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Qualitative Cross-Cultural Study on the Expression and Perception of Digital Images: Focusing on Cultural Schema

Gi Woong Choi
Yonsei University, Seoul, Republic of Korea

Solyung Kim
Samsung Electronics, Seoul, Republic of Korea

Jihyun Kim
NCsoft, Seoul, Republic of Korea

Inseong Lee*
Kyungil University, Gyeongsan, Republic of Korea

Jinwoo Kim
Yonsei University, Seoul, Republic of Korea

ABSTRACT

In this paper, we conducted cross-cultural studies on digital images, which is an important element of the user interface. We brought in the schema theory to explain the cross-cultural difference in expressing and perceiving digital images. Participant-ethnography, in-depth interview, and card sorting were conducted to explore how expression and perception of images are influenced by schemas. Our results of qualitative studies indicate that there are differences in schemas between cultures depending on the topic of expression and perception. With these results, we suggest globalization and localization strategies for websites.

Keywords: *Cultural Schema, Localization, Digital Photographic Image, User Interface, Qualitative Study*

1. INTRODUCTION

We live in a time of rapid globalization. Around the world, information technology (IT) firms seek to reach from domestic to global markets; and to do so, they must design and provide IT services viable across a broad range of cultures. However, while markets are global, cultures are not, and services tailored to the tastes and preferences of one country or region may not meet the needs of users somewhere else. Only a few studies have dealt with cross-cultural issues in online services [1-5].

No research has dealt more than in passing with the cross-cultural issues that surround digital photo images, and prior studies point to the need for such research. Photo images are a culture's visual language and do not automatically mean the same to a user in a different culture [1]. It is therefore important to distinguish whether and how a photographic image is cognizable across cultures [1],[6]. As noted, practice in this area has run ahead of research. Many global websites already localize photo images in their websites. For instance, among the many differences between the McDonald's Japan and UK websites, perhaps the most striking is between the photo images presented Fig. 1.

Fig. 1. Websites of McDonald's Japan and McDonald's UK

*Corresponding author, E-mail: inseong.lee@gmail.com
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The Japanese one focuses on the image of a family, and the UK one focuses on the image of a cheeseburger. There are other differences as well, but the difference between the photo images may be the most crucial, as the photos make the first and perhaps strongest impressions on the user. Another case of this would be Google. Google is famous for presenting different logos for different countries on special occasions to differentiate their user interface for each culture.

Rather than taking a whole user interface as its object, this study focuses on a single interface element, the photo image, believing that close investigation of its meaning across cultures may lead to more effective localization. We have used schema theory to investigate both the creation and the interpretation of digital photo images. Schema theory, applied to cultural groups, may offer a plausible theoretical account of the cultural differences that surround digital photo images.

Our research question is thus twofold: how and why do people from different cultures express the same theme with different photos and when and how do the lenses through which they interpret a given photo differ? Addressing these questions jointly required that we observe the whole process by which digital photos are created, categorized, and interpreted. We therefore used a sequence of qualitative research methods that would fit together easily. To observe the process of image-generation, we had participants capture the images they were later to interpret; we limited the photos to a single theme, asking participants to take photos they thought represented the culture of the city they were visiting. We then interviewed them to discern which topics they meant to capture and how those topics expressed the theme of the city's culture. Finally, we led participants through a card-sorting task in which they categorized and interpreted the photos produced earlier.

This study sought to determine how and why people from different cultures, given a common theme, create and interpret digital photos differently. To this end, we have formulated a new theoretical framework on the basis of cultural schema theory, implemented an integrated qualitative methodology, and arrived at several guidelines for the use of digital photo images in the user interfaces of IT systems.

2. THEORETICAL BACKGROUND

2.1 Photo Images and Culture

As a construct, culture has multiple dimensions, including daily livelihood, language, customs, religion, and academics [7,8], that come together as a single gestalt. Culture can nonetheless be operationalized, according to [9], in terms of language, value system, and artifacts. The digital photograph is one of the artifacts of the digital age. It bears cultural meaning, just as a physical artifact does, and perhaps just as much as a physical artifact does. As a cultural artifact, then, the digital photo is not some objective visual record of reality. Rather, in both its creation and its reception, it is an *interpretation* of reality, which makes cross-cultural study of digital photographs a highly meaningful enterprise.

