A Study on the Cultural Effects on User-Interface Design

With the Emphasis on the Cross-cultural Usability Testing through World Wide Web

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Abstract

The study sets the goal to find out what role culture plays in peoples' way of interacting with product and to evaluate the possibility of using World Wide Web as a tool for cultural study. World Wide Web (http://143.248.250.18) was developed for conducting cross-cultural usability testing and it is consisted of six sub-modules: demographic module, user-attitude module, cultural variable module, population-stereotype module, subjective preference module, and finally usability testing module for collecting interaction data. Total 172 respondents from 15 countries answered questions and performed tasks of operating computer-simulated microwave oven through worldwide web. All the answers and interaction results were saved in server and the interaction data was analyzed with data from other sub-modules for identifying relationships between interaction style and cultural characteristics. Comparison between Korea, Japan, and U.S subjects were made in interaction style and cultural characteristics. Some cultural differences were found in the depth of hierarchical structure in user-interface and stereotypes. The differences are accounted for different cultural characteristics in cultural variables such as temporal perception. However, other cultural dimensions were not found to bear any significant relationship with interaction style.

1. Introduction

The emergence of information society exerted big influences on the context of design. Among them, one of the most serious influences is "globalization" and, in turn, globalization has made "culture" as one of most important key factors for the success of product.

As culture becomes critical issues, designers have begun to realize the role of culture in design and to develop the method and process of applying cultural factors on design. However, major topics in cultural design are still limited only around identifying aesthetic stereotypes such as culturally preferred shapes or colors. Furthermore, major methods of cultural design were limited only in pencil and paper survey that requires significant time, effort, and cost.

The study sets the goal to find out what role culture plays in peoples' way of interacting with product through World Wide Web. More specific objectives are listed as follows:

- To identify a set of frameworks for cultural research in design
- To understand the relationship between cultural characteristics and peoples' interaction with product.
- To develop tool for usability testing with the use of WWW.
- To identify cross-cultural differences in interaction with product.

2. The Theoretical Rationale of the Study

In order to achieve the goal effectively, the structure of study is consisted of two major parts. One is to understand peoples' basic cultural characteristics and the other is to observe peoples' interaction with product. Upon having done two parts of study, a means to identify the relationship between culture and interaction can be available by cross-tabulating cultural characteristics with interaction data. The rationale of this approach comes from the theory of cultural structure.

Most anthropologists and other researchers related culture agree upon that culture has depth of layers. One is overt culture, which is visible and easily described, and the other is covert culture, which is not visible and presents difficulties even to the trained observer. Hall,[1] Vask and Grantham,[2] and Kluckhohn[3] are major researchers to propose diverse cultural models. Although researchers do not quite agree upon the number of layers and terminology describing each layers, they agree upon the theory that culture consists of portions that differ from each other in the degree of observability, tangibility, and abstraction.

This theoretical model of culture tells that complete understanding of culture requires one to look at not only surface levels of observable culture but also bottom levels of unconscious culture. This reciprocal aspect of culture requires "interpretive" approach in researching culture. The study follows this interpretive approach with cultural model. For understanding top layer of culture, peoples' way of interacting product(microwave oven) are observed and analyzed. Series of questions of cultural variables (bottom layer of culture) is used for understanding cultural characteristics and interpreting the background of specific pattern of observed interaction.

3. The Structure of Survey through World Wide Web

The web site is structured according to the theoretical rationale mentioned in prior section: a part for understanding cultural characteristics and the other part for collecting users' data of interaction with product. The Part of understanding cultural characteristics is consisted of three sub-sections: respondents' general demographic backgrounds, their attitude in using product, and questions of cultural variables. Part of understanding interaction characteristics is again comprised of three sub-sections of population stereotypes, subjective preferences and usability testing of product.

In the first module, respondents are asked to answer series of questions regarding their demographic backgrounds such as age, gender, education, occupation and nationality, and then, respondents are led to answer their attitudes in the use of microwave oven. In the module of cultural variables, 42 questions are asked for identifying respondents' cultural characteristics. Questions of 7 point Likert scale were generated from existing sets of questions developed by prominent researchers: Hall[4], Hofstede,[5] Trompenaars,[6] Kluckhohn,[7] and Schein.[8] Author also modified some questions and added some new questions.

