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LONG PAPER

Value of culturally oriented information design

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Abstract Cultural issues play a substantial role in the design process. This study aims to empirically prove a meaningful relationship between cultural context-oriented information and information design. It includes a literature review to identify the attributes that make information high quality. Several surveys were conducted to investigate the relations between these attributes and a set of cultural context-oriented information design cases. An open-ended evaluation from the respondents was also conducted to interpret the results of the previous survey stage and identify the properties of high quality information that were difficult to uncover in the previous survey stage. A universal design sample was utilized particularly for comparison and contrast and can illustrate cultural context-oriented information designs' pros and cons. By conducting a survey and statistical techniques at the same time, for objective and subjective interpretations, this study resulted in several conclusions. First, compared with universal information design, cultural context-oriented information design shows its limitations more or less in the pragmatic/rational aspects concerning conveying information meanings appropriately and objectively. Second, however, cultural context-oriented information design has a striking value in terms of aesthetic experience and emotional experience. The aesthetic experience aspects are important for making information attractive, creative, or innovative, and the emotional experience aspects work on information users' subjective and conscious experience, such as in being attractive, interesting, humorous, funny, joyful, pleased, bored, or uninterested. Third, under some restrictive conditions, cultural context-oriented information design also shows the strengths of cognitive aspects such as interpretability, accessibility, understandability, and lack of errors. Lastly, cultural context-oriented information can be incorporated with the concept of universal information design to be high quality information design available in the so-called glocalization context.

Keywords Cultural context-oriented information design · Universal information design · High quality information · Glocalization

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1 Introduction

Cultural issues have been addressed in a wide spectrum of academic areas, such as anthropology, sociology, psychology, and applied sciences. There are also diverse subfields within them that have varying perspectives and methodologies dealing with cultural issues [19]. When the majority of culture-related studies have tended to pay attention to verbal language [17], studies considering visual language and design with cultural issues have also gradually increased [29, 34]. The most active design areas concerning cultural issues are advertisement design, product design, and Web design [7, 10, 12, 24, 39]. In advertisement design, designers frequently utilize local cultural narratives such as traditional myths, legends, and tales to induce customers to view products positively and called the

cultural positioning strategy [1]. In product design, designers occasionally employ cultural factors to improve the usability of a product and achieve product innovation [41]. As the Internet enables global distribution of products and services, analyzing the wants, needs, preferences, and expectations of users of different cultures becomes one of the most challenging issues in Web design [23].

One of the representative information design studies dealing with cultural issues illustrated "how information designers can generally adapt cultural variations to information design and how cultural experiences affect a reader's interpretation of any visual artifact" [17]. In this study, Kostelnick showed, for example, that strategies for adapting information design to cultural variations can be divided into two opposing approaches—culture-focused information design and global information design—and they are different in three central design issues—perception, aesthetics, and pragmatics [17]. However, even though the study expanded the applicable boundaries of cultural issues in the information design research area, little attention has been paid to identify the intrinsic attributes of each approach available for high quality information that information designers need to consider to accurately meet users' needs. There are diverse barriers for information design concerning cultural issues, and these need to be studied more thoroughly. Notably, the tendency to acknowledge information design only from the standpoint of universal design is the most challenging part [2, 33]. Signs frequently used in public information systems, such as road signs, traffic signs, and signs for major international sporting events, are typical output of universal design approaches [18, 40]. These are always in the same place, approximately the same size, and incorporate the same pictorial and alphanumeric elements distributed in a board. From the universal design perspective, however, standardized signs are useful for making exchange and communication more effective in global contexts, which can increase production and management efficiency, although one cannot guarantee that such standardized signage design can also provide high quality information for all people in different cultural contexts. Information designers need to understand that information quality (IQ) concerns the relevance of information at the level of individual differences in social behaviors as well as personality [21], and their design activities are frequently based on transition of concepts from the sociocultural environment to the description of technical objects [30].

Therefore, information designers should be, in this context, able to integrate cultural concerns into information design so that information can be of high quality at an individual level. This will result in empowering users to achieve their goals more effectively through the given information. It also needs to be emphasized that now we are no longer living in a globalized, but rather a "glocalized" ("glocal" = global + local), environment, and global and local issues are equally respected [28, 31]. That is to say, glocalization means combining the idea of globalization with local considerations [24]. Thus, each of the cultural factors from global and local has to be valued at the same time, and efforts for integrating these into the information design process are also desirable.