2.2 Schemas

It is probable that there exist cross-cultural differences in the creation and interpretation of photo images. Nonetheless, much remains to be learned about the nature and sources of differences. We hypothesize that they are produced by schematic differences across cultures. Schema is a cognitive frame or perspective on the world, a frame of thoughts a person builds to overcome a problem or complete a task [10]-[12]. According to [11], a schema is formed through past experience, and helps a person solve a problem that resembles the problem encountered before. Schema is a dynamic cognitive structure that helps an individual efficiently analyze and express information related to a certain concept, entity, or event [10]. Schema may be understood as a sort of stereotype and can be referred to as a subjective frame of concept [12].

[13] provides functions of schema which can be applied to the creation and reception of digital photo images. Digital images are captured and interpreted in a structure that is formed by experience, directs the encoding and retrieval of information related to the image, and affects how information about the image is processed. That structure guides the filling of gaps in information triggered by the photo image, directs the evaluation of the image, and affects anticipation of photo images that might appear in the future.

[14] adapted the schema concept to social groups, proposing that schemas reveal the effects of organizational culture on sense-making. If people within the same cultural group repeatedly interact with each other in a certain situation or share certain information, group schemas are formed [14]. As interactions and information-sharing increase, schemas become more generalized—more abstract, organized, and compact—making communication within the cultural group more effective [11]. Group schemas reflect group culture, and may also be described as cultural schemas.

Because cultural schemas contain subject- and content-specific knowledge, no schema is relevant in all situations [15]. People evaluate stimuli based on similarity to already established cognitive categories and use different schemas in response to different types of stimulus [16]-[18]. The schemas used in interpretation, therefore, vary with the characteristics of the activating stimuli [15]. Many digital photo images, of course, present a range of stimuli, and which schemas are activated depends both on the elements in the image and on the characteristics of the viewer. Take, for instance, a photo of a Christmas party. Its elements include people celebrating, food, and various other objects. Some looking at the photo would focus on human figures, some on the food, and some perhaps on other objects. Since the photo image presents different types of stimulus, the schemas activated during interpretation of the images are likely to vary.

Based on the cultural schemas provided by past studies [11],[14],[19], we have identified six schemas relevant to the creation and interpretation of digital photo images: person, fact and concept, self, role, event/action, and emotion schemas. These cultural schemas have been suggested by many researchers in numerous studies [11],[14],[19].

The person schema contains knowledge about different types of people, including their personality traits [13],[20]-[22]. Photo images that focus on a person or on depicting his or her characteristics elicit the person schema.

The fact-and-concept schema involves general information

about facts and concepts [11],[23]-[26]. A photo image whose main purpose is the transfer of information (for instance, some journalistic photos) will elicit the fact-and-concept schema.

The self-schema contains people's knowledge about themselves [10],[11]. Photos images that trigger self-reflection, such as a photographer's self-portrait, elicit the self-schema.

The role schema contains knowledge about social roles—behaviors expected of people in particular social positions or capacities [11],[13],[20],[27]. Images that focus on social relationships (for instance, photos of couples or family) elicit the role schema.

The event/action schema includes knowledge about social contexts, situations, encounters, and events [14]. It pertains to expected event sequences and appropriate behavior in specific situations [14],[28]-[31]. Photo images that elicit this schema focus on the action or event itself—for instance, on a wedding *as* a wedding, rather than specific persons, relationships, or objects present at the wedding.

Finally, the emotion schema deals with affect [11],[14],[19]. Photo images that invoke this schema focus on eliciting emotion in the viewer. For example, an image of a peaceful morning in a forest may create calm or happy feelings, while an image of barking Doberman may elicit tension and anxiety.

3. RESEARCH FRAMEWORK AND METHOD

We propose the research framework in Fig. 2. Since schema is a frame of mind that helps an individual efficiently analyze and express information related to a certain concept, entity, or event [10], schemas will be in play during both the capture and the interpretation of digital photo images. We propose that, among the schemas described, different ones will be activated in persons of different cultures, during both the capture and the interpretation of digital photo images.

