Culturally-Situated Pictogram Retrieval

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Abstract. This paper studies the patterns of cultural differences observed in pictogram interpretation. We conducted a 14-month online survey in the U.S. and Japan to ask the meaning of 120 pictograms used in a pictogram communication system. A total of 935 respondents in the U.S. and 543 respondents in Japan participated in the survey to submit pictogram interpretations which added up to compose an average of 147 English interpretations and 97 Japanese interpretations per pictogram. Three human judges independently analyzed the English-Japanese interpretation words. As a result, two or more judges found 19 pictograms to have culturally different interpretations. The following patterns of cultural differences in pictogram interpretation were observed: (1) two cultures share the same underlying concept, but have different perspectives on the concept, (2) two cultures only partially share the same underlying concept, and (3) two cultures do not share any underlying concept.

Keywords: pictogram, interpretation, analysis, cultural difference

1 Introduction

Hand drawn images have long been used to convey messages, and are still being used as an effective iconic medium of representation. For instance, prehistoric drawings inside the Altamira Cave[6] tell us what wild animals lived during the ice age. Outlines of walking or standing human figures on the surface of a pedestrian traffic light alert us when to proceed or to stop.

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[6] http://whc.unesco.org/en/list/310

Hand drawn images are in essence iconic representation carrying semantic interpretation. We will call such images *pictograms* in this paper. One of the most familiar pictograms used nowadays are universal signs such as road signs, direction boards at the airports, and symbols of sports played in the Olympics. These pictograms are intended to convey particular information to a wide range of audiences. Much effort has been put on developing pictograms for AAC (Augmentative and Alternative Communication). AAC assists people with severe communication disabilities to be more socially active in interpersonal interaction, education, employment, and community activities. Sign language and Braille are good examples of AAC. Blissymbolics[1] and PIC[2] are some pictogram communication systems used in AAC.

In this paper, we look at a new kind of communication involving pictograms, one that exchanges pictogram messages via a network system[3–5]. A participant involved in pictogram message exchange creates a pictogram message by selecting and combining one or more pictograms which are registered to the system. Note that these registered pictograms are created by art major students who are novices at pictogram design.

Because pictograms have clear pictorial similarities with some object[6], pictogram communication has the potential to establish communication between participants speaking different languages. Successful pictogram communication, however, can be realized when the two participants share common pictogram interpretation. In the case of differing interpretation, misunderstanding may arise. In an intercultural communication setting where multilingual, multicultural users are involved, it would be beneficial if some intermediating system automatically detects and notifies the users of possible misunderstanding that might arise during message exchange. Such automatic detection, especially the detection of misconception attributable to users' linguistic or cultural differences, could help to establish mutual understanding and to facilitate communication among multilingual, multicultural users.

Various studies to support intercultural communication have been reported to date. [7] analyzed a large volume of multilingual BBS message log, and discovered that misunderstanding is likely to arise among different language speakers when there is a gap between the BBS message thread structure and the words used in the BBS messages. [8, 9] conducted a large scale web experiment to reveal cultural differences in the interpretation of avatars' facial expressions. [10, 11] proposed an infrastructure which supports composition of language services.

Here, we focus on culturally-situated pictogram retrieval, where a pictogram communication system user, situated in an intercultural communication setting, searches for relevant pictograms to compose a pictogram message. Retrieved pictograms are included in the pictogram message, and this message is sent to the conversational partner with different cultural background. Since pictograms used here are created by novices at pictogram design, each pictogram does not guarantee a single, clear interpretation: their interpretations may be various[12]. Consequently, multicultural users participating in pictogram communication may have varying, culture-specific interpretations of these pictograms.

Our goal is to notify the users of information regarding pictogram interpretation so that users creating pictogram messages can know in advance how certain pictograms are interpreted by members of different cultures. When this kind of notification is done during pictogram retrieval, it will allow the message creator to choose pictograms with discretion. This in turn will lead to the composition of more understandable pictogram messages.

To enable the notification of culture-specific pictograms, we first need to understand what kind of culture-specific pictogram interpretations exist. We do this by conducting an online survey, which asks the meaning of pictograms, to members of two different cultures: U.S. and Japan. Section 2 summarizes the U.S.-Japan online pictogram survey and reports the details of culture-specific pictograms found in the two countries. Section 3 discusses the findings, and Section 4 concludes this paper.