This study started with the question: what are the information designers' roles in the age of the glocal village? The question derives from long consideration for establishing a methodology for information designers who have struggled with the balance between culturally sensitive and universally understandable information. This question motivated this study to investigate the attributes of high quality information, the necessary conditions to constitute information high quality, and the relationship between cultural context-oriented information and high quality information.

The main purpose of this study is to examine the values of cultural context-oriented information design in the information design arena for the age of glocalization. This study involved a survey conducted with respondents from 19 different cultural backgrounds. To find out the pros and cons of cultural context-oriented information design cases, such cases were compared with and contrasted to a universal information design example. By conducting the survey and the comparison study at the same time, for objective and subjective interpretations, the results from this research present an argument on the potential value of cultural context-oriented information design.

2 Culture in information design

2.1 Defining culture and the scope of discussion

Researchers have addressed theoretical frameworks for exploring design as a modern-day cultural phenomenon and have perceived the term "culture" as having various connotations. It is in fact one of the most multifaceted words in the English language [25], and the notion of culture is understood and mobilized in diverse ways and contexts [19]. Nevertheless, it tends to be associated with describing small-scale cultural styles that emphasize the concepts of cultural identity, heritage, and local subcultures. From this standpoint, culture tends to be acknowledged as something to be traditionally celebrated and preserved for practicing a social convention accepted by a group of people belonging to a small-scale local society.

In contrast, in the wide spectrum of cultural study traditions, people are understood as participants in dynamic cultural layers that can be operated based on international,

global, and glocal scales, as well as local, regional, and national ones. Moreover, these cultural layers include explicit factors such as behaviors and materials that influence the relationship between artifacts and social relations and implicit factors such as meanings and values that are context dependent in everyday life in the global community.

"Since culture is an open set of practices and a dynamic process in which cultural meanings, objects, and identities flow across institutions, nations, and generations in diffuse time-space" [25] and there are extremely diverse points of view, it is important to reserve how the scope of discussion is defined. To begin with, this study is not necessarily aiming to address the general scope of culture, the boundary of cultural factors, and methodological approaches. Moreover, the present study should not aim at establishing profound cultural theory, and will not only address-specific cultural identities influenced by the conditions of location, gender, race, history, language, religious beliefs, etc. Rather, it will address relationships between information design and culture that ultimately influence people's behavior.

This study focuses on people's behaviors along with perception and judgment on culturally loaded visual information design artifacts. The expression of culture often takes the form of persistent physical manifestations, such as objects and their features. These physical signals of culture are generally referred to as "material culture." The accumulated residue of these manifestations—what is left by different social groups—constitutes cultural heritage and forms the basis of cultural information design. This study therefore takes culture neither as something to succeed nor to hand down, but rather as something to be created for the glocalization age. Consequently, the scope of discussion in this study will cover the domain of culture as a variable to create information meaning and determine information values. The procedures for these always influence humans' cognitive decision-making processes.

2.2 Why cultural awareness is needed in information design

Two different arguments have approached a "conceptualization method for information function" in information design. The first is that the function of information is realizing the results of user observation, because the function itself is basically conducting its role in an essential manner. The second is that it needs to have a method for revising bias and mistakes resulting from individuals' environmental and cultural differences [4].

The first argument is the aspect of acknowledging the function of information with an absolutistic view and emphasizing the design process of "fact-making" for describing reality. However, the second argument acknowledges the function of information with a relativistic view, emphasizing the design process of "sense-making" for revising diverse individual interpretations that always depend on time and space. The concept of sense-making emphasizes that interest should not be restricted to the information itself. Therefore, information designers should take the sense-making design process as a repeated process of redesigning information meaning. In this respect, the meaning should be the subject of constant deconstruction and reconstruction. For example, the most important part of designing a city's geological map is the precise description of essential information that is mostly fact based, such as location, direction, and distance. In mass media, however, information design used for explanation, definition, investigation, and argument of information about something concentrates on sense-making, the concept of which is focusing on minimizing users' bias and misunderstandings in interpreting that information.