In the module of population stereotypes, a series of 8 questions are asked in order to understand respondents' expectations on product operation. Population stereotypes refers to expectations people have that have been acquired from day-today experiences and training.[9] In the module of evaluating subjective preference, respondents are asked to evaluate their subjective preferences on different styles of microwave ovens. In order to generate diverse representative sets of microwave ovens, major features and levels of microwave ovens were identified: layout (grid or dynamic), label (graphic or verbal), structure of interface (wide and shallow or deep and narrow). Total 8 variations of computer-simulated microwave ovens were generated. Finally, in the Module of Usability Testing, respondents actually perform tasks given to them over computer-simulated microwave oven. Tasks given to respondents include ' cooking rice' , ' heating pizza' , and ' defrosting frozen meat' .

The website (http://143.248.250.18) was developed by FLASH for its several advantages: fast animation, relatively small size of data, and interactive animation. The web site allows users to access in three different languages of Korean, English, and Japanese. Microwave oven was selected as a product for usability testing for its wide range of users and user-interface elements.

4. Result and Discussion

4-1. Conduct of Survey

In order to collect data from world-wide as much as possible, messages asking for visiting website were posted in design related mailing list (IDFORUM), HCI related mailing lists, School BBS, and newsgroup of COMP.Human.Factors. Total 172 valid data were collected from 15 different countries during 10 days of collecting data. Out of 15 nations, only data of Korea, Japan, and USA was used for the study because the goal of study is conducting cross-cultural study between Korea, Japan, and USA.

Table 1: Responses from countries

nation	Australia	Brazil	Canada	Denmark	France	Germany	Italy	Japan	Korea	Philippine	Poland	Turkey	UK	USA	ETC
count	1	1	4	1	1	1	2	16	111	6	1	3	1	22	1

Due to the relatively short dates of website posting and limited range of users who are computer-literate, respondents are mostly students of university and age of 20-29. Particularly, this tendency was found out to be true in Korea (61% of students) and Japan (81.3% of students). About 70% of total respondents were male whereas genders were fairly evenly distributed in case of Japan (56% of male and 44% of female).

4-2. Attitudes in the Use of Microwave Oven

Approximately 3 quarters of respondents have more than 4 years of experience of using microwave oven, indicating that they are pretty much qualified as samples for this survey. Major usage of microwave oven were turned out to be ‘heating the food’ (76.5%). There were significant differences among countries on the question of “ Before using microwave oven, I read user manual first rather than just try”.(Table 2) Compared with Korean and Japanese respondents, American respondents were appeared to just try new product rather than to read manual first (USA: 68.2%, Korea: 46.8%, Japan: 37.5%). Korean, Japanese, and American respondents (85.9% of total respondents) were turned out to agree on that they use microwave oven for convenience rather than gourmet cooking. American respondents far outnumbered in the rate of using function of reserved cooking (USA 81.8%, Japan 12.5%, Korea 3.6%).

Table 2: Attitude in Use of Microwave Oven (%)

Use/Nations	Read manual first rather than just try	Just try first rather than read manual	Total
Korea	59 (53.2)	52(46.8)	111(100)
Japan	10 (62.6)	6(37.5)	16(100)
USA	7(31.8)	15(68.2)	22(100)

4-3. Cultural Characteristics

Questions of cultural variables are regrouped and analyzed.

4-3-1 Relationship with Nature Control

- Control vs. Subjugate: Is nature controllable or should it be accepted as given?

Q1: I believe that nothing is predetermined and our fates are controlled depending on our effort.

Q2: Uncertainty is normal feature of life, and each day should be accepts as it comes.

Q3: In our world, there are some things we cannot control, and we should accept them as they occur.

American respondents were turned out to be more ‘control’ compared with Korea and Japan whereas Korean and Japanese respondents tend not to ‘accept uncertainty’.