2 Cultural Ambiguity in Pictogram Interpretation

To understand how different cultures interpret pictograms, we conducted an online survey in the U.S. and Japan. The selection of the two countries is based on the fact that chances of finding cultural differences in pictogram interpretation would be higher if we choose cultures that have greater cultural differences. Since existing literatures on cross-cultural studies have found the two countries' cultures to be distinct in many aspects[13–15], we proceed with our survey in the two countries.

2.1 Pictogram Web Survey

Objective: An online pictogram survey was conducted to understand whether differences in pictogram interpretation exist in two countries, U.S. and Japan, and if so, what they are.

Method: A pictogram survey, which asks the meaning of 120 pictograms used in the system, was conducted to respondents in the U.S. and Japan via the WWW from October 1, 2005 to November 30, 2006.[7] Human respondents were shown a webpage containing 10 pictograms, and were asked to write the meaning of each pictogram inside the textbox provided below the pictogram. Each time a set of 10 pictograms was shown at random, and respondents could choose and answer as many question sets they liked. The maximum question sets a respondent could answer was 12 sets where 120 pictograms were questioned.

Data: A total of 543 respondents in Japan and 935 respondents in the U.S. participated in the survey. An average of 97 interpretations consisting of Japanese words or phrases (duplicate expressions included) and an average of 147 interpretations consisting of English words or phrases (duplicate expressions included) were collected for each pictogram. For each pictogram, unique interpretation words or phrases were listed for each language, and the occurrence of those unique words were counted to calculate the frequency.

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[7] The URL of the online pictogram survey is http://www.pangaean.org/iconsurvey/.

An example of U.S.–Japanese word count result for one of the surveyed pictogram is shown in Table 1. The left two columns show interpretation words and frequencies collected from the U.S. respondents. The right two columns show interpretation words and frequencies collected from the Japanese respondents.

Table 1. U.S.–Japan interpretation words and frequencies for the below pictogram

INTERPRETATIONS IN U.S.	FREQ.	INTERPRETATIONS IN JAPAN	FREQ.
dancing	51	dance (*dansu*: kt)	45
dance	25	dance (*odori*: kj+hr)	13
gymnastics	7	dance (*odori*: hr)	6
dancers	6	dance (*dansu*: hr)	2
ballet	5	fun (*tanoshii*: kj+hr)	2
play	5	dance (*odoru*: hr)	1
cheerleaders	4	circus (*sa–kasu*: kt)	1
danceing	3	dancer (*dansa–*: kt)	1
playing	3	performance (*pafo–mansu*: kt)	1
family	2	clown (*piero*: kt)	1
friends	2	theatrical play (*engeki*: kj)	1
acrobatics	1	hobby (*shumi*: kj)	1
ballerina show	1	battle (*tatakai*: kj+hr)	1
cheerleading	1	gymnastics (*taisou*: kj)	1
cherrleaders	1	dance (*odoru*: kj+hr)	1
dance class	1	dance (*odori*: kj+hr) dance (*dansu*: kt)	1
dancing triplets	1	everyone getting along well (*minnanakayoku*: hr+kj+hr)	1
exercise	1	rhythmic sports gymnastics (*shintaisou*: kj)	1
flexable	1		
girls playing	1		
hurting eachother	1		
i like to dance	1		
play time	1		
playin	1		
TOTAL FREQUENCY	126	TOTAL FREQUENCY	81

For example, U.S. interpretation word "*dancing*" placed at the top has a frequency of "51". This means that fifty-one U.S. respondents wrote "*dancing*" as the meaning of the pictogram displayed at the top of the table. Comparative charts that were created for analyses contain the original Japanese words as they are, but in this paper we translate all Japanese words into English for readability.

A Japanese-English dictionary, EDICT[8], was used for translation. Words and phrases which were not listed in the dictionary (including colloquial expressions) were translated by humans. Parentheses following each English translation (of the Japanese words) in Table 1 contain the original Japanese term expressed in alphabet (shown in *italics*) and the Japanese character construction of the original term: "hr" denotes *hiragana*, "kt" denotes *katakana*, and "kj" denotes *kanji*. Italicized Japanese term and its character construction are delimited by a colon(:).

Analysis. Tables comparing English and Japanese pictogram interpretation words and frequencies (similar to Table 1, but containing the original Japanese words and phrases) were created for each of the 120 surveyed pictograms. To determine whether culture-specific interpretations were present, three human judges independently analyzed the 120 English-Japanese pictogram interpretations for cultural differences. Two judges were Japanese and one judge was Korean. All three judges had college level Japanese and English proficiency. After reviewing the 120 pictogram interpretation words, each of the three judges found 8, 21(Korean judge), and 28 pictograms to have culturally different interpretations. 19 pictograms were found to have culturally different interpretations by two or more judges. 7 pictograms were found to have culturally different interpretations by all three judges.