It therefore needs to extend the sense of acknowledging the way users interpret information and formulates the world to establish the relationship between users and information. For this, culture that is the eventual result of time and space should be investigated more thoroughly in the information design area because "information describes an ordered reality that varies across time and space" and from culture to culture [4].

2.3 Two contrasting views on cultural issues in information design

The world has become substantially closer than ever, and the term "globalization," covering a wide range of distinct commercial, political, and cultural trends, has become one of the most used modern-day buzzwords. It also advances the mentality that moves from the local or regional toward the universal [32]. Concerning this context, information design studies and practices based on the universal design approach have increased dramatically. Their concept is founded on inclusive design available for all users, irrespective of nationality or cultural background.

On the other side, the UNESCO Universal Declaration on Cultural Diversity (drafted in 2002, in Paris, France) had a significant impact on considering the usefulness of unique and traditional cultural values derived from regions of the world [37]. Information scientists have identified that these cultural values are important moderators of the psychological effects that can affect information processing rather than fundamentally change human psychology [27]. For example, a cultural value is a unique component so deeply embedded in people's lives that our ignorance of it usually leads to the state of not meeting a desired or intended purpose [6]. This cultural issue itself is also a

truly important variable affecting how an information designer represents, transfers, and applies information to accurately satisfy users' needs. Information designers, however, are not yet inclined to be aware of the methodology of integrating cultural issues into information design.

As Fig. 1 shows, there are two contrasting representative information design cases: one based on universality for all people (upper images) and the other on uniqueness for the people within a specific cultural context (lower images: left is a women's restroom sign in a restaurant in China, and right are restroom signs on a Hinduist Island in Thailand). Within the two contrary issues of universal and cultural, each information design output presents advantages and disadvantages in accommodating the needs of people from different cultures [17]. Though information design based on the universal concept makes information more easily perceptible compared with the cultural one, regardless of the person's cultural background, it neither socially supports people who want to accommodate their own unique cultural values nor psychologically generates optimized information to the individuals. To the contrary, information design based on the cultural concept may arouse high interest or appeal among many people because of offering uncommon images. However, it could sometimes cause a group of people who share a different cultural context to be confused and frustrated during the information interpretation process because those from different cultures look for different information points when they make their own psychological constructs, such as cognitive and emotional functioning. Universal information design approaches are likely to yield less-aesthetic designs because they tend to be based on the Gestalt approach of ensuring the figure-ground relationship [22] that excludes excessive detail to focus attention and minimize perceptual confusion.

Fig. 1 Two contrasting views of information design

In contrast, information design focusing only on a specific cultural context will not guarantee that people of different cultural backgrounds can easily interpret the information's visual messages because culturally oriented visual images tend to be expressed metaphorically rather than materially or realistically. Means of metaphorical expression influence the functional legibility of information, which is the degree to which the visual images are understandable or recognizable based on their appearance. Figure 1 shows a good example of this—a contrast of universal and cultural context-oriented restroom signs.

The two contradicting worlds described above are clearly challenging for information designers to reflect in effective strategic principles during information design for the glocalization context. In information design history, however, the possibility of acceptable information design between universalism and cultural diversity has rarely been questioned. This leads this study to assume new principles for designing effective information signage that can balance universalism and cultural diversity. Thus, as a beginning state for finding advanced or innovative design principles, this study first uses an empirical study to compare pros and cons of universal and cultural context-oriented information design.

3 High quality information

3.1 Definitions of terms

3.1.1 Information design

Information, as defined by the Information Design Exchange (idX)[1] group, "is the result of processing, manipulating, and organizing data in a way that adds to the knowledge of the person receiving it." Design, as approved by the International Institute for Information Design (IIID) General Assemblies of 1993 and 2000, "is the identifying of a problem and the intellectual creative effort of an originator, manifesting itself in drawings or plans which include schemes and specifications." Accordingly, information design "is the defining, planning, and shaping of the contents of a message and the environments in which it is presented, with the intention to satisfy the information needs of the intended recipients (IIID definition modified by the idX group)."

[1] idX = Development of International Core Competencies and Student and Faculty Exchange in Information Design, a project initiated by Prof. Jill Dacey, University of Idaho, and realized within the EU/US Cooperation Program in Higher Education and Vocational Education and Training, August 2007.