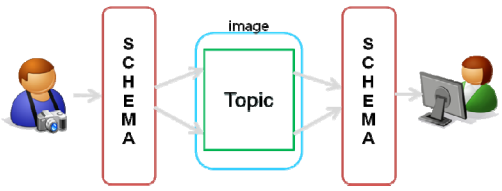

Fig. 2. Research Framework

In this study we adopted several qualitative research methods. First, we used participant-driven visual ethnography to explore how people from different cultures express a given theme in digital photo images differently. Having participants express themes from their own perspective allowed us to observe the entire process of photo taking. Second, we conducted in-depth interviews to determine which schema was activated during the expression phase. Finally, to identify differences in interpretation of digital photo images, we had participants sort the photos into categories, which they also named. Detailed accounts of each step follow.

3.1 Participants

The study participants were visitors, mostly from foreign countries, to a metropolitan city. Most were either tourists or short-term exchange students. All participants had come to the country as adults. The entire research process was conducted in English, in which most participants were fluent. 21 individuals from 12 different countries took part in the participant-driven ethnography, in-depth interview, and card-sorting task. The research lasted for approximately a month, and participants were compensated for their time with 100 dollars each. In order to expedite the comparison among major cultural groups, we divided the participants into several groups and observed the process group by group. To measure the participants' cultural characteristics we adopted [32]'s four cultural dimensions. K-means cluster analysis of the survey results yielded five distinct cultural groups, among which the 21 participants were distributed. Group A consisted of five participants from US, Sweden, and Canada. Group B consisted of four participants from Mexico, Brazil, and Latvia. Group C consisted of four participants from China and Hong Kong. Group D consisted of five participants from Singapore, Thailand, and Taiwan. Lastly, Group E consisted of three participants from Korea. When [33] divided countries according to cultural values, he arrived at similar groupings.

3.2 First Phase: Participant-Driven Visual Ethnography

In the participant-driven visual ethnography, subjects were assigned a common theme, "the culture of a metropolitan city." We expected a theme this broad to allow a wide range of interpretations, and to reveal clear differences among participants from different cultural backgrounds. We gave participants about a week to take photos and the following directions: "Suppose you are to explain the culture of this city through digital photos displayed on the website. Please capture the moments which you think that represent the culture of the city most." After taking photos, they were to upload them to the study website, so that the researchers could monitor their activities. We had subjects take part in the entire process of generating and transmitting photo images so as to explore their overall behavior. Participants were asked to take at least 10 photos over the week. They took 21 photos on average.

3.3 Second Phase: In-Depth Interviews

Following the first phase, subjects were interviewed individually. The interview was semi-structured and touched on several topics regarding the photos they took during the ethnography session. . Typical questions included, *Why did you take this photo? What did you focus on? What aspect of culture did you try to capture? Why do you think this picture represents the culture of the city more than others?* We wanted to learn what was on participants' minds when they took each photo and what motivated them to photograph a particular object, situation, or scene in the particular way they had. In following the trail of thoughts in the photo image-generation process, we sought to know which schemas were active during that process.

After the interview, participants were asked to pick five to seven of their own photos they thought represented the culture of the city well. The selected photos (107 in all) were gathered into the database for the third phase. When the interviews had been completed, the interview data was transcribed and classified to determine which schemas were active during the photo-taking process. Coding was conducted according to the

schemas defined in Section 2.2, except that we decided to omit the fact-and-concept schema. Since the participant's task was expressing his or her *concept* of the city's culture, the schema effectively applied to all photos and could reveal no meaningful differences. Two researchers initially coded separately and then compared results and discussed differences until agreement was reached. [34]'s kappa index, used to measure inter-coder reliability, yielded a value of 0.82, above the recommended threshold value.

3.4 Third Phase: Card Sorting

The study's first two phases explored which schemas were activated as the digital photos were taken. The third phase investigated when and how people with different cultural schemas interpreted the photo images differently. Card sorting task using photos collected in the previous phase had participants categorize photos and name each category; because schemas are dynamic, interactive, and cognitive structures that help one efficiently analyze and express information related to a certain concept, entity, or event, we expected cultural schemas to be activated during the categorization process [22,35-38]. Also, the card sorting process allows, through the use of non-linguistic stimuli, comparison of participants with no common language [39], making it especially suitable for cross-cultural research. Therefore, we thought, by going through the card sorting process, that we could observe how participants perceive during the process and extract which schemas they use.

