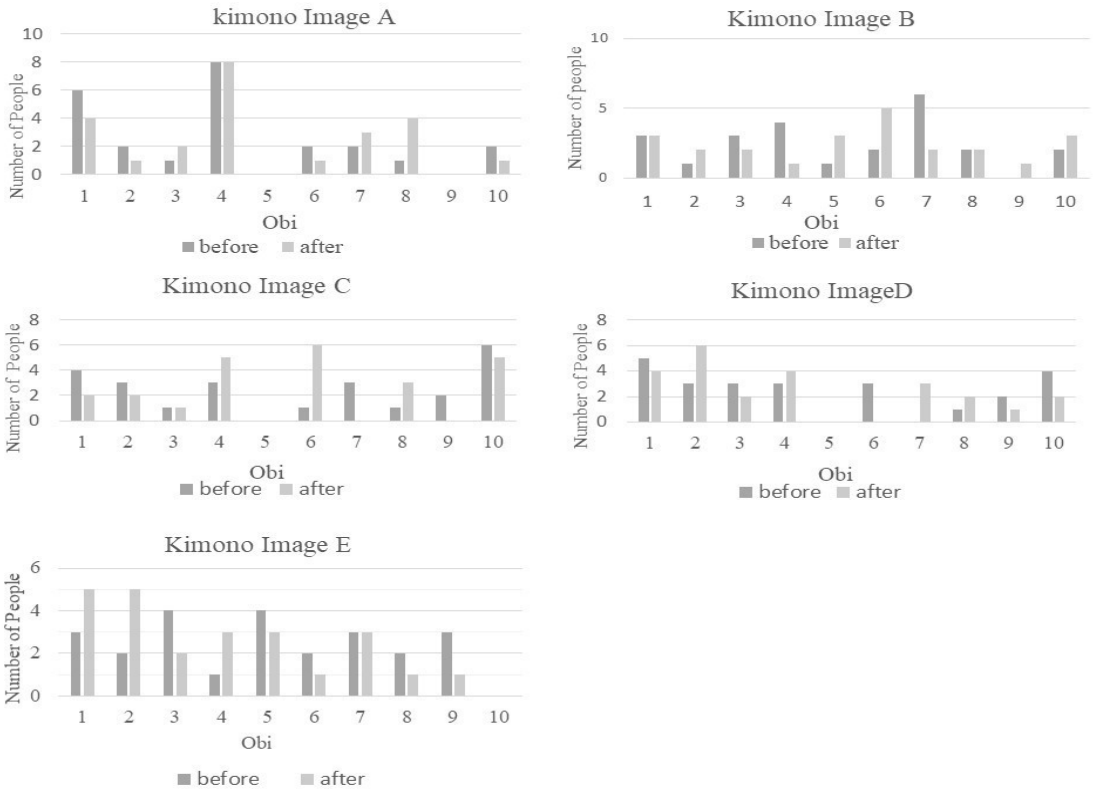


Figure 4: The Results of Obi Selections before or after the Instructions, for the *Kyoyuzen*® Kimono Images A through E Selected by Participants without Kimono Knowledge

one autonomous variable (Oshio, 2004). In this research, the physical quantity of the color of the obi pictures, RGB, the average of each u'v', the standard deviation, the skewness, the kurtosis, the maximum, and the minimum, were calculated using SPSS (Ver. 11. OJ, IBM, Co.). In other words, we extracted the contributing variables. Furthermore, when selecting a suitable obi for experts and graduate students who do not have kimono knowledge, we compared the degree to which "color" was regarded as important. The specialist's discriminant analysis was conducted first. In 2, the top two "suitable obis" were selected for *hannari* eliciting kimono images A through E (Figure 1) by experts from 102 obi images. A total of 10 obi numbers were indicated in the Expert column of Table 1. Moreover, the two lowest rank images were selected as "unsuitable obi" as shown in the Expert column of Table 2.