3.1.2 Information quantity

Information quantity is the sheer amount of information available [35, 42]. When the amount of information provided with a unit is too much beyond the information consumer's cognitive abilities, the information consumer will not be able to accurately assess the information. Therefore, it can be recognized that information quantity is generally related with the issue of information density used to measure the quantity of information points or clusters that are estimated in mass or volume.

3.1.3 Information quality

Quantity concerns how much of something is available. In contrast, quality links to the fitness for purpose or how long something sustains its fitness for a purpose. Embury et al. [35] stated that information is regarded as being of high quality if it is fit for the purpose, which only the consumer of the information can judge. IQ can therefore be regarded as the inherent usefulness of information that affects the information consumer's ability to make an accurate assessment of the best alternative in a choice set [16]. The idX group also states it is often pragmatically defined as: "fitness for use of the information provided." That is to say, it is the degree of information consumer satisfaction [5]. Regarding the two viewpoints of inherent and pragmatic IQ, "information quality assurance" can be recognized as a process for guaranteeing the confidence in particular information meeting context-specific quality requirements.

3.2 High quality information attributes

Poor quality information is thought to result from inappropriate, ambiguous, biased, nonobjective, and incompletely represented information that may lead to negative feedback when information users use the information to interact with social and cultural factors. Although information designers are interested in issues concerning the improvement of IQ, their efforts have not yet been made to significant performance to identify what information types are more satisfied or suitable for information users with their varied needs. The problem is also that most information designers' efforts have been primarily concentrated on the visual completeness of information itself rather than proactive consideration of the cultural context information users are facing. Psychologists have also revealed that the cultural context plays an important role in information interpretation [11, 15]. High quality information should empower users to achieve goals associated with their cultural interaction.

To better understand the notion of IQ, this study adapted the outcomes of discussions on IQ that are covered in the field of business administration and information retrieval. Table 1 summarizes the five representative examples. The first row lists the dimensions uncovered in Zmud's pioneering IQ research study [43], which considers information dimension as important for hard copy reports users. Notably, the accessibility dimension is excluded, unlike in other models shown in Table 1 because accessibility is the concept usually treated in the online environment, not offline where the issue of hard copy reports is included. The Product and Service Performance for Information Quality (PSP/IQ) model shown on the third row of Table 1 consolidates the high quality dimensions into four quadrants—sound, dependable, useful, and usable information—and the quadrants include 17 specific attributes. The quadrants represent IQ aspects relevant to IQ improvement decisions [20]. In the fourth row of Table 1, the Wang and Strong model applies an empirical market research approach for collecting data from information consumers to determine important dimensions [20].

All these models proposed a set of categories that group the attributes of IQ into smaller subgroups. For example, Wang and Strong [38] grouped the IQ attributes into four categories: intrinsic IQ, contextual IQ, representational IQ, and accessibility IQ. Intrinsic IQ includes the attributes of accuracy, believability, reputation, and objectivity. In the same way, contextual IQ includes value-added, relevance, completeness, timeliness, and appropriate amount. The PSP/IQ model, whose focus is on product or service delivery and on how quality can be assessed by specifications or customer expectations, employs the quality aspects relevant to delivering better quality information. Further details of the PSP/IQ model and its development process can be found in [14].

In this study, though dividing the attributes into such sub-groupings is not required, the attributes need to be modified to suit the research direction, headed toward signage design. This is because the above-mentioned models mainly deal with the issue of high quality attributes for improving the quality of products or services in the field of business administration or for the purpose of improving computer-generated information systems. Signage design, discussed in this study, has traditionally focused on minimizing time and effort for users to interpret informational signs and reducing the user's mental workload and frustration. To modify the attributes to be suitable for this study, the open-card-sorting method was performed with five participants—graduate students (three with master's degrees and two doctoral candidates) majoring in information design. Further in-depth interviews were also conducted, again with the card-sorting process, with a professor with expertise in information design. Participants were given cards on which high quality information attributes were written.