2.2 Result

We give details of the 19 pictograms which were judged by two or more judges to have culturally different interpretations by the U.S. respondents and Japanese respondents. To guide our explanation, we divde the pictograms into the following groups: (i) **gesture**, (ii) **gender and color**, (iii) **time**, (iv) **space**, (v) **familiar scene**, and (vi) **facial expression**. The top five frequently occuring U.S.–Japan pictogram interpretation words are listed for each pictogram along with their percentages. The percentage(PCT, %) of each word or phrase is calculated by dividing the interpretation word frequency with the total frequency. For example, the percentage of the word "*dancing*" in Table 1 can be calculated as $(51/126) * 100 = 40.48\%$. For all Japanese interpretation words, English translations, alphabetical expressions of the Japanese terms (in *italics*), and Japanese character constructions are provided as those shown in Table 1.

Gesture. Pictogram of a person holding up one's hands above one's head to form a circle-like shape (Table 2 top) was interpreted as "*exercise, jump rope, exercising, yoga, dance, stretch*" by a majority of the U.S. respondents whereas a majority of the Japanese respondents interpreted it as "*OK, circle, correct, all right, bingo.*" U.S. interpretations center around exercise-related concept while Japanese interpretations center around agreement-related concept.

Table 2. Gesture

Pictogram	U.S.	Pct(%)	Japan	Pct(%)
	exercise	19.47	OK (originally submitted in alphabet)	18.81
	jump rope	5.31	circle (*maru*: hr)	9.90
	happy	4.43	correct (*seikai*: kj)	8.91
	exercising	3.54	O.K. (*okke–*: kt)	7.92
	yoga	3.54	O.K. (*iiyo*: hr)	5.94
	mad	31.90	no good (*dame*: hr)	26.73
	angry	30.17	no good (*dame*: kt)	11.88
	no	4.31	wrong* (*batsu*: hr)	5.94
	stubborn	3.45	wrong* (*batsu*: kt)	3.96
	anger	1.72	no (*iie*: hr)	2.97
	talking	10.19	thank you (*arigatou*: hr)	6.33
	praying	9.55	please (*onegai*: hr+kj+hr)	6.33
	thinking	8.28	to speak (*hanasu*: kj+hr)	5.06
	speaking	5.10	soliloquy (*hitorigoto*: hr)	3.80
	lonely	3.19	soliloquy (*hitorigoto*: kj+hr+kj)	3.80

Likewise, pictogram of a person holding up one's arms to form an "X" (Table 2 middle) was interpreted as "*mad, angry, anger, frustrated, upset*" by a majority of the U.S. respondents whereas a majority of the Japanese respondents interpreted it as "*no good, wrong*[9]*, no, miss, don't.*" U.S. interpretations center around the concept which deals with negative emotions while Japanese interpretations center around the concept which deals with prohibition or criticism.

As for the pictogram that shows a standing person placing hands together while a a speech balloon hangs next to the head (Table 2 bottom), approximately 40% of both the U.S. and Japanese respondents interpreted it as some kind of a speech act ("*talking, speaking*" and "*to speak, soliloquy*" respectively). At the same time, however, 14.6% of U.S. respondents interpreted it as "*praying, pray, prayer*" while 17.7% of Japanese respondents interpreted it as "*thank you, please.*" These differences in the interpretations of the three pictograms, we think, are due to the differences in how gestures are interpreted in the U.S. and Japan. The body gestures expressing a circle or a cross are gestures well-recognized in Japan which respectively indicate that something is correct or wrong. However, such gesture is not recognized in the United States: therefore we suppose that the circle depicted in the pictogram was perceived as an expression of motion while the "X" was perceived as crossing of one's arms (hence, the stubborn or angry gesture) by the U.S. respondents.

The important thing to note is that while the two countries' overall interpretations of the top and middle pictogram differ greatly, the bottom pictogram contains a mixture of both the differing interpretations ("*thank you*" vs. "*pray-*

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[9] Although EDICT lists three entries to the Japanese term "*batsu*," English translation fitting the context of the pictogram (the "X" gesture) could not be found so a more appropriate human translation is given.