Discriminant analysis was conducted on the RGB values of the above total of 20 images, the average of each u'v', a standard deviation, skewness, kurtosis, the maximum, and the minimum. Next, we conducted a discriminant analysis for the graduate students without kimono knowledge. The graduate students without kimono knowledge selected "suitable obi" from the 10 obi images in Figure 2 for kimono image A, Figure 1. The top 2 obi image numbers, those with the largest number of votes, are shown in Table 1 in the Non-Expert column. In addition, the two most "unsuitable obi" were likewise chosen from the ten obi images in Figure 3. Since the second most unsuitable obi for kimono image A and E had tie scores, a total of 22 images were used. Discrimination analysis was performed on the resulting 22 images. The color features of an obi suitable for a *hannari* eliciting kimono were explained. In addition, we

compared it the expert and those without kimono knowledge, clarifying how much "color" is regarded as important.

Results and Consideration

1. Selection of the obi image stimulus suitable for a kimono

The expert selected two images as “suitable obi” for the Figure 1 Kyoto yuzen kimono images A through E. The top two obi images selected by students without kimono knowledge as “suitable obi” are shown in Table 1. In the same way, the expert and students without kimono knowledge selected the two most “unsuitable obi” from among the ten obi images in Figure 3, for Kyoto yuzen kimonos A through E. The result was that none of the obi chosen as suitable were the same for both the expert and the students without kimono knowledge, and only one unsuitable obi was ranked the same, image 1 as paired with kimono D. (Table 2)

2. Protocol analysis

The results of the protocol analysis of the expert’s obi matching is shown in Table 3. In this experiment, the kimono and obi were matched in accordance with semi-formal attire, the “status” was established to be that of attending a formal occasion, such as a wedding. The thought process that resulted from protocol analysis as the expert chose an obi first considered the season then the color, pattern, and the other obi combinations, in that order, the choice of obi then became clear.

3. The effectivity of instructions for people without kimono knowledge

The “before” data in Figure 4 shows the results of having 12 graduate students with no kimono knowledge select suitable obi for each kimono image A through E from Figure 2. A general lack of convergence in obi selection resulted from the students without kimono knowledge choosing suitable obi for kimono images A through E, we presume this is because they were choosing according to individual preference. Then, 15-minute instructions were performed by an instructor using the expert’s obi selection thought process shown in Table 3. After that, the students without kimono knowledge again selected suitable obi, as shown by the “after” data in Figure 4. In this result as well, the “suitable obi” answers weren’t concentrated on any particular obi, so we presume the choice was made by taste. Furthermore, in order to check whether the instructions for selecting suitable obi were effective for people without kimono knowledge, the expert obi matching answers shown in Table 1 were taken as the correct answers. The accuracy rate before and after the instruction is as shown in Table 4. The results were that in obi matching for the five kimono images A through E, only images B and C showed an increase in the rate of correctness, and the image with the highest increase rate was C with a 16.7% increase. For all kimono images A through E the rate of correct obi matching after instruction was 33.3% or less, and no remarkable increase in the rate of correctness was found. From this, it became clear that short instructions about the kimono expert’s thought process when obi-matching cannot be said to be effective.

Table 4: Correct Answer Rate after the Instruction for Selecting Suitable Obi

Kimono Image	Accuracy Rate before Instruction	Accuracy Rate after Instruction	Percentage of Accuracy Rate
A	33.3	20.8	-12.5
B	12.5	25	12.5
C	16.7	33.3	16.7
D	20.8	29.2	-8.4
E	29.2	20.83	-8.37

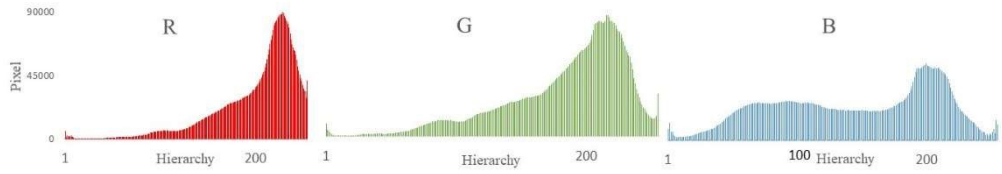


Figure 5: The Number of Pixels in Obi Images 1 through 10 in Fig.2 Added Together by RGB Values, and Expressed as a Histogram