We asked participants to categorize 107 digital photo images gathered during the ethnography session. We did not limit the depth of categories. Subsequently, to explore the schemas activated during the interpretation stage, we coded the card-sorting data along the lines used in the in-depth interview. Since participants categorized their photos freely, naming categories as they saw fit, data simplification was required. We used the factor analysis suggested by [40], which converts categories and subcategories into binary data, then used the Jaccard Scoring Method, a common technique for calculating item similarities, to group the photos into categories [41]. This method can calculate similarities among both duplicated items and nested categories. Each photo was scored by using Jaccard Scoring Method, and the scores were grouped through the factor analysis. Through the factor analysis, the photos with similar scores were grouped as a category. The factor analysis grouped the photos into nine topics: food, social relationships, consumerism, history and tradition, drinking and lifestyle, traffic, social issues, happenings, and scenery. Photos that fell into none of these nine groups were omitted. Thus 75 of the 107 photos were used in the analysis.

3.5 Capture and Interpretation of Digital Photo Images Compared in Terms of Schema

We then rearranged, for the purpose of comparison, the schema-related data for both the capture and interpretation of photo images. Schema data for the image capture stage (*expression* of the theme) was taken from the second phase, data for the *interpretation* stage from the third phase. For each topic we made a two-part diagram to show the schema usage by each cultural group. The diagram shows which schemas were activated for that topic and for each group during the capture and the interpretation of digital photos. We then determined the schema matching rate: the degree to which schema activation during expression matched that during interpretation. For example, for a given photo, if the person schema was the only activated schema during the expression stage, and if the same held true in the interpretation stage, the matching rate was 100%, meaning there was no difference in which schemas were active or inactive for that photo. If, however, during the expression stage only the person schema was activated, but during the interpretation stage the event schema was also activated, there was one non-matching item out of five schemas which are person, role, self, event and action, and emotion schema, yielding a matching rate of 80%. We calculated the matching rate for each photo and compiled the results in nine topic diagrams.

4. RESULTS AND DISCUSSION

Below are sample photos and diagrams for each topic. Each diagram is made of three parts. Two parts show which schemas were activated for each cultural group when they captured and interpreted digital photo images. More frequent activation is rendered with thicker arrows. In Fig. 3 below, for example, the paths from Group A (USA, Canada, Sweden) to S4 (event/action) and from Group B (Brazil, Mexico, Latvia) to S4 show medium activation on the capture side. All other paths on the capture-side show weak schema activation. The absence of a path indicates no schema activation at all. On the interpretation side, groups A, B, C (China, Hong Kong), and D (Thailand, Singapore) have thick arrows to either or both of S1 (Person) and S4. These groups used these schemas frequently during the interpretation stage. Groups or schemas that show high activity are colored black; gray indicates moderate activity; white indicates no activity at all.

The third part of the diagram shows the matching rate for each group—the degree of schematic congruity between those who captured the digital photo images and those who interpreted them. We determined the matching frequencies for each group and converted them to percentage scores. The average overall matching rate was 70%. A matching rate greater than the average we considered high; rates equal to or below the average we considered low. Figure 3 shows that most groups show low matching rate for the topic of food: during interpretation most groups used schemas different from those used by the photographers. A detailed analysis of the topic diagrams follows.

4.1 Topic One: Food

Fig. 3 and Fig. 4 show the diagram for the topic of food and the nine photos that belong to it. Groups A and B connected the topic of food to the city's culture most strongly. In the expression stage, the event/action schema was activated the most often, and the self and emotion schemas frequently as well. The strongest correlation, however, was between food and events or actions. The interviews reveal that many participants associated food with social events or traditional holidays; the idea of food was bound up for them with the idea of eating. A

participant in group B, for instance, associated food with a special cultural event, activating the event/action schema:

This is local eating culture. This is my friend's house. It's New Year's Day. It shows local eating culture very well … and that there are really big variety of different dishes and small plates with many people … I think all together. You can say two parts. The food's variety, and also eating culture as well.

In the interpretation stage, participants used only the person and the event/action schemas. One member of group A put the photo described in the interview script above in a category called "Food and Eating Habits." Habits are personality traits, implying activation of the person schema, and eating is an activity, implying activation of the event/action schema. The greater use of the person schema (compared to use in the expression phase) is likely due to the lessened role of the self in the interpretation phase: the person viewing the photo is an observer, not a creator. Group E (Korea) showed the highest matching rate for expression and interpretation.

