

## A KANSEI MODEL FOR PREFERENCES OF CHICKEN APPEARANCE IN CHIANG RAI AND OKINAWA

Akira HARADA\*, Jue ZHANG\*\*, Masaru TAKADA\*\*\*, and Pornthep LERTTEVA-SIRI\*\*\*\*

\* *Sapporo City University, 1 Geijutsu-no-mori, Minami-ku, Sapporo, Hokkaido, 005-0864, Japan*

\*\* *Kogakuin University, 1-24-2 Nishi-Shinjuku, Shinjuku-ku, Tokyo 163-8677, Japan*

\*\*\* *The Research Institute of Evolutionary Biology, 927 Unten Nalijin, Okinawa, 905-0405 Japan*

\*\*\*\* *Chulalongkorn University, Phayathai Road Pathumwan Bangkok 10550 Thailand*

### ABSTRACT

Domesticated creatures, such as chickens, have evolved into different forms of their untamed ancestors, and artificial selection by humans has led to more uniform physical and physiological features and the like. In this process, elements such as the cultural background of the area, the purpose of breeding, people's sense of values, and livestock, and kansei have all affected the creature's biological features, including variety, form and color, to some extent. The common-or-garden chicken, *Gallus gallus domesticus* is considered to have been domesticated from its wild ancestral form - the red jungle fowl (*Gallus gallus*) - for the purpose of exploitation by humans. The coloring of the plumage and shank of the chicken are considered to be quite important elements for ritual ceremonial use in some Asian countries and regions. In order to elucidate the domestication process, we propose an examination of whether individual elements based on different cultural backgrounds (e.g., senses of values, preference and knowledge) influence judgment in human evaluation of the shape and color of chickens during domestication. We conducted a survey in Thailand's Chiang Rai Province and Japan's Okinawa Prefecture to enable comparison of local investigation results between the two countries. The optimal solution models obtained demonstrate differences in preference related to the appearance of chickens between the target nations of Thailand and Japan.

*Keywords: form, kansei evaluation, preference investigation, conjoint analysis*

## 1. INTRODUCTION

Living creatures have not only evolved through natural selection. When we consider the various forms of life that come about through human cultural elements such as domestication, one important and current issue is deciding on an approach for ascertaining how their appearances are formed. Thailand is considered the birthplace of the jungle fowl, and chickens are venerated and preserved as a unique cultural property within the nation's ritual traditions. Under the formal auspices and direction of Her Royal Highness Princess Maha Chaki Sirindhorn of the Thai Royal Family, as well as the direction of His Imperial Highness Prince Akishinomiya Fumihito of Japan, the Human-Chicken Multi-Relationships Research Project (HCMR) was established as an international joint research project between Thailand and Japan to tackle these matters.

The main objective of this research is to examine how human beings evaluate the shape and color of chickens, and to ascertain how these factors relate to chicken appearance, through a multifaceted investigative approach. As we know, kansei (\*1) is a term that encompasses the meaning of words such as sensibility, sensitivity, sense, feeling, impression, aesthetics, emotion and affection. When humans make evaluations in the process in which a new variety of chicken is produced, both logical evaluation and kansei evaluation are required. It is important to investigate what kind of kansei evaluation humans use at that time. Moreover, the purpose of this research is to explore whether kansei works according to the type of cultural background involved.

## 2. RESEARCH METHOD

This research used conjoint analysis to achieve an investigation structure that determines subjects' preferences and identifies the effect value of each attribute level of chicken form factors according to their appearance, based on an investigation of Thai people's preferences.

As a result, we were able to combine each level of form element to compose a chicken prototype as an evaluated object, by means of preference research to create 25 kinds of ideal images of a new, virtual chicken.

### 2.1. Creation of a factor/level table for composition of a chicken prototype

All of the body forms of the chickens used in the investigation is divided into six factors, each with five typical pattern levels. The following were used as reference. Illustrated Encyclopedia of European Poultry (\*2) (1994). We analyzed chicken forms and identified six form factors: crest, neck and body, tail feathers, thighs, legs, and pattern/color. Each of these factors has five typical pattern levels (Figure 1).