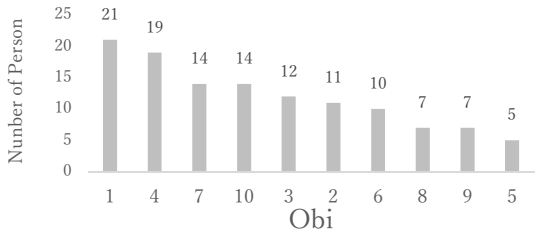


Figure 6: The Breakdown of the Suitable Obi Chosen by Graduate Student without Kimono Knowledge from the 10 Options in Fig.2

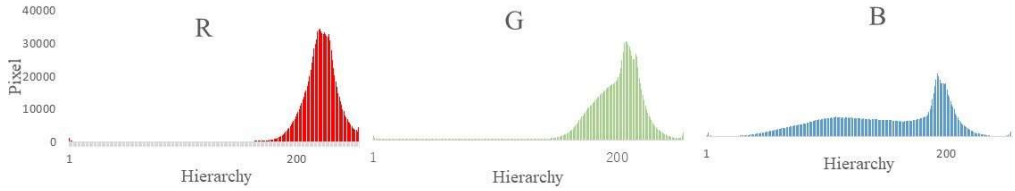


Figure 7: The RGB Histograms of RGB Images of the Top Obi Images 1 and 4 Chosen by Graduate Students without Kimono Knowledge

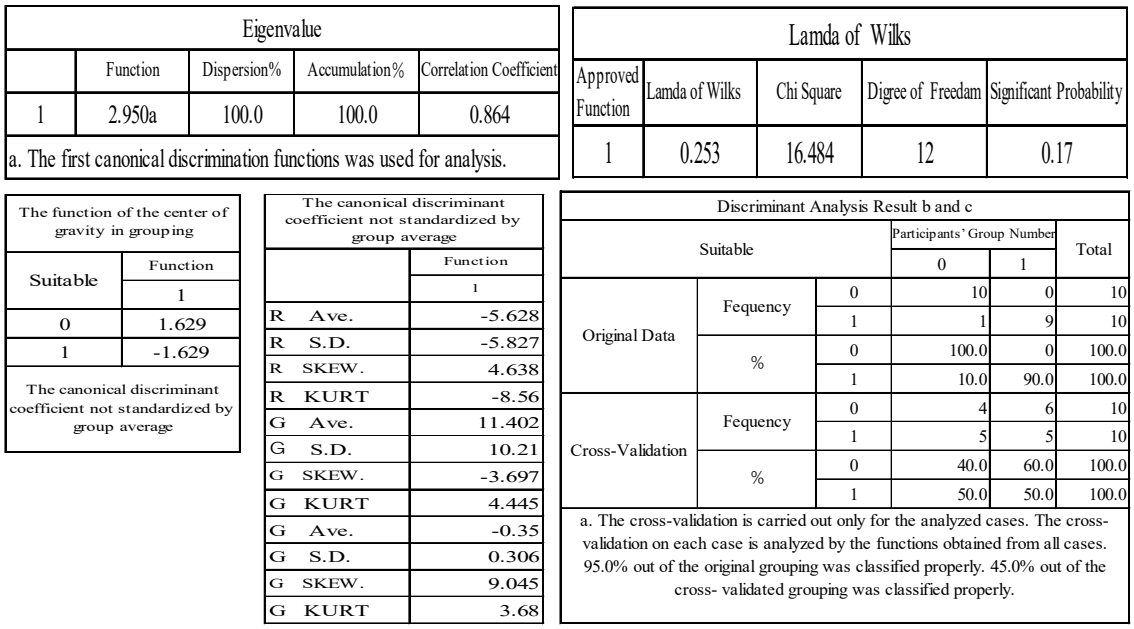
4. Abstraction of the physical features of the obi pictures