Fig. 3. Photos on Topic 1

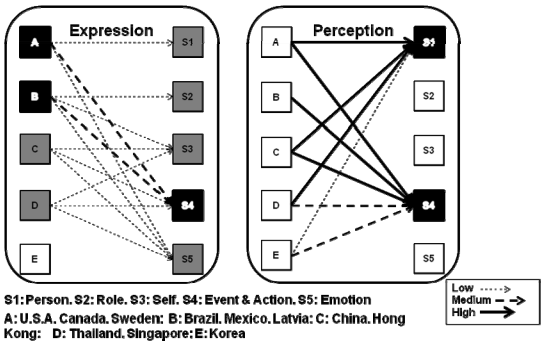

Fig. 4. Diagram for Topic 1

4.2 Topic Two: Social Relationships

Fig. 5 and Fig. 6 show the diagram for the topic of social relationships and the eight photos that belong to it. Participants in group A expressed the topic mostly with the event/action schema, but interpreted the topic with the person and role schemas. One member of group A explained how he expressed the topic of social relationships by capturing an action:

Well, yeah or you can see like middle school boys even high school boys that will go around with their hands around their friends' shoulders, we can't do that. It's sad that we can't do that… I mean it will be weird to do that in our country, but it's not weird in this country.

Interestingly, the same participant put other photos for this topic in a category he called "Sociability/Family/Couples." Also interesting is the inactivity of the event/action schema with this topic. Along similar lines, participants in group B used the person and event/action schemas when expressing the topic, the person and role schemas when interpreting it. The matching rates suggest that people from Eastern cultures (groups C, D, and E, all with high rates) are more likely than those from Western cultures (groups A, B, both with low matching rates) to consider social relationships a part of culture.

Fig. 5. Photos on Topic 2

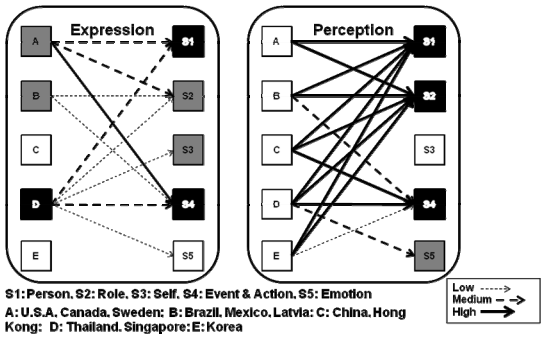

Fig. 6. Diagram for Topic 2

4.3 Topic Three: Consumerism

Fig. 7 and Fig. 8 show the diagram for the topic of consumerism and the thirteen photos that belong to the topic. As with most of the other topics, the person and event/action schemas were the most activated, in both the expression and the interpretation stages. A member of group B associated the photo of a market at night with busy nighttime activity, implying activation of the event/action schema:

Then they don't have enough time to look for, they are transferring from on subway to another and they see something they just buy and don't have to spend much time.

Participants in group E, who did not refer to this topic at the expression stage, interpreted it using the person and event/action schemas. The matching rate of groups was generally high (Above average).

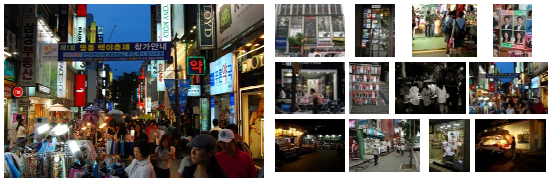

Fig. 7. Photos on Topic3

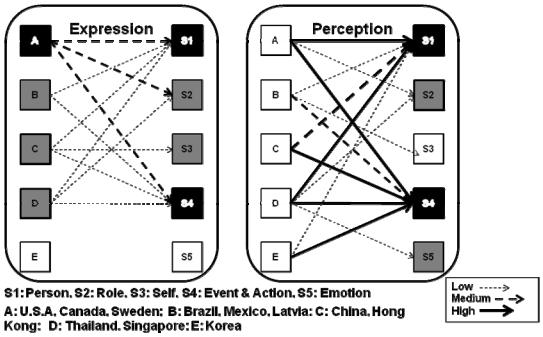

Fig. 8. Diagram for Topic 3

Participants in group E, who did not refer to this topic at the expression stage, interpreted it using the person and event/action schemas. The matching rate of groups was generally high (Above average).

4.4 Topic Four: History and Tradition

Fig. 9 and Fig. 10 show the diagram and the six photos for this topic. Only groups B and C connected this topic to the culture of the city. At the expression phase, the emotion schema was used most frequently; the role and event/action schemas were inactive. A member of group C described the emotion she felt when taking a photo of this topic:

I thought the Independence Gate was lonely. I felt bad since no one was paying attention to it.