Name of element	Item (Factor)	Level (Patterns of Each Factor)				
		1	2	3	4	5
crest wattles	A Crest	Single Crest	Feather Crest	Angle Crest	Walnut Crest	Three Sheets Crest
						
face earlobe eye beak breast back saddle wing bow	B Neck and Body	Triangle	Quadrangle	Oblong	Longwise	Trapezoid
						
sickles tail coverts main tail feather	C Tail feather	Hanging Down Long	Regular	Raising Up	Short	Standing On
						
thigh hock	D Thigh	Inclination	Vertical Long	Regular	Round	Short
						
shank spur toe leg	E Leg	Feather	Extensive Feather	Long	Middle	Short
						
hackle saddlefeathers secondaries primaries	F Pattern Color	Red	White	Black	Spot	Line
						

Figure 1: The six factors and five levels of chicken construction

## 2.2. Orthogonal arrangement (\*3)

By combining the 5 levels for each of the 6 factors, a total of 15,625 varieties of chicken appearances are generated. However, this amount of cards would be too many for preference evaluation. The method of creating a combination of models from the orthogonal arrangement table, and collecting and analyzing data about each model without creating all the cards is called the experimental planning method (\*4). In the rectangular arrangement table, numerical arrangements were settled so that factors and the contents of the level may appear equal. Then, according to the orthogonal array chart of experimental planning method, these factors can be allocated, resulting in 25 different varieties (Table 1).

The arrangement table is expressed by setting the level used for the card concerned in the five levels of each item of a prototype, to 1 and setting the level not used, to 0.

Table 1: Orthogonal arrangement table

Item level	A	B	C	D	E	F
	Crest	Neck and Body	Tail feather	Thigh	Leg	Pattern Color
1	Single Crest	Triangle	Hanging Down Long	Inclination	Feather	Red
2	Feather Crest	Quadrangle	Regular	Vertical Long	Extensive Feather	White
3	Angle Crest	Oblong	Raising Up	Regular	Long	Black
4	Walnut Crest	Longwise	Short	Round	Middle	Spot
5	Three Sheets Crest	Trapezoid	Standing On	Short	Short	Line
prototype						
1	1	3	2	4	3	2
2	5	3	5	1	5	4
3	1	1	1	1	1	1
4	2	5	5	5	3	1
5	1	4	5	3	4	5
6	4	3	3	3	2	1
7	5	4	3	5	1	2
8	4	1	2	5	5	5
9	2	3	4	2	1	5
10	3	5	2	3	1	4
11	3	3	1	5	4	3
12	1	5	3	2	5	3
13	4	5	4	1	4	2
14	5	5	1	4	2	5
15	5	2	2	2	4	1
16	4	2	5	4	1	3
17	2	2	1	3	5	2
18	5	1	4	3	3	3
19	3	4	4	4	5	1
20	1	2	4	5	2	4
21	4	4	1	2	3	4
22	3	2	3	1	3	5
23	3	1	5	2	2	2
24	2	1	3	4	4	4
25	2	4	2	1	2	3

### 2.3. Using prototype cards for preference investigation.

Based on the orthogonal arrangement table, we created 25 prototype cards of new chicken forms using 3D CG composition. (Figure 2)



Figure 2: Prototype cards

### 3. FIELD RESEARCH IN CHIANG RAI, THAILAND AND IN OKINAWA, JAPAN

The purpose of this local research was as follows:

- (1) To identify a preference investigation method that is optimally applicable in the local area;
- (2) To verify whether there are differences in preference for chickens' appearances among regions and ethnic groups;
- (3) To ascertain whether the methods of investigation and analysis are effective;
- (4) To verify whether the preferences in these areas are based on the cultural factors there.

#### 3.1. Field Research in Chiang Rai

Period: Dec. 2004 Place: Chiang Rai, Subjects: 11 people living in 3 villeges (Baan Natch, Baan Huay, Nam Khun, Baan Li-se)

#### 3.2. Subject profiles in Thailand

In order to pinpoint the relationships between subjects' preferences and cultural identities (such as ethnic groups and regions), we acquired a simple profile of 11 subjects. (Table 2)

**Table 2:** Subject profiles in Chiang Rai, Thailand (\*5, \*6)

Subjects	sex		age	Breeding Chicken															
				breeding		number of breeding	breeding period	Crest			Leg			Aim of Breeding					
	male	female		yes	no			red	black	other	yellow	black	other	meat	egg	appreciation/pets	cockfighting	ceremony	
Chang Rai	0.82	0.18	43	0.91	0.09	16	39	0.91	0.09	0.00	0.64	0.55	0.36	0.73	1.00	0.36	0.45	0.82	
index	ratio		years	ratio		birds	years	ratio			ratio			ratio					

The subjects in Chiang Rai, Thailand were from hill tribes, and since many did not understand the Thai language, questionnaires were collected from only 11 subjects. The research was carried out by translating English into Thai and then translating Thai into the ethnic language. Consequently, the procedure was extremely time consuming.