The RGB value of the obi image 1-10 (Figure 2) chosen by the expert as “suitable obi” for the kimono picture eliciting a sense of *hannari* was calculated, and expressed with a histogram for each value R, G, and B. In order to investigate the RGB features of a suitable obi image as selected by an expert for kimono images eliciting a sense of *hannari*, the number of pixels in obi images 1 through 10 in Figure 2 were added together by RGB values, and expressed as a histogram in Figure 5. In addition, for the purpose of examining the characteristics of the RGB of the suitable obi chosen by graduate students without kimono knowledge, the top two “suitable obi” by number of votes from the 10 options in Figure 2 for kimono images A through E were graphed in Figure 6. The resulting top two images were 1 and 4, so the RGB histograms of RGB images of obi images 1 and 4 were shown in Figure 7. In Figure 5, the expert's chosen "suitable obi" 10 RGB histograms showed peaks from 190 to 220 in all of the RGB levels, and R and G showed the characteristics of having a long-tail to the left. In the histogram

for B, in addition to the peak around 200, a gentle peak was also found around 60 to 120. In the histogram of the obi image chosen by students with no kimono knowledge, a peak was seen around 200 in RGB values in Figure 7 as well, in the same way, the histogram for B showed a low peak at around 110.

5. Discriminant analysis of RGB and u'v'

Discriminant analysis for explaining the obi considered suitable for kimono images eliciting a sense of *hannari* by an expert was conducted using the average value of RGB, a standard deviation, skewness, and kurtosis. (Figure 8) The magnitude of the absolute value of the canonical discriminant coefficient standardized in Figure 8 indicates the degree to which the independent variable contributes in grouping (Oshio, 2004). In this research, we decided to explain the suitable obi by considering the top two discriminant function variables with a large absolute value as a contribution item. In the discriminant analysis in the expert RGB, as shown in the standardized canonical discriminant coefficient of Figure 8, the average of G is a large value of 11.4, which then became the standard deviation 10.2 for G. Since the function of the center of gravity of the "suitable obi" is negative, the "suitable obi" chosen by an expert can be described as "an obi image with a small mean and standard deviation of G". Next, we conducted discriminant analysis of u'v' at the time the expert chose a suitable obi, the results are shown in Figure 9. The items with a large absolute value was 8.94 for "kurtosis of v", and 7.82 for "skewness of v", Because the function of the center of gravity of the band which matches is also negative here, a "suitable obi" can be explained by a small skewness and kurtosis of v'. Next we analyzed the suitable obi chosen by the graduate students without kimono knowledge. The RGB analysis results are indicated in Figure 10. The largest absolute value of the result was 15.1 for the degree of the skewness of R, next was the kurtosis of R at 13.3, because the function of the center of gravity of the obi which matched this was negative, it can be described as "an obi image with a small skewness and kurtosis of R" Furthermore, the result of the discriminant analysis of u'v' is shown in Figure 11. In this result, the large absolute value items were 23.2 for the skewness of u' and 10.84 for the "standard deviation of u'", as the function of the center of gravity of the "suitable obi" is positive, it can be described as "an obi image with a large skewness and standard deviation of u'". These results were gathered in Table 5. From this result, there is no item with the same RGB or u'v' color features when experts and people without kimono knowledge select "suitable obi", it turned out to be chosen on a completely different basis. Moreover, the success rate of the itemization of the expert's RGB discriminant analysis was 45.0%, and the success rate of u'v' was as low as 55.0%, this could indicate that when the expert chooses a "suitable obi" it is not only for the color but also due to other factors, such as the "status" and so forth, being taken into consideration. In addition, the success rate of the itemization of students without kimono knowledge RGB discriminant analysis was 81.8%, and 77.3% for u'v', both showing a high value. This suggests that, since the students without kimono knowledge did not know about "status" etc., they mainly chose the "suitable obi" for the "color".



Eigenvalue

	Function	Dispersion%	Accumulation%	Correlation Coefficient
1	2.950a	100.0	100.0	0.864

a. The first canonical discrimination functions was used for analysis.