Table 1 Comparison of models of information quality

Name of model	Author (s)	Attributes		
Dimensionality of the concept of information	Zmud [43]	Accurate	Reliable/timely	Reasonable
		Factual	Arrangement	
		Quantity	Readable	
Attributes of high quality information	idX group (adapted from Wang, Richard Y. and Strong) [9]	Accessibility	Conciseness	Timeliness
		Appropriateness	Errorlessness	Security
		Attractiveness	Interpretability	Understandability
		Credibility	Objectivity	Valuableness
		Completeness	Relevance	
PSP/IQ model (Product and Service Performance/Information Quality)	Kahn, Strong and Wang [13, 14]	Concise Representation	Relevancy	Ease of manipulation
		Completeness	Understandability	Reputation
		Consistent Representation	Interpretability	Value-Added
		Timeliness	Objectivity	Free-of-Error
		Security	Believability	
		Appropriate Amount	Accessibility	
Dimensions of Information Quality	Wang and Strong [38]	Accuracy	Value-Added	Format
		Objectivity	Timeliness	Coherence
		Believability	Completeness	Compatibility
		Reputation	Amount of information	Accessibility
		Relevancy	Interpretability	Access security
Six Quality Metrics	Zhu and Gauch [42]	Currency	Information-to-noise ratio	Popularity
		Availability	Authority	Cohesiveness

The participants were responsible for creating a new group of the attributes to be available for signage information design and then in-depth interviews were conducted to investigate their opinions. At the start of the card-sorting process, the attributes recommended by the idX group [9] were adapted as the group's diverse expertise originates from its work in information design (see second row of Table 1). The idX group's model includes 14 attributes related to high quality information: accessibility, appropriateness, attractiveness, credibility, completeness, conciseness, errorlessness interpretability, objectivity, relevance, timeliness, security, understandability, and valuableness.

The study resultantly extracted nine attributes applicable for the theme of signage information design: *accessibility*, *appropriateness*, *attractiveness*, *completeness*, *lack of errors*, *interpretability*, *objectivity*, *relevance*, and *understandability*. Accessibility, which has mainly been considered a value for online information, is included because it can be meaningful for sign information if one tries to paraphrase the concept of accessibility into that of "speed of thought." To do this, for example, the survey question for measuring accessibility is deliberately stated as, "How long did you take to recognize this as a restroom sign?" (see fourth row of Table 3).

The other five attributes—timeliness, security, credibility, conciseness, and valuableness—are excluded because they tend to be treated as important primarily for information design in education, research, science, or products and services. Because signage is used to provide information for guiding, regulating, and warning purposes in a static environment or a system, it is meaningless to measure timeliness, which usually works in a dynamic situation wherein a decision-maker's preferences change over time. Concerning security, this commonly tends to be related to specific information technologies whose forms are most often generated by computer systems. In connection with credibility, the components generally include trustworthiness or expertise of sources, which tend to be subjectively perceived. The restroom signs are aiming to represent relatively objective characteristics of the message for public use rather than the use at individual level. Thus, credibility does not need to be involved for this study. In a similar vein, conciseness was excluded. Value and timeliness are related to contextual relevance [36]. That is, measuring those values is reliant on the particular state or

Table 2 Questionnaire construction

Questionnaires		Questionnaire item construction	Question types
Phase 1	Subjects' generic attitude toward each restroom sign	9 items (about attributes of high quality information)	6-point Likert scale
		1 item (about attributes of high quality information)	Open-ended question
Phase 2	Subjects' comparative attitude toward restroom signs	9 items (about attributes of high quality information)	Nominal scale (ex: most and least)
Phase 3	Demographic questions	Gender, age, education, occupation, nationality	Nominal-polytomous

situation surrounding a sign. The survey conducted in this research examines respondents' attitudes and responses mainly concerning each restroom sign without presenting any clues for the respondents to perceive the atmosphere surrounding restrooms. Value and timeliness were therefore excluded.

4 Relationship between high quality information and information design

4.1 Survey construction and stimuli design

Adequate questionnaire construction is critical for the success of a survey. The aim of this survey is to examine the relationship between universal information design and cultural context-oriented information design and the nine attributes of high quality information. To achieve this, the questionnaires were designed considering the following three points of view. First, they were divided into three phases to reduce respondents' mental fatigue because the large amount of questions can be tiring (see phases 1, 2, and 3 in Table 2). To reduce the respondents' psychological burden when responding, the question sequence was designed to flow from more general to more specific (see questions according to the order from the first item of "interpretable" to the last item of "errorless" in Table 3). The open-ended question was also offered after the 6-point Likert scale question is completed. This is not only to correctly interpret the result of answers through the 6-point Likert scale question, but also to screen the results of responses of those questions (see Table 2).