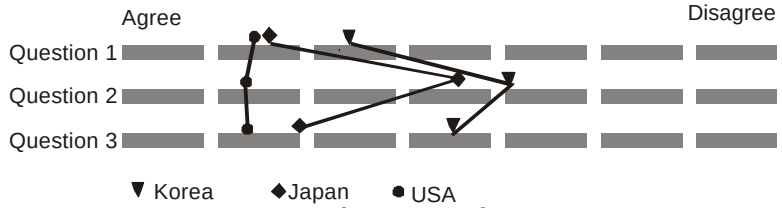


Figure 1: Comparative profile chart of relationship with nature control

4-3-2. Nature of Human Activity

- Doing vs. Being: Action-oriented or just being-orientation
- Achievement vs. Ascription: How are status accorded – individual achievement, or birth, educational record, kinship and so forth.

Q1: The respect a person gets is highly dependent on education and family background.

Q2: It is better to do nothing than to disappoint.

Q3: It is better to figure a problem out first than to waste time doing things the wrong way.

Q4: Graduation from a better school promises a better future.

Q5: When using a new product, I just try it rather than take the time to read the manual first.

Q6: Theory is derived from experience, so we should be ready to go out into the field and experiment.

Q7: Change is inherently good and we should search for something different in their future.

Compared with Japan and America, Korea was found to be relying more on personal background than individual performance. America is shown to be most action-oriented, and Korea is appeared to be most being-oriented culture with Japan in middle.

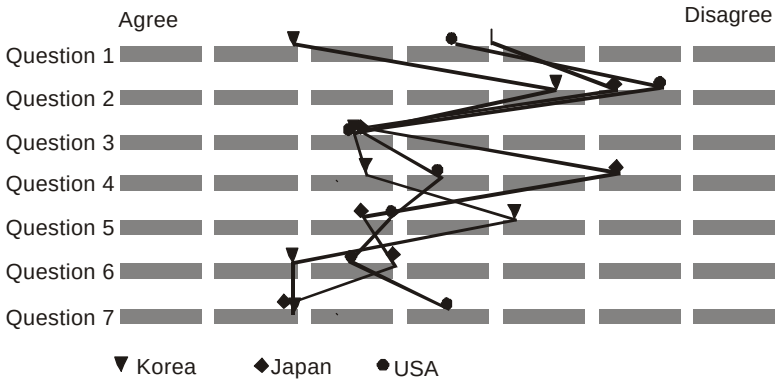


Figure 2: Comparative profile chart of nature of human activity

4-3-3. Nature of Reality and Truth

This dimension refers to how truth is determined: truth is relying on facts and figures or feeling and intuition.

Q1: I don' t feel comfortable with too strict precision and punctuality.

Q2: Conclusion should be drawn from theory and logical quantitative data.

Q3: Facts and figures are not necessarily more correct than instinct.

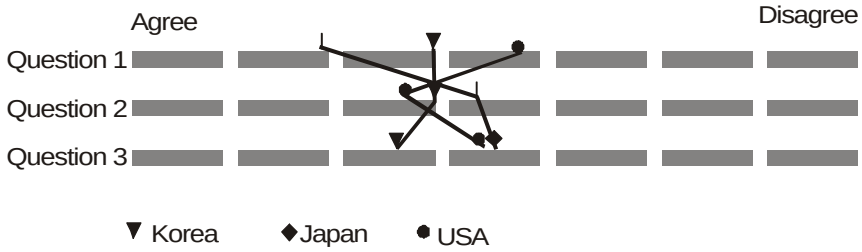


Figure 3: Comparative profile chart of nature of reality and truth

There were no significant differences in the dimension of nature of reality and truth but Korea was appeared to be ‘ feeling and intuition-oriented’ slightly more than Japan and USA.

4-3-4. Human nature

- Basically good vs. basically evil: Are people basically good or evil?

Q1: The most important thing in life is to think and act in the ways that are true to your beliefs, even if you don’ t get things done.

Q2: People are basically bad and need constant direction and supervision because they will try to get away with as much as possible.

Q3: People are basically good and self-directed, so they should be given the freedom to take the initiate and do what has to be done with minimum external control.

Korean respondents were appeared to think that people are basically bad and need constant direction whereas Japanese and American showed opposite disposition.