During the interpretation process, however, she put photos for this topic in a category called "Tourist Spot/Symbolic Architecture," a grouping that makes no reference to emotions.

Fig. 9. Photos on Topic 4

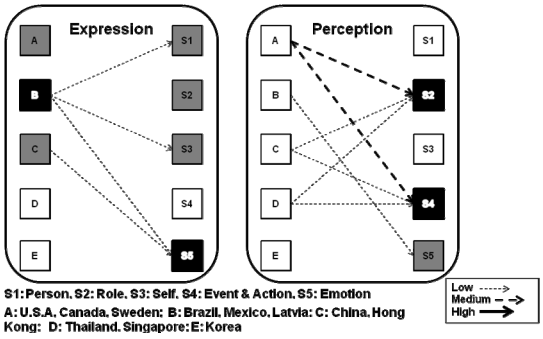

Fig. 10. Diagram for Topic 4

4.5 Topic Five: Drinking and its Lifestyle

Fig. 11 and Fig. 12 show the diagram and the ten photos for the topic. The photos all portray alcoholic drinks or drinking activities. At the expression stage, Group D expressed this topic the most, group E not at all, and the person and event/action schemas were most activated. Said one member of group D:

My local friend has to drink with his colleagues after work, he can't refuse them. When you are in university you drink everyday in freshman. Then for fun once a week when you're a senior, when you work you have to drink with the boss, that's a boss.

These comments suggest that participants who thought about drinking focused either on the activity itself or on the people doing the activity. Many participants thought drinking and its lifestyle were an important aspect of the city's culture. The interpretation stage showed similar schematic patterns; most participants used the event/action or person schemas to interpret these photos. Group C had the highest matching rate.

Fig. 11. Photos on Topic 5

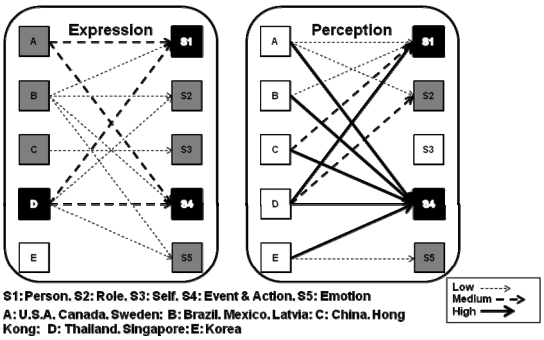

Fig. 12. Diagram for Topic 5

4.6 Topic Six: Traffic

Fig. 13 and Fig. 14 show the diagram and the six photos that belong to the topic of traffic. Participants saw traffic as a distinguishing feature of the city and its culture. At the expression stage the self and emotion schemas were used relatively frequently. At the interpretation stage, however, the person and event/action schemas saw the most use. The matching rate was quite low, especially for group C, and with the exception of group E.

Fig. 13. Photos on Topic 6

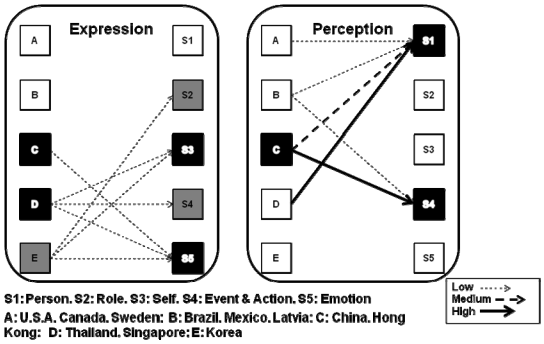

Fig. 14. Diagram for Topic 6

4.7 Topic Seven: Social Issues

Five photos belonged to this topic. Fig. 15 and Fig. 16 show the diagram and the photos. This category contained photos showing negative aspects of the culture.