Table 3 Questions and six ordered response levels of subjects' general attitude toward each restroom sign

Interpretable	Not at all, hardly, confused, guessable, certainly, definitely
Could you recognize this as a sign for restroom?	
Accessible	No idea at all, couldn't, took long time, took a little, took a moment, right away
How long did you take to recognize this as a restroom sign?	
Appropriate	Very inappropriate, inappropriate, unacceptable, acceptable, appropriate, very appropriate
Do you think this is appropriate for a restroom signage? (Is this reasonable to be used for a restroom signage in your opinion?)	
Objective	Highly, nonobjective, very, nonobjective, nonobjective, objective, very objective, highly objective
Is this sign found objective to you? (Should this be generally used?)	
Attractive	Strongly disagree, disagree, undecided, agree, strongly agree, very strongly agree
Do you find this sign attractive?	
Relevant	Never, not, little, a little, some, very
Do you find this sign is related to the Hawaiian* identity? (To what extent do you think this sign related to Hawaii?)	
Complete	Never, not, little, a little, some, very
Do you find this sign contains meaning of restroom and Hawaiian* identity at the same time? (Does it show it is Hawaiian restroom?)	
Understandable	Never, not, little, a little, some, very
Does it make you understand that it is restroom?	
Errorless	Frequently, often, sometimes, seldom, rarely, never
How much error would be occurring to find restroom with this signage?	
Could you figure out any positive or negative characteristics from this signage (as a restroom signage)?	Open-ended question on Positive, Open-ended question on Negative

* Cultural background: Scottish, Hawaiian, Middle Eastern, Belgian, Hindu, Apple Company, the Science Fiction Museum, South American, Korean, Taiwanese, Universality

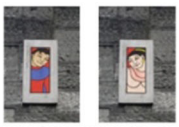
Code No. & Cultural context and its meaning	Original signs	Modified design deliverables
A-01 Restroom Signs in a Storehouse at Foulis, Scotland. In the countryside of Scotland, roosters stand for men and chicks women.		
A-02 Restroom Signs in a restaurant in Hawaii. This sign borrows the images of traditional Hawaiian costumes, Aloha shirts.		
A-03 Restroom Signs in a restaurant in Oman. This sign borrows the images of traditional Arabian costumes. Historically, Arab men wear Turban and Arab women harem hat with a veil.		
A-04 Restroom Signs in a restaurant in Budapest, Hungary. But its origin was derived from the statue of Cheap pee in Belgium.		
A-05 Restroom Signs in Hinduism Island in Tailand. It based on the symbolic meaning of Monkey God in Hinduism. The Monkey god is worshiped as a symbol of physical strength.		
A-06 Restroom signs for Apple Headquarter. Early models of Apple Macintosh displayed pixel images.		
A-07 Restroom signs for Science Fiction Museum in Seattle, USA. These signs borrow the images of aliens, namely Martian for the Man and Venusian for the Woman.		
A-08 Restroom Signs for areas related to South America in Disney Sea, Japan. This sign borrows the images of traditional South American (including Mexico) costume.		
A-09 Restroom Sign in a Korean restaurant in NY City. This sign borrows the images of traditional Korean costumes.		
A-10 Restroom Sign in a restaurant in Taiwan. In Taiwan, the chines character 母 means woman and 公 Man.		
A-11 Restroom ADA signs. The signs are commonly used in the world for restroom sign.		

Fig. 2 Stimuli (original and standardized signs)

Table 2 shows the questionnaires composed of three phases and the each item's construction. As shown in Fig. 2, the survey used 11 different restroom signs (A01–A11) as stimuli. Historically, restrooms are the representative facilities of culturally reflective environments and contain the history and art of humanity's most ubiquitous activity. For all travelers, one of the most commonly encountered pieces of information in the glocalization age is the restroom sign. Therefore, it was considered that identification, which is the representative function of the information of restroom signs, can fit the purpose of this study, which is to examine the values of cultural context-oriented information design in the information design area for the glocalization age.