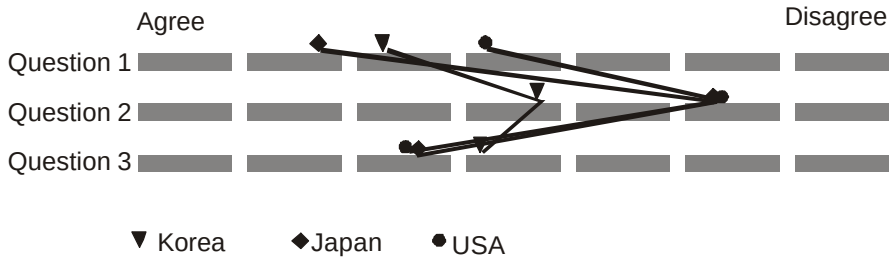


Figure 4: Comparative profile chart of perception of human nature

4-3-5. Nature of Human Relationship

- Social vs. Task orientation: Which one is more important, human relationship or task?
- Particularism vs. Universalism: Rule-based or relationship-based?
- Hierarchy: How are relationships between people structured?
- Individualism vs. Collectivism: Do people perceive themselves primarily as individuals or as members of group?

Q1: I would feel forced to retire if my subordinate were to be promoted to a position higher than mine.

Q2: I would tell a white lie to protect my close friend from being fined for a traffic violation.

Q3: Before calling for a lawyer, it is better for the people involved to try to resolve their problem.

Q4: I would rather focus on a task than a personal relationship.

Q5: Girls cry, boys don’ t: boys should fight back when attacked, girls should not.

Q6: I would rather not drive a car better than the one my boss has even if I could afford it.

Q7: Subordinates today expect to be consulted rather than to be told what to do.

Q8: Students are afraid to express disagreement with their teachers.

Q9: If one of my team members fails to get his or her job done right, I am also responsible.

Q10: When meeting time is over, I would stop even though all the business is not finished.

Q11: In our society's schools, students feel comfortable with open-ended learning situations and teachers may say "I don't know."

Q12: As much as possible, there should not be more rules than necessary.

Q13: A meeting should be extended beyond the scheduled end if agreement has not been reached.

America is turned out to be most flexible in hierarchical structure whereas Korea and Japan are more rigid hierarchically. In the dimension of particularism and universalism, there were no significant differences among countries. America is appeared to be more task-oriented than other two countries.

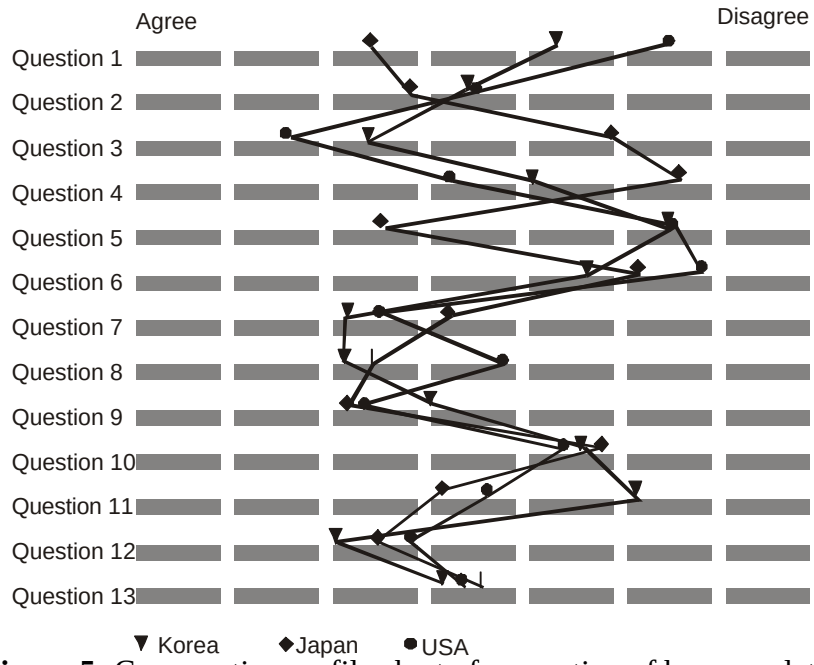


Figure 5: Comparative profile chart of perception of human relationship

4-3-6. Space

The Dimension of space refers to 'hidden dimension' which one perceives as intimate, personal, public, or social. These assumptions regarding personal space determine the nature and degree of involvement with others, what is expected from friendships and family and from colleagues.