The number of breeding chicken was an average of 16 birds. 91% of respondents preferred a red crest, while only 9% said they preferred black. About the color of leg: Yellow was 64%, and black was 55%. The other colors, such as gray, were 36%. With regard to the purpose of breeding, 100% of the chickens were bred for their eggs; 82% for ceremonial use; 73% for their meat; 45% for cockfighting; and 36% for appreciation/pets. The peculiar cultural background to chicken breeding in this area is displayed by the fact that the number of birds bred for appreciation/pets is less than that of birds bred for their meat and eggs, and for ceremonial use, and that almost half of the subjects bred birds for cockfighting.

### 3.3. Research in Okinawa, Japan

Based on the investigation results and the problems identified in Thailand, we performed another survey in Japan.

Period: Jan. 2006 Place: Nakijin, Okinawa, Japan. Subjects: 50 people living in and around the village of Nakijin.

### 3.4. Subject profiles in Okinawa

In Japan, in order to compare the results of the preliminary survey in Thailand, we adopted the same prototype cards used there for the preference investigation.

And to pinpoint the relationships between subjects' preferences and cultural identities in Okinawa, Japan, we acquired a simple profile of each subject using the same questionnaire used in Chiang Rai.

**Table 3:** Subject profiles in Okinawa, Japan

Subjects	sex		age	Breeding Chicken															
				breeding		number of breeding	breeding period	Crest			Leg			Aim of Breeding					
	male	female		yes	no			red	black	other	yellow	black	other	meat	egg	appreciation/pets	cockfighting	celemony	
Okinawa	0.52	0.48	55	0.45	0.55	40	12	0.98	0.26	0.05	0.79	0.48	0.19	0.47	0.67	0.67	0.19	0.09	
index	ratio		years	ratio		birds	years	ratio			ratio			ratio					

Although the questionnaire was gathered by 50 subjects in Okinawa, the number of effective samples was 43. Only 45% of the respondents kept chickens. The average number of chickens bred by each respondent was 40 birds, which is more than in Chiang Rai. The person who answered about the color of crest: red was 98%, and black was 26%. About the color of leg: Yellow was 79%, and black was 48%. The other colors, such as gray, were 19%. As for the feature, yellow is much more in Okinawa than Chiang Rai, and, black is less. With regard to the purpose of breeding: 67% of the respondents bred for their eggs; 67% for appreciation/pets; 47% for their meat; 19% for cockfighting; and 9% for ceremonial use.

The peculiar cultural background of chicken breeding in Chiang Rai is shown by the percentage of birds bred for appreciation/pet purposes, cockfighting and ceremonial purposes. The peculiar cultural background of chicken breeding in Okinawa is shown by the fact that compared to Chiang Rai. The percentage of birds bred for appreciation/pet purposes is high. But the percentage of birds bred for ceremonial and cockfighting purposes is low.

## 4. PREFERENCE INVESTIGATION

### 4.1. Preference test in Chiang Rai and Okinawa

To facilitate the gathering of orderly data on preferences, the subjects were first requested to classify the cards into two groups: agreeable or disagreeable.



Figure 3: Division of two groups of cards



Figure 4: Sequencing

The cards from the "agreeable" group were then arranged in order of preference, and those from the "disagreeable" group were arranged in order of indifference. (Figure 3) The order of the favorite cards was arranged from number 1, while the most disagreeable cards were arranged in reverse order from number 25. Finally, we were able to derive an order of preference for all 25 cards. (Figure 4)

## 5. RESULTS OF THE PREFERENCE TEST USING PROTOTYPE CARDS

### 5.1. Average ranking of each prototype card in Chiang Rai

In the Chiang Rai area, the average ranking shows that the preference for each prototype card was different in each ethnic group. (Table 4)

### 5.2. 5.2 Important Degree of each item for chicken appearance

The average preference ranking by all subjects is changed into a ranking score, which is considered as the data for analysis. These ranking scores are set as objective variables. Each level of each item is made into an explanatory variable. The partial correlation coefficient is calculated by performing multiple regression analysis (\*7, \*8) to these two sets of variables. Furthermore, contribution rate is computed by weighted average of the partial correlation coefficient of each level. By reading the range of contribution rate, we could understand which part of the chickens shown in the proto-type card attracted the attention of the subjects. We call it important degree. (Table: 5)