Lamda of Wilks

Approved Function	Lamda of Wilks	Chi Square	Digree of Freedam	Significant Probability
1	0.253	16.484	12	0.17

The function of the center of gravity in grouping

Suitable	Function
	1
0	1.629
1	-1.629

The canonical discriminant coefficient not standardized by group average

The canonical discriminant coefficient not standardized by group average

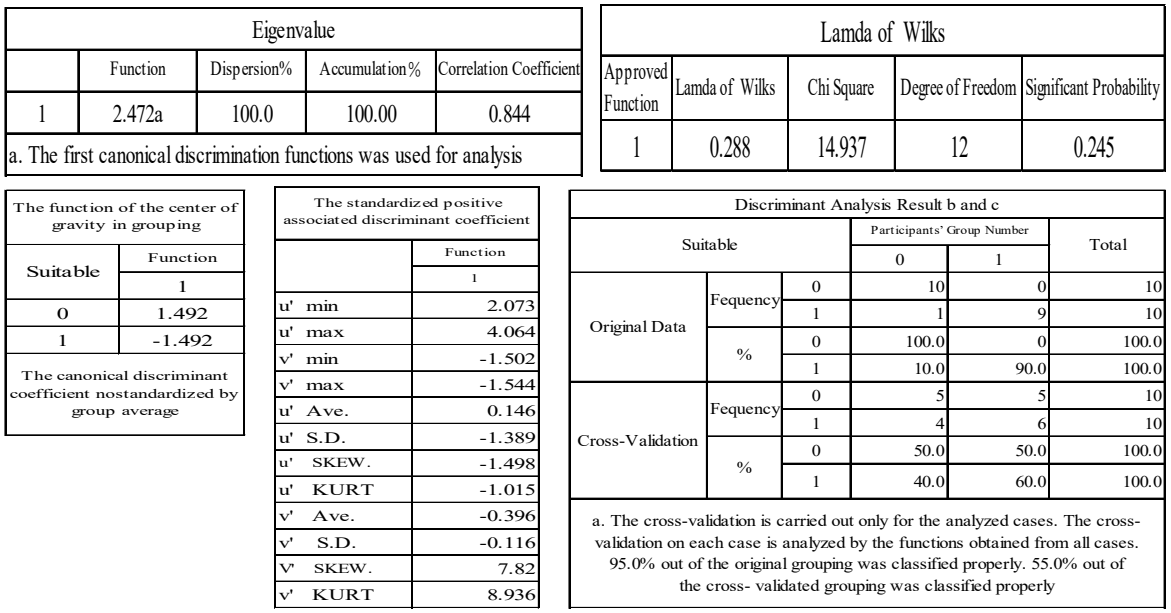
	Function
	1
R Ave.	-5.628
R S.D.	-5.827
R SKEW.	4.638
R KURT	-8.56
G Ave.	11.402
G S.D.	10.21
G SKEW.	-3.697
G KURT	4.445
G Ave.	-0.35
G S.D.	0.306
G SKEW.	9.045
G KURT	3.68

Discriminant Analysis Result b and c

Suitable			Participants' Group Number 0	Participants' Group Number 1	Total
Original Data	Fequency	0	10	0	10
		1	1	9	10
	%	0	100.0	0	100.0
		1	10.0	90.0	100.0
Cross-Validation	Fequency	0	4	6	10
		1	5	5	10
	%	0	40.0	60.0	100.0
		1	50.0	50.0	100.0

a. The cross-validation is carried out only for the analyzed cases. The cross-validation on each case is analyzed by the functions obtained from all cases. 95.0% out of the original grouping was classified properly. 45.0% out of the cross- validated grouping was classified properly.