Question 1: It is okay for guest to look around my bedroom.

Question 2: I do not like a passer-by to touch me

Question 3: I tend to allow people who knock to enter my home as long as they do not seem harmful.

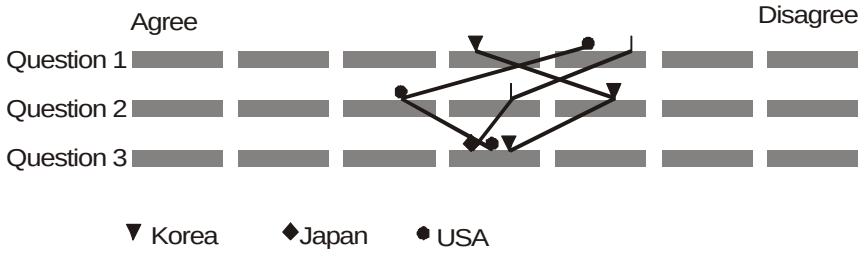


Figure 6: Comparative profile chart of perception of space

Korean respondents were shown not to keep personal space as strict as USA and Japan.

American respondents were found to keep more their personal privacy than Korea and Japan.

4-3-7. Language

- High and Low Context: High context or low context refers to the amount of information that is in a given communication as function of the context in which it occurs.
- Neutral or Emotional: This value-orientation pair measures the range of emotions that people express when dealing with others.

Question 1: Even though I say ‘ yes’ , sometimes I don’ t really mean ‘ yes’ .

Question 2: I believe that, as much as possible, all communications should be straightforward and explicit.

Question 3: People should not show their feelings: they should keep them carefully controlled and subdued.

American respondents were appeared to be far more straightforward in communication than Korea and Japan whereas Korean and Japanese respondents tended to keep some messages in context.

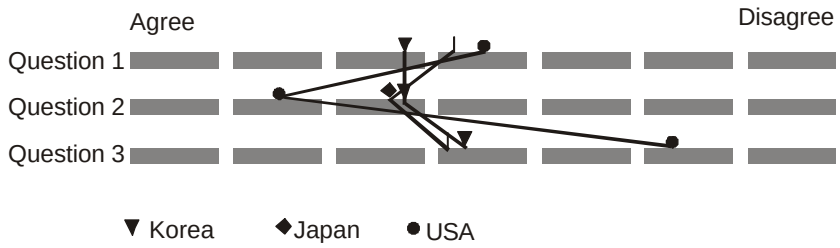


Figure 7: Comparative profile chart of perception of language

4-3-8 Time

- Monochronic and Polychronic: Do people do one thing at a time or many things at once?
- Past, Present and Future: What value do people put on past, present and future?

Question 1: I wait until a speaker finishes talking, even when I have something to say.

Question 2: I do one thing at a time rather than many things at once.

Question 3: I structure my activities sequentially and linearly.

Question 4: We should not worry about past events, but concentrate on what will happen in the future.

In the dimension of time, Japanese respondents showed rather different pattern than other Korean and American counterparts. Japanese people are shown to be more monochronic compared with Korean and American.

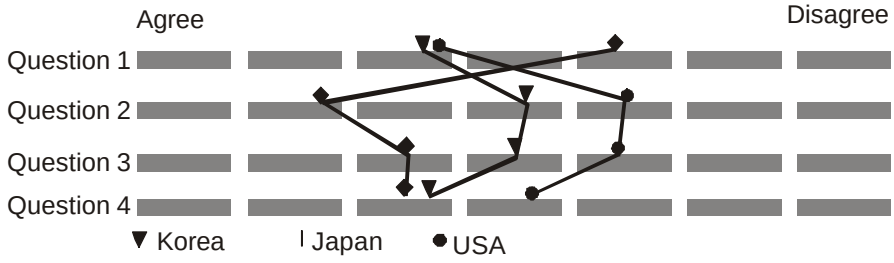
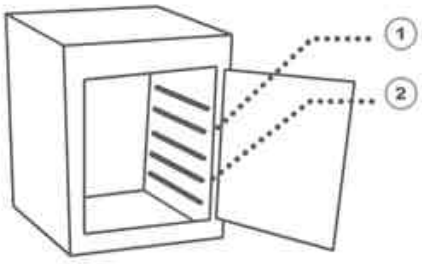


Figure 8: Comparative profile chart of perception of time

4-4. Population Stereotypes

- Which one is the second rack of oven?