**Table 4: Average ranking**

	ALL	AKHA	MUSER	LUER	TAI YAI
Average ranking	card NO.	card NO.	card NO.	card NO.	card NO.
1	7	7	7	3	14
2	12	3	16	1	7
3	3	12	1	5	11
4	21	1	15	22	21
5	1	15	17	6	17
6	16	21	12	15	3
7	15	16	4	11	22
8	11	2	22	12	2
9	2	5	11	7	12
10	22	11	2	21	25
11	17	8	9	16	13
12	5	22	18	2	23
13	4	17	21	14	6
14	6	4	5	17	5
15	23	10	13	24	16
16	13	13	25	18	4
17	8	23	23	23	9
18	18	6	6	8	8
19	14	18	24	10	18
20	25	19	3	19	24
21	9	20	19	25	15
22	19	9	10	4	19
23	24	14	14	9	1
24	10	24	8	13	20
25	20	25	20	20	10

**Table 5: Important Degree of each item in Chiang Rai and Okinawa**

importance of item in Chiang Rai					importance of item in Okinawa				
items	Max	Min	Range	Importance	items	Max	Min	Range	Importance
Crest	2.025	-2.502	4.527	17.0	Crest	1.487	-3.285	4.772	18.0
Neck & Body	1.407	-1.556	2.963	11.1	Neck & Body	1.059	-1.749	2.808	11.0
Tail feather	2.225	-4.393	6.618	24.8	Tail feather	2.319	-5.833	8.152	31.0
Thigh	1.316	-1.175	2.491	9.4	Thigh	1.822	-0.909	2.731	11.0
Leg	1.825	-3.720	5.545	20.8	Leg	1.383	-3.849	5.232	20.0
Pattern & Color	2.262	-2.229	4.491	16.9	Pattern & Color	0.811	-1.493	2.304	9.0
		Total	26.635	100.0			Total	25.999	100.0

According to the preference results of the investigation, the most important part for people in Chiang Rai (Table 4) was the tail feather (24.8 %), followed by the leg (20.8%) and the crest (19%). However, the thigh was deemed to be the least important (9.4%). From such a important degree, it can be presumed that the standard for chickens in Chiang Rai reflects their purpose for ceremonial use.

Important Degree of each item in Okinawa is as follows, the most important part for people in Okinawa (Table 4) was the tail feather (31.0 %), followed by the leg (20.0%) and the crest(18.0%). However, the pattern and color was deemed to be the least important (9.0%). From such a important degree, it can be presumed that the standard for chickens in Okinawa reflects their purpose for appreciation and pets.



## 6. CONJOINT ANALYSIS

Then, the use of conjoint analysis (\*9, \*10) enabled identification of the partial effect values for all subjects.(Table 6) According to the results of the analysis, the partial effect values for each level of chicken appearance in Chiang Rai and Okinawa are outlined below.

**Table 6:** Partial effect value of each level  
(Mark of "\*" shows most valued score in each level of the items of appearance)

Items of Appearance	level	Partial effect value	
		Chiang Rai	Okinawa
Crest	1. Single Crest	1.39	1.49*
	2. Feather Crest	-2.50	-3.28
	3. Angle Crest	-1.27	-0.48
	4. Walnut Crest	0.35	-0.26
	5. Three sheet Crest	2.03*	1.42
Neck & Body	1. Triange	-1.56	-0.91
	2. Quadrangle	0.68	0.23
	3. Oblong	0.88	1.06*
	4. Longwise	1.41*	-1.75
	5. Trapezoid	-1.41	0.76
Tail Feather	1. Hanging Down Long	2.23*	2.32*
	2. Regular	-0.74	0.95
	3. Raising up	2.03	1.67
	4. Short	-4.39	-5.83
	5. Standing on	0.88	0.50
Thigh	1. Inclination	0.57	1.82*
	2. Vertical long	1.32*	0.26
	3. Regular	-1.47	-0.72
	4. Round	-0.9	0.27
	5. Short	0.19	-0.91
Leg	1. Feather	1.83*	0.42
	2. Extensive Feather	-3.72	-3.85
	3. Long	1.21	0.98
	4. Middle	0.26	1.38*
	5. Short	0.43	0.60
Pattern & Color	1. Red & black	-0.08	0.67
	2. White & Black	2.26*	0.73
	3. Black	1.17	-1.49
	4. Spot	-2.23	0.81*
	5. Line	-1.12	-0.40