Fig. 15. Photos on Topic 7

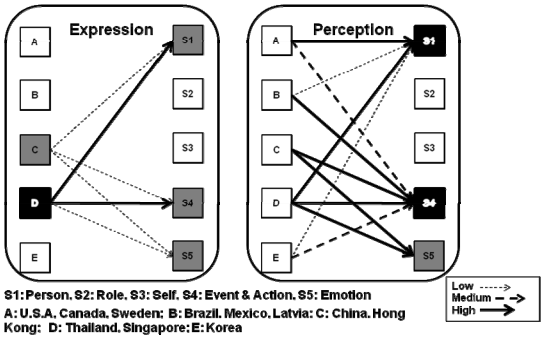

Fig. 16. Diagram for Topic 7

Group D was the most active in expressing this topic; group C was the only other one to express it. Both groups related the topic to courtesy toward others. All five groups referred to this topic at the interpretation stage; once more, the person and event/action schemas were the most frequently activated. Participants named their categories as "The City/The Filthy Side," "Daily Life/Lifestyle," and "Rubbish/Trash/Dirt." Matching rates were high, except for group C.

4.8 Topic Eight: Happenings

Fig. 17 and Fig. 18 show the diagram and the ten photos for this topic. Participants in groups B and E expressed this topic most. At the expression stage, the person and event/action schemas were most activated, while at the interpretation stage, participants also used the role and emotion schemas. The low matching rate suggests that people from different cultures have different perspectives on this topic.

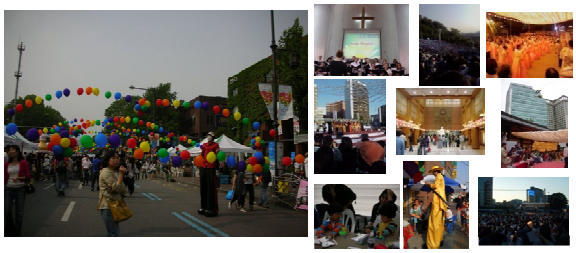

Fig. 17. Photos on Topic 8

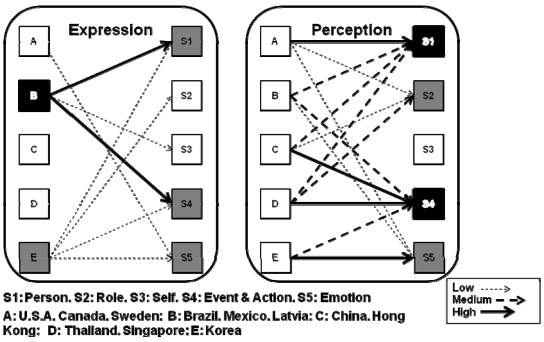

Fig. 18. Diagram for Topic 8

4.9 Topic Nine: Scenery

Fig. 19 and Fig. 20 show the diagram and the eight photos that belong to the topic, which relates to the overall view of the city. The topic was expressed mostly by group E, who, being local, knew the city's culture fairly well. All the schemas except the role schema were used at this stage. At the interpretation stage, the event/action schema was the most activated. Except for the group D, the matching rate was rather low, perhaps because "scenery" is a vague category, open to a wide range of interpretations.