For the perception of position of rack of gas oven, Japan showed difference by choosing predominantly choosing "from top".



	1: From top	2: From bottom
Korea	37.3 %	62.2%`
Japan	62.5%	31.3%
USA	36.4%	63.6%

Figure 9: Perception of position of rack in gas oven

- Which one is big number?

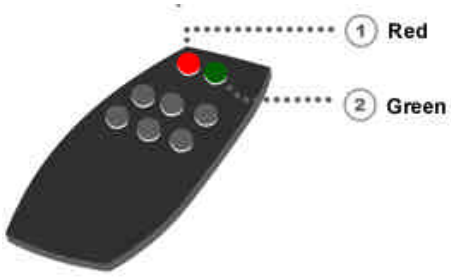
Again, Japan is different from Korea and USA by showing graphical perception.

	1: Big in graphic	2: Big in content
Korea	41.4 %	58.6%`
Japan	68.8%	25.0%
USA	45.5%	54.5%

Figure 10: Perception of graphic or number

- Which one is power ' ON' ?

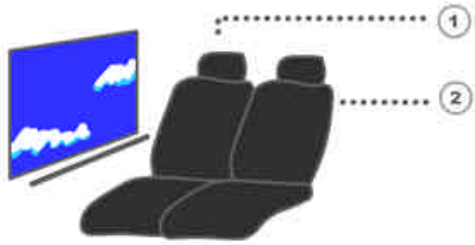
American respondents selected dominantly ' green' as on whereas Korean Japan chose ' red' .



	1: Red	2: Green
Korea	91.0 %	9.0%`
Japan	87.5%	6.3%
USA	13.6%	86.4%

Figure 11: Perception of color

- Which seat is ' A' seat?

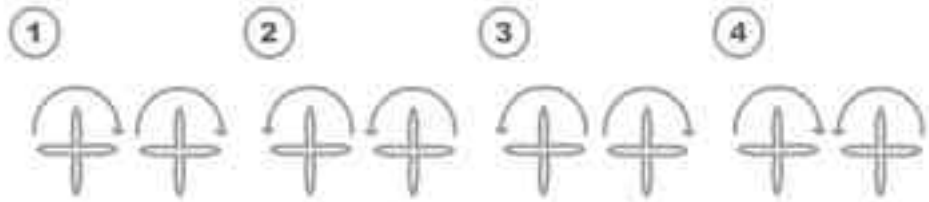


	1: By window	2: By aisle
Korea	70.3 %	29.7%`
Japan	87.5%	6.3%
USA	77.3%	22.7%

Figure 12: Perception of order of seat

There were no big differences between countries in selecting seat although Japanese respondents were turned out little bit more homogeneous than the other two countries.

- Here are two faucets on the bathroom sink, looking down at them. Which one is correct way to turn the water on?



	1: clockwise & clockwise	2: counter clockwise & counter-clockwise	3: counter clockwise & clockwise	4: clockwise & counter clockwise
Korea	18.0%	53.2%	26.1%	2.7%
Japan	87.5%	6.3%		
USA	13.6%	31.8%	45.5%	9.1%

Figure 13: Perception of the way of turning water on

Japanese showed high coherency in perceiving the way to turn the water on and also selected quite different one (clockwise & clockwise). On the other hand, Korean and American respondents did not show coherent answers.

- What color is it?