Figure 8: RGB The Discriminant Analysis for Explaining the Obi Considered for Kimono Images Eliciting a Sense of *Hannari* by an Expert



Eigenvalue

	Function	Dispersion%	Accumulation%	Correlation Coefficient
1	2.472a	100.0	100.00	0.844

a. The first canonical discrimination functions was used for analysis

Lamda of Wilks

Approved Function	Lamda of Wilks	Chi Square	Degree of Freedom	Significant Probability
1	0.288	14.937	12	0.245

The function of the center of gravity in grouping

Suitable	Function
	1
0	1.492
1	-1.492

The canonical discriminant coefficient nostandardized by group average

The standardized positive associated discriminant coefficient

	Function
	1
u' min	2.073
u' max	4.064
v' min	-1.502
v' max	-1.544
u' Ave.	0.146
u' S.D.	-1.389
u' SKEW.	-1.498
u' KURT	-1.015
v' Ave.	-0.396
v' S.D.	-0.116
V' SKEW.	7.82
v' KURT	8.936

Discriminant Analysis Result b and c

Suitable			Participants' Group Number 0	Participants' Group Number 1	Total
Original Data	Fequency	0	10	0	10
		1	1	9	10
	%	0	100.0	0	100.0
		1	10.0	90.0	100.0
Cross-Validation	Fequency	0	5	5	10
		1	4	6	10
	%	0	50.0	50.0	100.0
		1	40.0	60.0	100.0

a. The cross-validation is carried out only for the analyzed cases. The cross-validation on each case is analyzed by the functions obtained from all cases. 95.0% out of the original grouping was classified properly. 55.0% out of the cross- validated grouping was classified properly

Figure 9: The Discriminant Analysis of u'v' at the Time the Expert Chose a Suitable Obi

Eigenvalue				
	Function	Dispersion%	Accumulation%	Correlation Coefficient
1	22.326a	100.0	100.0	0.978
a The first one of the canonical discriminant functions was used for analysis				

Lamda of Wilks				
Approved Function	Lamda of Wilks	Chi Square	Degree of Freedom	Significant Probability
1	0.43	47.243	10	0.00

The function of the center of gravity in grouping	
Suitable	Function
	1
0	4.113
1	-4.935
The canonical discriminant coefficient not standardized by group average	

The standardized positive associated discriminant	
	Function
	1
R Ave.	11.470
R S.D.	9.520
R SKEW.	15.065
R KURT	13.339
G Ave.	-6.503
G S.D.	-2.844
G SKEW.	2.673
B Ave.	-0.756
G S.D.	-4.861
G SKEW.	-2.097

Discriminant Analysis Result b and c					
Suitable			Participants' Group Number		Total
			0	1	
Original data	Fequency	0	12	0	12
		1	0	10	10
	%	0	100.0	0	100.0
		1	10.0	90.0	100.0
Cross-Validation	Fequency	0	11	1	12
		1	3	7	10
	%	0	491.7	8.3	100.0
		1	30.0	70.0	100.0
a. The cross-validation is carried out only for the analyzed cases. The cross-validation on each case is analyzed by the functions obtained from all cases. 100.0% out of the original grouping was classified properly. 81.8% out of the cross- validated grouping was classified properly.					

Figure 10: The RGB Discriminant Analysis of the Suitable Obi Chosen by the Graduate Students without Kimono Knowledge

Eigenvalue				
	Function	Dispersion%	Accumulation %	Correlation Coefficient
1	19.142a	100.0	100.0	0.975
a The first one of the canonical discriminant functions was used for analysis				

Lamda of Wilks				
Approved Function	Lamda of Wilks	Chi Square	Degree of Freedom	Significant Probability
1	0.50	45.042	10	0.00

The function of the center of gravity in grouping	
Suitable	Function
	1
0	-3.806
1	4.57
The canonical discriminant coefficient not standardized by group average	

The standardized positive associated discriminant coefficient	
	Function
	1
u' min	5.092
u' max	-2.121
v' min	1.789
v' max	-2.083
u' Ave.	-6.7476
u' S.D.	10.843
u' SKEW.	2
u' KURT	23.221
v' Ave.	-9.426
v' S.D.	-0.116
V' SKEW.	7.82
v' KURT	8.936

Discriminant Analysis Result b and c					
Suitable			Participants' Group Number		Total
			0	1	
Original data	Fequency	0	12	0	12
		1	0	10	10
	%	0	100.0	0	100.0
		1	10.0	100.0	100.0
Cross-Validation	Fequency	0	9	3	12
		1	2	8	10
	%	0	75.0	25.0	100.0
		1	20.0	80.0	100.0
a. The cross-validation is carried out only for the analyzed cases. The cross-validation on each case is analyzed by the functions obtained from all cases. 100.0% out of the original grouping was classified properly. 77.3% out of the cross- validated grouping was classified properly.					