Table 3. Gender and color (top in red, bottom in blue)

PICTOGRAM	U.S.	PCT(%)	JAPAN	PCT(%)
	woman	29.05	woman (*onnanohito*: kj+hr+kj)	28.00
	man	11.49	woman (*josei*: kj)	27.00
	mom	8.78	woman (*onna*: kj)	10.00
	dad	7.43	mother (*okaasan*: hr)	5.00
	adult	5.41	mother (*okaasan*: hr+kj+hr)	3.00
	man	34.23	man (*otokonohito*: kj+hr+kj)	27.72
	dad	10.07	male (*dansei*: kj)	26.73
	woman	8.05	man (*otoko*: kj)	9.90
	adult	6.04	father (*otousan*: hr)	3.96
	mom	5.37	father (*otousan*: hr+kj+hr)	3.96

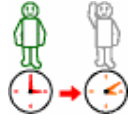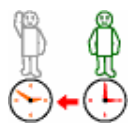*ing*") and the common interpretation shared by the two countries ("*talking*" and "*to speak*").

Gender and Color. "The color red denotes women and the color blue denotes men" is a prevalent notion in Japan, but it is not so in the U.S. as indicated by the pictogram interpretations.

While 92% of the Japanese respondents interpreted the red human figure (Table 3 top) as "*woman, mother, adult female, sister, girl*" which all contain the female gender concept, 31.8% of the U.S. respondents interpreted it as "*man, dad, father, boy, male*" which all contain the male gender concept. Strong agreement in interpretation was reached by the Japanese respondents, but not by the U.S. respondents. The remaining 8% of the Japanese interpretations consisted of "*adult*" and "*person*" which lacks any gender concept, and "*boy*" that was answered by one Japanese respondent. As for the remaining U.S. respondents, most of them interpreted the red human figure similarly as the majority of Japanese did as some kind of a female person. Small portion of the U.S. respondents interpreted as "*adult, person, teenager, grown up, parent.*"

Likewise, the blue human figure (Table 3 bottom) was interpreted by 93% of the Japanese respondents as "*man, male, father, adult male, brother, boy*" which all contain the male gender concept. In contrast, 20.8% of the U.S. respondents interpreted it as some person with the female gender, i.e. "*woman, mom, big girl, female, old women.*" Only one Japanese respondent interpreted it as a "*girl.*" The remaining U.S. respondents interpreted the blue human figure similarly as the Japanese as some kind of a person with the male gender.

In sum, it can be concluded that the correlation of color and gender (red denotes female and blue denotes male) is evident in the Japanese interpretations, but not in the U.S. interpretations. The important thing to notice is that while the Japanese interpretations center around a single gender concept, i.e. the concept of either male or female, the U.S. interpretations include both gender concepts for each pictogram leading to a greater ambiguity in interpretation.

Table 4. Time

Pictogram	U.S.	Pct(%)	Japan	Pct(%)
	late	11.38	the future (*mirai*: kj)	16.83
	time	10.18	10 minutes later (*juppungo*: num+kj)	9.90
	10 minutes	3.59	the future (*mirai*: hr)	5.94
	later	2.99	afterwards (*atode*: hr)	3.96
	future	2.40	time passes (*jikangasusumu*: kj+hr+kj+hr)	2.97
	on time	16.87	now (*genzai*: kj)	11.11
	time	12.65	now (*ima*: kj)	10.00
	now	3.61	time (*jikan*: kj)	6.67
	what time is it	3.61	now (*ima*: hr)	4.44
	clock	3.01	time (*jikan*: hr)	4.44
	early	12.27	the past (*kako*: kj)	18.09
	before	4.29	10 minutes ago (*juppunmae*: num+kj)	11.70
	past	3.68	the past (*kako*: hr)	7.45
	time	3.68	time is turned back (*jikangamodoru*: kj+hr+kj+hr)	4.26
	late	3.07	some time ago (*sakki*: hr)	3.19

Time. In both countries, pictograms containing clock image(s) (Table 4) were interpreted as some kind of a concept relating to time, but the first ranking interpretations were different between the two countries.