According to the optimal solution of all the subjects, a "three-sheet crest" was the most valued level in Chiang Rai, while a "single crest" was the most valued level in Okinawa. As for the neck and body, "long" was the most valued level in Chiang Rai, while "oblong" was the most valued level in Okinawa. For tail feathers, "hanging down long" was the most valued level in both Chiang Rai and Okinawa. As for thighs, "vertically long" was the most valued level in Chiang Rai, while the level of "inclination" was the most valued in Okinawa. With regard to legs, "feathered" was the most valued level in Chiang Rai, while "medium" was the most valued in Okinawa. As for pattern and color, "white and black" was the most valued in Chiang Rai. While, "spotted" was the most valued in Okinawa.

## 7. OPTIMAL SOLUTION MODEL (\*10, \*11)

The differences between the dimensional virtual kansei model in Thailand and Japan. By combining the maximum partial effect value of each level in each item, the kansei model that demonstrates the maximum ranking score can be predicted. Figure 5 is the model A that combined the pattern level of maximum partial effective value of subjects in Chiang Rai.

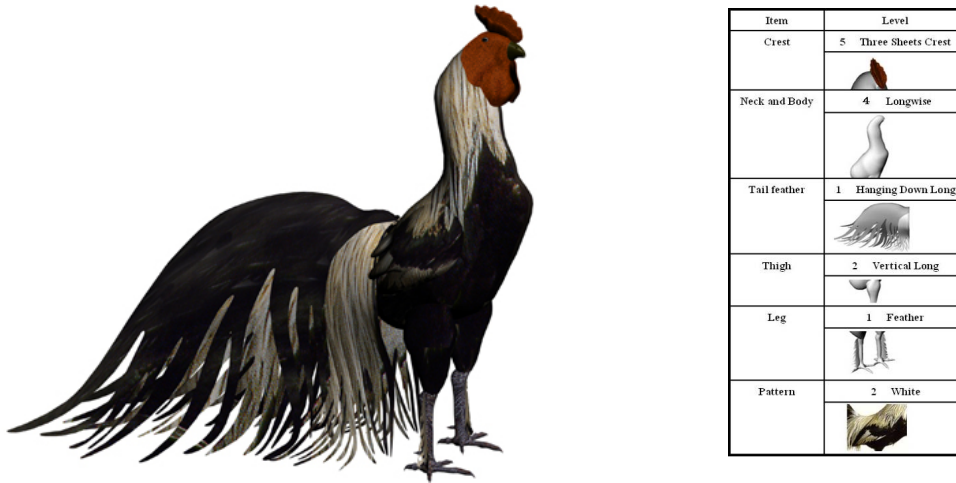


Figure 5: Optimal solution model in Chiang Rai (model A)

Figure 6 is the model B that combined the pattern level of maximum partial effect value of subjects in Okinawa.

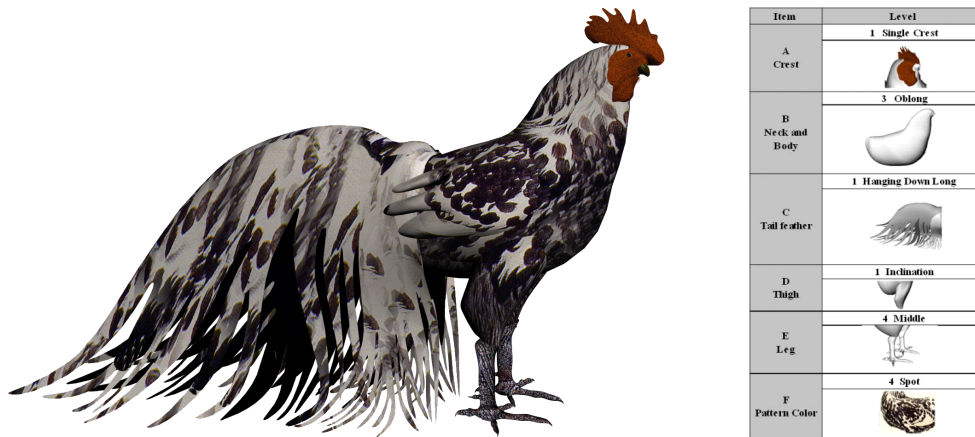


Figure 6: Optimal solution model in Okinawa (model B)

The difference in the kansei models of model A and model B shows how people of Chiang Rai and Okinawa have regarded prototype cards. These appearances are expression of the image calculated by the attachment dream of kansei evaluation. Relation of a chicken and a man is not unitary. Each race has various cultural styles, such as edible, cockfighting, economy, praise, and courtesy. Therefore, the difference among model A and model B can be predicted the different background culture.