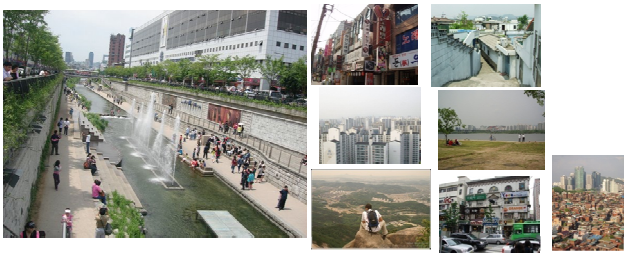

Fig. 19. Photos on Topic 9

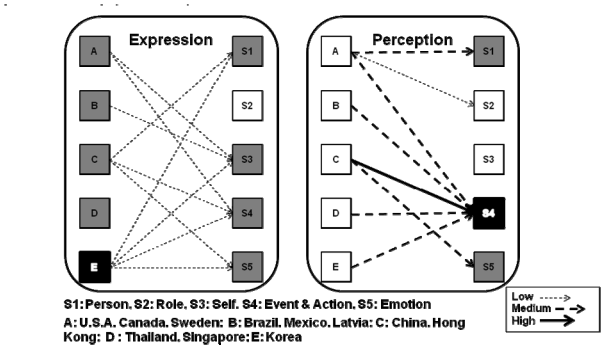

Fig. 20. Diagram for Topic 9

5. GENERAL DISCUSSION

Our research question—how and why people from different cultures capture and interpret digital photo images differently—can be addressed from the perspective of topic or from the perspective of culture. Taking the former perspective, we note that the overall average matching rate, which indicates whether participants interpreting photo images used the same schemas as those who created the image, was 70 percent. A low matching rate indicates that a topic is localized and a high rate that it is globalized. Five topics were localized and four globalized. Globalized topics were food, traffic, happenings, social relationships, and scenery. Localized topics were consumerism, history and tradition, drinking and lifestyle, and social issues. The localized topics were those that in conversation are rarely invoked independent of other topics. Discussion of food, for example, usually also involves discussion of the people preparing or eating the food. As a consequence, whether one schema or another was activated depended on what aspect of food the participant focused on. Thus it was easier for the creator and the interpreter of the photograph to differ. Conversely, the globalized topics generally stand as single, sustained topics of conversation, constraining which schemas might be activated, and yielding more concurrence between photographer and viewer. Interestingly, the localized topics are generally broader than the generalized topics. In other words, the localized topics are those to which people turn when attempting to describe any culture different from their own, while the globalized topics touch on features specific to urban local culture. Broad topics left room for interpretation—for divergent interpretations by persons from different cultures—and thus yielded more localization. Narrow topics led observers from other cultures to concur in their judgments, leading to greater globalization.

6. IMPLICATIONS AND LIMITATIONS

This study employed cultural schema theory and several qualitative methodologies to explore cross-cultural differences in the creation and interpretation of digital photographic images. The research has several practical implications. It offers guidance to web-based providers who want to use culturally suitable images to target specific markets. The research provides a foundation for more effective sort and search algorithms. A photo image search system that accounted for cross-cultural differences and provided results tailored to the user's cultural schema would present more useful and relevant results. Finally, the study identifies which topics should be localized and which topics should be globalized. (In this context, "localization" means localization of the schema, not of the content.) People from different cultures are more likely to use the same schemas to interpret images of topics that can be globalized. Some topics, however, need to be localized, so that a web service using images of food or scenery, for instance, should tailor them to the culture of its target market.

This research also has a theoretical implication. We used cultural schema theory to explain differences inexpression and interpretation of digital photo images. While past studies of cultural differences have investigated user interfaces as a whole, we examined one specific interface element, the digital photo image, believing a narrow focus more suitable for an in-depth investigation. This research has a limitation. We recruited international participants who came for a short visit to the same city at around the same time. Cross-cultural research performed in a single location runs the risk that participants may have already adapted to the host culture. However, to control for confounding factors and make the research results comparable across cultures, we sought to limit the creation and interpretation of photo images to a single topic, and since that topic was the host city's culture, we needed participants who were from different cultures, who were in a common locale, and who knew that locale well enough to complete the assigned task. In conclusion, having observed the full process by which digital photos are captured and interpreted, this study suggests that people from different cultures not only choose different images for the same topic, but also see the same images through different lenses. Moreover, since this was an exploratory study, research findings have not been evaluated. Further studies on the topic needs to be done to objectively evaluate and verify the research findings.

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Gi Woong Choi
He obtained his B.S. degree from the Department of Biosystems, KAIST and M.S. degree from the Cognitive Science Program, Yonsei University. Currently, he is a Ph.D. student in Instructional Systems, Pennsylvania State University. His research interests focus on learning sciences, HCI in education, game user experience, and technology & ethics.

Solyung Kim
She obtained her B.S. degree from the School of Electrical, Electronic, and Computer Engineering, Sungkyunkwan University and M.S. degree from the Cognitive Science Program, Yonsei University. Currently, she is a senior researcher in the Home Appliances Division, Samsung Electronics. Her research interests focus on UX Innovation, UX research methodology, user behavioral modeling.

Jihyun Kim
She obtained her B.S. degree from the School of Science, Yonsei University and M.S. degree from the Cognitive Science Program, Yonsei University. Currently, she designs social network service in NCsoft. Her research interests focus on emotional aspects of UX, emotional support in social network, and subjective well-being.

Inseong Lee
He obtained his B.S., M.S., and Ph.D. degree from the School of Business, Yonsei University. Currently, he is an assistant professor in the School of Business, Kyungil University. His research interests focus on product & service innovation, social media, co-experience, co-creation, emotional aspects of UX, and UX research methodology.

Jinwoo Kim
He is a Professor of HCI in the School of Business, Yonsei University, and director of the university's HCI Lab. His research interests focus on Human-Centered Innovation through Human-Computer Interaction. Current research interests include co-experience, co-creation, and social collective innovation.