Starting with the top pictogram in Table 4, the first ranking U.S. interpretation was "*late* (11.38%)" whereas the first raking Japanese interpretation was "*the future* (16.83%)." Since the third ranking Japanese interpretation shown in the table is also "*the future* (5.94.%)," it can be combined with the first ranking interpretation to yield a total percentage of 22.77%. Similar interpretations to the first ranking U.S. interpretation ("*late*") also existed below the ranking, which include "*5 min. late, late or later, you are late*" which were each answered by one U.S. respondent. A total of 4.19% U.S. interpretations contained interpretations similar to the first ranking Japanese interpretation: they were "*future, forward in time, past to future.*" A total of 5% of Japanese interpretations contained interpretations similar to the first ranking U.S. interpretation: they were "*lateness* (*chikoku*: hr, kj), *to be late* (*okureru*: kj+hr)." Common interpretations shared by the two countries included "*10 minutes later, time passes.*"

As for the middle pictogram in Table 4, the first ranking U.S. and Japanese interpretations were "*on time* (16.87%)" and "*now* (11.11%)" respectively. Since the second and fourth ranking Japanese interpretations shown in Table 4 are also "*now* (10.00% and 4.44%)," they can be combined to yied a total percentage of 25.55%. Similar interpretations to the first ranking U.S. interpretation ("*on time*") existed below the ranking, which include "*be on time, you are on time.*" A total of 6.63% U.S. interpretations contained interpretations similar to the first ranking Japanese interpretation: they were "*now, present, current time,*

<div align="center">**Table 5.** Space</div>

Pictogram	U.S.	Pct(%)	Japan	Pct(%)
	up	18.88	there (*asoko*: hr)	30.63
	there	14.69	that (*are*: hr)	27.03
	far	6.29	there (*acchi*: hr)	9.91
	over there	4.90	above (*ue*: kj)	5.41
	point	4.90	far (*tooi*: kj+hr)	3.60
	down	18.88	here (*koko*: hr)	36.04
	here	16.08	this (*kore*: hr)	26.13
	near	6.99	this direction (*kocchi*: hr)	5.41
	big	3.50	below (*shita*: kj)	5.41
	low	3.50	near (*chikai*: kj+hr)	3.60

present time." A total of 5.56% Japanese interpretations contained interpretations similar to the first ranking U.S. interpretation: they were "*just* (*choudo*: hr), *on time* (*ontaimu*: kt, *jikandoori*: kj+kt)." Common interpretation shared by the two countries was "*time.*"

For the bottom pictogram in Table 4, the first ranking U.S. and Japanese interpretations were "*early* (12.27%)" and "*the past* (17.89%)" respectively. Since the third ranking Japanese interpretation shown in the table is also "*the past* (7.37%)," it can be combined to yield a total percentage of 25.26%. Similar interpretations to the first ranking U.S. interpretation ("*early*") existed below the ranking which include "*10 minutes early, 5 min early, early or earlier, someone's early, you are early.*" A total of 4.91% U.S. interpretations contained interpretations similar to the first ranking Japanese interpretation: they were "*past, backward in time, future to past.*" A total of 2.11% Japanese interpretations contained interpretations similar to the first ranking U.S. interpretation: they were "*arrived early* (*hayakutsuichatta*: kj+hr+kj+hr), *arrived 10 minutes ago* (*juppunmaenikimashita*: num+kj+hr)." Common interpretation shared by the two countries was "*10 minutes ago.*"

In sum, the three pictograms containing clock image(s) were interpreted by the U.S. respondents as "*late, on time, early*" whereas Japanese respondents interpreted them as "*future, present, past.*" It can be said that the U.S. interpretations deal with a concept of appointment in relation to time while the Japanese interpretations deal with temporal relations along the time axis. The important thing to notice is that the basic time concept is shared by the two countries, but the detailed interpretations that unfold around the time concept differs as manifested by the two countries' first ranking interpretations.

Space. Two pictograms portraying an index finger pointing to a specific place were interepreted differently by the two countries. Although both countries' interpretations centered around the concept of space, the perspectives held by the respondents were different. We focus on the first ranking interpretations (as we did in the prior time related pictograms) to highlight the differences.

For the Table 5 top pictogram, 18.88% of the U.S. respondents interpreted the finger's direction to be pointing "*up*" whereas 30.63% of the Japanese respondents interpreted it as pointing to "*there.*" Since the third ranking Japanese interpretation shown in the table is also "*there* (9.91%)," it can be combined with the first ranking Japanese interpretation to yield a total percentage of 40.54%. Similar interpretations to the first ranking U.S. interpretation ("*up*") existed below the ranking which add up to 11.89%: example interpretations include "*high, pointing up, up/above, above, look up, up high.*" Combining the first ranking U.S. interpretations with the similar, below ranking interpretations, the percentage of the major U.S. interpretation "*up*" adds up to 30.77%.