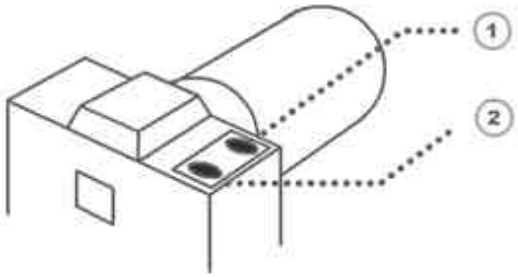
	1: Red	2: Yellow
Korea	73.0 %	27.0%`
Japan	75.0%	18.8%
USA	90.9%	9.1%

Figure 14: Perception of color and verbal

Three countries showed no big differences and perceived "color" over "verbal" whereas American respondents slightly more coherently chose color than the others.

- Which one is the correct control to zoom in (look closer)?

Korean, Japanese and American respondents did not show any differences in selecting ' zoom in' control.



	1: Outward	2: Inward
Korea	82.0 %	18.0%`
Japan	81.3%	12.5%
USA	86.4%	9.1%

Figure 15: Perception of position of ' Zoom in' control

4-5 Subjective Preference

Scores that respondents evaluated their subjective preferences on 8 different microwave ovens were used as input data for Conjoint analysis. The results of relative importance of features and utility of levels are shown as follows:

Table 3: Comparative result of relative importance on features and utility on levels

Relative importance/ Nations	Depth of Interface (Shallow or Deep)	Label (Verbal or Graphic)	Layout (Dynamic or Grid)
Korea	1.60	48.38	50.01
Japan	34.78	13.04	52.17
USA	8.77	15.79	75.44

Utility of level/ Nations	Depth of Interface		Label		Layout	
	Shallow	Deep	Verbal	Graphic	Dynamic	Grid
Korea	0.002	-0.002	-0.068	0.068	-0.07	0.07
Japan	-0.0125	0.0125	0.047	-0.047	-0.188	0.188
USA	0.030	-0.030	-0.054	0.054	-0.256	0.256

Three countries were shown to think the feature of ‘layout’ as most important in subjective preference. However, American respondents (75.44) were appeared to put far more importance on ‘layout‘ than Korean(50.01) and Japanese(52.17) respondents. ‘Depth of interface’ played more important role in Japanese(34.78) than Korean(1.60) and American(8.77). Feature of ‘label’ contributed more significantly to Korean preference(48.38), compared with Japanese(13.04) and American(15.79).

All of three countries are turned out to prefer more ‘grid’ style of layout than ‘dynamic’ curved layout. Japanese respondents showed different utilities. Japanese preferred ‘deep’ interface structure and ‘verbal’ label whereas Korean and American preferred ‘shallow’ and ‘graphic’.

4-6. Usability Testing

Time taken for conducting 3 tasks were averaged for different microwave ovens and compared between countries. This data of time was used as input data for Conjoint analysis in order to identify which element contributed most to the usability.

Table 4: Comparative results of relative contribution to usablity

Relative importance/ Nations	Depth of Interface (Shallow or Deep)	Label (Verbal or Graphic)	Layout (Dynamic or Grid)
Korea	47.59	21.31	31
Japan	13.81	26.68	59.52
USA	60.15	36.46	3.39

'Depth of interface' was turned out to be most contributing factor for usability of Korea (47.59) and USA(60.15) whereas most insignificant factor for Japanese(13.81). This extreme difference between countries has some positive relationship with their cultural characteristics in whether they do one thing at a time and many things at once (Monochronic or Polychronic). Japanese was most Monochronic, and American least with Korean in the middle (note the result found in 4-3-8). For Japanese 'layout' was appeared to be most influencing factor(59.52) but least important influencing factor for American(3.39).

5. Conclusion & Further Prospects

The study found that there exist significant differences between Korea, Japan, and America both in cultural characteristics and interaction styles. This study also showed the possibility of using cultural variables as useful tool to understand the cultural behavior. Subjective preference was shown not to have positive relationship with usability (i.e. emotionally preferred object is not necessarily usable one).

However this study found some limits in some respects that need further researches. Respondents also made many comments pointing out these limits. First, computer-simulated microwave oven is too big to be displayed in computer monitor. Labels were not almost readable. Big product was found not to be appropriate for usability testing through WWW. Second, the range of respondents of seriously limited to computer literate people who are not necessarily target users. The way of recruiting real users should be developed. Third, the survey was found to be so long that some respondents gave up in the middle. Time taken to load many graphic images in survey also contributed to this difficulty.

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