Even with living creatures, new varieties are produced not only by natural hereditary law, but also by artificial design. According to these results, I want to believe that the diversity on environment is not spoiled.

## **8. RESULT OF THE SURVEY IN CHIANG RAI, THAILAND AND OKINAWA, JAPAN**

(1) The survey of chicken prototype preferences using chicken image cards based on the orthogonal table was found to be effective.

(2) Dividing the 25 image cards into two groups first, then using the method of sequence comparison was also found to be effective.

(3) The optimal solutions obtained demonstrated differences in the prototype preferences of each ethnic group.

(4) It was therefore confirmed that conjoint analysis was effective.

(5) Since there were only eleven subjects in Thailand, Figure 6 may not be the most effective result of calculations.

(6) The key is how to extract the different kansei values for subject groups in Thailand and Japan.

## **9. CONCLUSION**

This research yielded the following results:

(1) A chicken appearance with the form levels of single crest, oblong body, long hanging-down tail feathers, inclined thighs, average leg length and spotted pattern was evaluated as the optimal solution model by the subjects in Japan.

In evaluation of the degree of importance that influences the preference investigation for each item in the optimal solution for all subjects, tail feathers was the most valued element, while pattern was the least valued in this preference investigation.

(2) Comparison of the results for each level by partial effect value between the subjects in Thailand and Japan indicated that the details of preference were different, although there were some common features.

(3) It was clarified that subjects with a uniform recognition background of chickens also tended to have strong preferences and made concentrated kansei evaluation.

(4) Based on this knowledge, it can be said that cultural background may influence the external and internal features of chickens.

(5) We could understand that the elements based on cultural background (for example, sense of value, preference and knowledge) from which each differs, does influence the process of domestication.

(6) For the ethnic minority, when it had trouble in language, according to the expression by appearance on the prototype cards, it turned out that communication for the investigation is made smooth at each other.

## ACKNOWLEDGEMENTS

This research was supported by HCMR (the Human-Chicken Multi-Relationships Research Project) and financially assisted by the Scientific Research (No. 170015) of the Japanese Minister of Education, Science, Sport and Culture.

## REFERENCES

1. J. Zhang: The Role of Perception and Knowledge in  $\sigma$  Evaluation, University of Tsukuba, 2007
2. Akishinomiya Fumihito, R. Kakizawa, M. V. Roberts: Illustrated Encyclopaedia of European Poultry, Heibonsha, 1994.
3. Asano, H.: A Monte Carlo Simulation of Conjoint Analysis, An Empirical Study on the Recovery of Structure, NRC marketing Bulletin, 3. 87-97, 1982
4. G. Nakamura: Introduction of experimental design, Kindaikagakusha, 1997
5. Jim Goodman, The Akha: Guardians of The Forest, People and Cultures of Southeast Asia, Teak House Publication, 1997
6. David Bradley, Hill Tribes Phrasebook, (Lahu, Lisu, Karen & Other Hill Tribes), Lonely Planet Publications, 1999
7. E. A. Louis: An Introduction to Linear Regression and Correlation, W H Freeman, 1993
8. T. Kan: Multivariate analysis by Excel, Ohmsha, 2001
9. Akira Harada: Evaluation for Design concept and Suitable Design, AXIS, No.10, pp12-15
10. Jue Zhang, Masaru Takada, Akira Harada, Fumihito Akishinomiya and Yoshihiro Hayashi: Applying the *Kansei* Model to the Preference of Chicken Figures in Japan and Thailand, Journal of the Yamashina Inst. for Ornithology, 40:23-42, 2008.
11. Akira Harada, Zhang Jue and Pornthep LERTTEVASIRI: Human *Kansei* Preference and Chicken Form, Report for the Scientific Research (No. 170015) of the Japanese Minister of Education, Science, Sport and Culture. 2006-2008.