For the Table 5 bottom pictogram, 18.88% of the U.S. respondents interpreted it as "*down*" whereas 36.04% of the Japanese respondents interpreted it as "*here.*" Since the third ranking Japanese interpretation, "*this direction* (5.41%)," shown in the table contains similar meaning to the first ranking Japanese interpretation, it can be combined to yield a total percentage of 41.45%. Similar interpretations to the first ranking U.S. interpretation ("*down*") existed below the ranking which add up to 20.98%: example interpretations include "*low, pointing down, down/below, below, look down, down low.*" Combining the first ranking U.S. interpretations with the similar, below ranking interpretations, the percentage of the major U.S. interpretation "*down*" adds up to 39.86%.

Major interpretation observed in one country was also observed in the other country, but with a lower percentage. The first ranking Japanese interpretations "*there*" and "*here*" for the top and bottom pictogram (Table 5) were also observed within the U.S. interpretations (totaled 24.48% and 25.87% respectively): example interpretations include "*there, over there, go there, look there, spot there*" and "*here, right here, come here, look here, spot here.*" On the other hand, the Japanese interpretations similar to the first ranking U.S. interpretations "*up*" and "*down*" (top and bottom pictogram in Table 5) were totaled 9% and 8.11% respectively: example interpretations include "*above* (*ue*: kj, hr), *high* (*takai*: kj+hr)" and "*below* (*shita*: kj, hr), *low* (*hikui*: kj+hr)." Common interpretations shared by the two countries were "*far*" and "*near*" respectively for the top and bottom pictogram in Table 5.

In sum, the two pictograms depicting a finger pointing to a certain direction were interpreted as "*up, down*" by the U.S. respondents whereas the Japanese respondents interpreted them as "*there, here.*" It can be said that the U.S. interpretations contain a vertical perspective of space while the Japanese interpretations contain a horizontal perspective of space. The important thing to notice is that while the basic concept of space is shared by the two countries, the major (or the first ranking) interpretations vary as evidenced by "*up* vs. *there*" and "*down* vs. *here.*" However, it should be also noted that the second major U.S. interpretations ("*there, here*") overlap with the first ranking Japanese interpretations. In contrast, in the case of the Japanese interpretations that overlap with the first ranking U.S. interpretations ("*up, down*"), the percentages were low (9% and 8.11% respectively).

Table 6. Familiar scene

Pictogram	U.S.	Pct(%)	Japan	Pct(%)
	eiffel tower	19.23	tokyo tower (*toukyoutawa–*: kj+kt)	44.57
	paris	19.23	tower (*tawa–*: kt)	23.91
	tower	15.38	tower (*tou*: kj)	7.61
	eifel tower	4.62	eiffle tower (*efferutou*: kt+kj)	6.52
	france	4.62	tower (*denpatou*: kj)	3.26
	winner	30.63	athletic meet (*undoukai*: kj)	36.59
	winning	6.88	number one (*ichiban*: kj)	8.54
	champion	5.63	overall victory (*yuushou*: kj)	6.88
	first place	5.00	number one (*ichiban*: hr)	3.66
	cheering	3.13	first place prize (*ittoushou*: kj)	3.66
	friends	9.38	liar (*usotsuki*: hr)	7.89
	party	8.13	to tell a lie (*usowotsuku*: hr)	5.26
	gossip	3.75	lie (*uso*: kj)	3.95
	happy	3.13	lie (*uso*: hr)	2.63
	happy group	3.13	malicious gossip (*kageguchi*: hr)	2.63

Familiar Scene. In some cases, the U.S. and Japanese respondents recalled familiar scenes from the visual scenery depicted in the pictograms. These recalled scenes varied according to culture.

In the case of the top pictogram in Table 6, nearly half (43.08%)[10] of the U.S. respondents interpreted the red tower as the "*eiffel tower*" while nearly half (47.83%) of the Japanese respondents interpreted it as the "*tokyo tower.*" Apparently, the respondents recalled specific instances of the tower they were familiar with. None of the U.S. respondents submitted "*tokyo tower*" as the interpretation, but 7.6% of the Japanese respondents submitted "*eiffel tower*" as the interpretation. Common interpretation shared by the two countries was "*tower.*"