Figure 11: The Discrimination Analysis of u'v' of the Suitable Obi Chosen by the Graduate Students without Kimono Knwledge

Table 5: The Top Second Place of the Discriminant Analysis of RGB and u'v' according to the Expert and the Graduate Students without Kimono Knowledge

	RGB		u'v'	
	Item 1	Item 2	Item 1	Item 2
Expert	Average G is small	S.D. G is small	Kurt v' is small	Skew v' is small
Graduate Students without Kimono Kknowledge	Skew R is small	Kurt R is small	Skew of u' is big	S.D u' is big

Conclusion

In this study, attention is paid to the problem of the difficulty of choosing suitable obi as a cause of the aversion to a kimono (Komizo, 2014), we examined what kind of obi is suitable for kimono that elicit a sense of *hannari*. In the first experiment, an expert and students with no kimono knowledge chose suitable obi for the same kimono image, but the selected obi images were hardly in agreement. Therefore, we clarified the thought process of the kimono specialists when choosing a suitable obi, and made an experiment on the hypothesis that even those who do not have knowledge of kimono would be able to choose a suitable obi if taught, however, we did not observe an increased accuracy rate. Furthermore, we compared the results of discriminant analysis on the obi selection of both the students without kimono knowledge and the expert, using only color information, only 45.0% of the expert's "suitable obi" selection was distinguishable. On the other hand, 81.8% of the "suitable obi" selected by students without kimono knowledge were distinguishable using only "color" information. It is thought that the students without kimono knowledge were selecting suitable obi matching with a certain degree of uniform standard related to their color. In response to this result, we interviewed a kimono expert, "Situation is important for kimono styling, so this sort of attire when you go to this place, examples are necessary to teach "status". It's possible to use images and summaries, the color selection is next phase, last is the matter of taste." Based upon the foregoing, it is important that in order to teach obi matching that first plenty of instructions are given using images showing "status" changing based on where to and with whom one goes, and after that, it is thought to be good should you choose to consider the "season", "color", "pattern", and "combination with other obi". In addition, conventionally when a store person selects an obi, it is done subjectively, without any objective indications. These findings will provide guidance for the automated selection of "suitable obi" for images of kimono eliciting a sense of *hannari*. According to the sales people, most obis are not purchased independently but rather with a kimono, or purchased as an accompaniment for a kimono already owned. If that is the case, it would be possible to develop an application that could suggest a suitable obi by using an image of a kimono that one already owns. Due to this sort of application, we can expect this research to be useful for Internet business. There are many other kimono conventions beside obi arrangement. There are currently 390 rules written in what is called the kimono instruction book published in 1972, approximately 50 years ago, and 26 of them are about obi arrangement. Among them, it is written that it is safe to choose the color pattern of a visiting dress which harmonizes well with the background woven pattern (Shiozuki, 1972), and not only the color but also the color scheme of the pattern, patterns only used for certain events, as well as the meaning of the pattern. On the other hand, it is also enjoyable, in wearing kimono, to harmonize

the choice for the color of the decorative collar, the obi band, the obi bustle and the tabi. Presently, if dressing in kimono, it is not possible to ignore the rules handed down by people from generation to generation since around 1970. Because of this, there are several parameters that kimono must consider. Now that AI has begun to spread, it is possible to construct a system to learn the complex rules of the kimono, to analyze using feature quantities of images, to propose multiple matches from within the database of images, and finally to choose a favorite color from among them according to one's own sensibility. It is expected that making use of these technologies could curtail serious kimono aversion.

Future work

In this study, the individual color scheme of kimono and obi could not be discussed. In addition, "pattern" is an important element of the obi. Therefore, we will pursue the study on the color scheme of a kimono with the obi as well as the color of the pattern in future.

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