In the case of the middle pictogram in Table 6, the first ranking interpretations given by the U.S. and Japanese respondents were "*winner* (30.63%)" and "*athletic meet* (36.59%)" respectively. Note that such athletic meet depicted in the pictogram is a regularly held school event in Japan. Therefore, it is reasonable to assume that the Japanese respondents associated the pictogram's visual scenery to the school hosted athletic meet. Similar interpretaions shared by the two countries (U.S. / Japan) were "*winning / overall victory*" and "*champion, first place / number one.*"

The case with Table 6 bottom pictogram should be given greater attention since the two countries' interpretations vary greatly, almost going the opposite direction. While most of the U.S. respondents interpreted the pictogram to mean "*friends, party, happy, happy group, laughing, having fun*, etc." which all indicate a cheery, positive scene, most of the Japanese respondents interpreted it to mean

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[10] Twelve misspelled versions of the "Eiffel" were observed in the U.S. interpretations including the fourth ranking "*eifel tower.*"

"*liar, to tell a lie, lie, malicious gossip, split personality, vicious, to deceive, scheming*, etc." which all indicate a shadowy, negative image. We assume that the Japanese respondents have interpreted the black face on the upper right corner as a person having a malicious intent or an ulterior motive. Hence, the negative interpretation.

In contrast, we assume that the U.S. respondents interpreted the black face to be an African American, and as a result, interpreted the four faces as a group of people with varying ethnic background. Since people from diverse ethnic groups are portrayed as chatting together, it is a desirable scene, and thus positive interpretations are derived. Such interpretation, however, may be difficult to come out from Japanese respondents, since Japan is a monoethnic country, and almost all people (excluding the foreigners) belong to the same ethnic group. Therefore, it is more natural to interpret a different face color as signifying the person's state of mind. The important thing to mention with regard to the three pictograms dealing with familiar scenery is that they contain a mixture of different interpretation patterns: while the top and middle pictogram respectively contain a common underlying concept such as "*tower*" and "*winning*," the bottom pictogram contains vastly varying interpretations.

Facial Expression. Facial expressions were interpreted differently not only between the two countries' respondents, but also by the respondents within the same country. Starting from the top pictogram in Table 7, the greatest common U.S. interpretation was "*whistling, whistle* (25.16%)" whereas the greatest common Japanese interpretation was "*feigning ignorance, pretending not to know* (30.38%)." Diverse interpretations were observed by members of each country. For instance, U.S. respondents interpreted as "*curious, kiss, relieved, sad, startled, embarrassed, snobby*" while Japanese respondents interpreted as "*to pout, to deceive, boring, to jeer, to get angry, to tell a lie, to bluff.*"

As for the second pictogram in Table 7, the top two interpretations in the U.S. and Japan were "*scared* (24.84%), *cold* (11.8%)" and "*cold* (60.95%), *scared* (24.27%)" respectively. Notice that although both countries share the same two interpretations "*cold, scared*," the first and second commonly shared interpretations are reversed between the two countries.

Moving to the third, fourth, and fifth pictogram in Table 7, the first ranking interpretations for each of the three pictograms were "*happy, happy, happy*" by the U.S. repondents, and "*good-looking, cute, pretty*" by the Japanese respondents. Japanese respondents tend to interpret the outer appearance of the face while U.S. respondents interpreted the state of the mind projected through the face. The fourth pictogram had, compared to the other two pictograms, a relatively high agreement in interpretation within each country with 25.64% "*happy*" interpretation in the U.S. and 42.72% "*cute*" interpretation in Japan. As for the remaining two pictograms (Table 7 third and fifth), low agreement on interpretation was reached especially among the U.S. respondents.

The last pictogram shown at the bottom of Table 7 consists of mixed interpretations from both within each country and between the two countries. It can

Table 7. Facial expression

Pictogram	U.S.	Pct(%)	Japan	Pct(%)
	whistling	13.21	feigning ignorance (*shiranpuri*: hr)	5.06
	whistle	10.06	to be peevish (*suneru*: hr)	5.06
	no	5.66	hmm (*hun*: hr)	5.06
	annoyed	2.52	acting rudely and suddenly (*pui*: hr)	5.06
	ignore	2.52	whistle (*kuchibue*: kj)	5.06
	scared	18.01	cold (*samui*: kj+hr)	27.18
	cold	10.56	cold (*samui*: hr)	23.30
	worried	10.56	scary (*kowai*: hr)	9.71
	nervous	9.94	scary (*kowai*: kj+hr)	4.85
	sad	9.94	trembling (*buruburu*: hr)	2.91
	happy	6.49	good-looking (*kakkoii*: hr)	31.7
	mean	5.19	handsome (*hansamu*: kt)	8.65
	smart	4.55	boast (*jiman*: kj)	2.88
	boy	3.90	nice man (*iiotoko*: hr+kj)	1.92
	mischevious	3.90	ahem (*ehhen*: hr)	1.92
	happy	25.64	cute (*kawaii*: hr)	42.72
	girl	3.85	pretty (*kirei*: hr)	5.83
	nice	3.85	cute (*kawaii*: kj+hr)	2.91
	pretty	3.85	beautiful person (*bijin*: kj)	2.91
	sweet	3.85	chuckling (*ufufu*: hr)	1.94
	happy	8.05	pretty (*kirei*: hr)	16.49
	in love	4.70	beautiful person (*bijin*: kj)	13.40
	cute	4.03	cute (*kawaii*: hr)	8.25
	pretty	3.36	beautiful (*utsukushii*: kj+hr)	4.12
	sweet	3.36	a prim girl (*osumashi*: hr)	2.06
	sly	11.95	to make fun of (*bakanisuru*: hr)	3.00
	sneaky	11.32	bitter smile (*nigawarai*: kj+hr)	3.00
	happy	6.92	doubt (*utagai*: hr)	2.00
	cool	2.52	grinning (*niyaniya*: hr)	2.00
	shy	2.52	broadly grinning (*niyari*: hr)	2.00

mean "*sly, sneaky, happy, cool, shy*" in the U.S. while "*to make fun of, bitter, doubt, grinning, broadly grinning*" in Japan. However, most of the Japanese interpretations contained negative connotations whereas the U.S. interpretations contained both negative and positive connotations. For example, the U.S. interpretation such as "*pleased, smile, clever, glad, proud, calm, smart*" were positive interpretations that never appeared in the Japanese interpretations.

In sum, pictograms containing facial expressions can have varying interpretations not only between the two countries, but also among the members of the same country. Note that although there were other pictograms that depicted facial expressions, for example, pictograms depicting a crying face or an angry face, these pictograms depicting negative facial expressions were interpreted similarly by the two countries. There were no cultural differences in interpretations.

3　Discussion

We looked at the details of culturally different interpretations in 19 pictograms. Although each pictogram contained specific cultural differences in interpretation, we think that these cultural differences can be categorized into the following three patterns. We give examples of each pattern.

- The basic concept captured by the two cultures are the same, but the perspectives on that concept is different.
  e.g. The concept of time, space, tower, face are captured by both members (U.S. and Japan), but how they are percieved vary.
  - [Table 4] *late* vs. *future*, *on time* vs. *now*, *early* vs. *past*
  - [Table 5] *up* vs. *there*, *down* vs. *here*
  - [Table 6 top] *eiffel tower* vs. *tokyo tower*
  - [Table 7 third, fourth, fifth] *happy* vs. *good-looking, cute, pretty*

- The basic concept(s) are only partially captured by the two cultures.
  - [Table 2 bottom] *talking, to speak* is shared, but *praying* vs. *thank you*
  - [Table 3] *female* is shared, but *male*, *male* is shared, but *female*
  - [Table 6 middle] *winning, overall victory* is shared, but *athletic meet*

- There are no common concept captured by the two cultures.
  e.g. A gesture may be recognized by one culture, but not by the other.
  - [Table 2 top & middle] *exercise* vs. *O.K.*, *mad* vs. *no good*
  - [Table 7 top] *whistle* vs. *feigning ignorance*
  e.g. Specific environment may lead to specific recognition.
  - [Table 6 bottom] *friends* vs. *liar*

4　Conclusion

As a first step to understanding how pictograms are interpreted in different cultures, a pictogram web survey asking the meaning of pictograms were conducted in the U.S. and Japan. Three human judges independently analyzed the English–Japanese pictogram interpretations collected from the survey to determine whether cultural differences in pictogram interpretation exist between the two countries. As a result, 19 out of 120 surveyed pictograms were judged by two or more human judges to have culturally different interpretations.

Analysis of the 19 culturally different interpretations confirmed the following three patterns of cultural differences in pictogram interpretation: (1) two cultures share the same underlying concept, but have different perspectives about the concept, (2) two cultures only partially share the same underlying concept, and (3) two cultures do not share any underlying concept. These findings can be used to design a pictogram retrieval system which can automatically detect cultural differences in pictogram interpretation.

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