Ten pieces (A01–A10) are cultural context-oriented, and A11 is universal signage widely used. A05, A07, and A09 were samples the first author found in use in local environments, and A03 was taken in the Suwon Toilet Museum in South Korea, the world's first toilet theme park. The rest were found on the Internet. The original signs were considered inappropriate for eliciting participants' accurate responses because of their irregular forms, materials, scales, and backgrounds. Thus, the actual stimuli's background images and scales are standardized, while the fundamental parts (unique visual DNA) are preserved as original. Figure 2 provides the location, cultural background, and meaning of each sign, along with the code number.

4.2 Composing the questionnaire and stimuli

This study adopted the attributes of high quality information extracted from those recommended by the idX group. The survey extracted respondents' attitudes and responses in those nine selected attributes.

The questionnaire is composed of two stages. The first stage asks about how the respondents perceive each restroom sign (Fig. 2) in accordance with the nine high quality information attributes. It is to be answered through 6-point Likert scales and an open-ended question at the end. The second stage shows each sign and lets respondents indicate the priority order among the 11 signs (Fig. 2) based on each high quality information attribute in a relative manner. For example, for objectivity, they need to rank them from most objective to least objective.

The respondents' answers for the first phase of the survey questions were measured utilizing a 6-point Likert scale. Although a 5-point Likert scale format is typically used, an even number of ratings was preferred to have respondents commit to either the positive or negative end of the scale [3].

Table 3 shows the questions related to the attributes of high quality information, with six ordered response levels and the open-ended question. Table 4 shows the questions and the nominal scale of subjects' comparative attitudes toward the restroom signs (Table 5).

Table 4 Questions and nominal scale of subjects' comparative attitude toward 11 restroom signs

Interpretable
Choose most difficult and easiest ones for understanding as a restroom sign
Most difficult to interpret/easiest to interpret
Accessible
Choose longest time-taken and shortest time-taken ones for understanding as a restroom sign
Longest time-taken/shortest time-taken
Appropriate
Choose most and least appropriate ones for understanding as a restroom sign. (Most and least reasonable to be used for a restroom signage in your opinion)
Most inappropriate/most appropriate
Objective
Choose most and least objective signs. (Most and least generally usable for a restroom signage in your opinion)
Least objective/most objective
Attractive
Choose most and least attractive ones
Least attractive/most attractive
Relevant
Choose most and least relevant ones for restroom sign
Least relevant/most relevant
Complete
Choose most and least recommendable ones for international use
Least recommendable/most recommendable
Understandable
Choose most and least understandable ones as a restroom sign
Least understandable/most understandable
Errorless
Choose ones that shows most and least probability of mistake
Least probable/most probable

5 Analyses

5.1 Subjects

Forty-five males and 47 females (total 92) participated in this survey, which was sent by e-mail. To avoid negative influence of order effect, three types of questionnaires configured with different order of the stimuli items were distributed. The respondents were from 19 different countries, including South Korea and the United States. They included 50 South Koreans and 10 of other nationalities staying in South Korea, and the other 32 non-South

Table 5 Demographic characteristics

	Frequency	Percent
Gender		
Male	45	48.9
Female	47	51.1
Total	92	100.0
Age		
16–19	1	1.1
20–24	45	48.9
25–29	24	26.1
30–34	10	10.9
35–39	6	6.5
40–44	4	4.3
45–49	1	1.1
50–54	1	1.1
Total	92	100.0
Nationality		
Korean	50	54.3
American	12	13.0
Australian	6	6.5
Singaporean	1	1.1
Malaysian	3	3.3
Indian	2	2.2
Pilipino	1	1.1
South African	1	1.1
Vietnamese	1	1.1
German	1	1.1
New Zealander	1	1.1
Canadian	2	2.2
Irish	1	1.1
Pakistani	1	1.1
Iran	1	1.1
China	2	2.2
Nepal	1	1.1
Indonesia	4	4.3
Peruvian	1	1.1
Total	92	100.0
Occupation		
Student	69	75.0
Professional/technical	18	19.6
Officials	1	1.1
Others	4	4.3
Total	92	100.0
Education		
Some high School	1	1.1
High school	36	39.1
College credit	1	1.1
Bachelor's Degree	23	25.0
Master's Degree	27	29.3
Doctorate Degree	4	4.3
Total	92	100.0
Countries visited		
No other country except for my country	25	27.2
1–2 countries	27	29.3
3–5 countries	12	13.0
6–10 countries	8	8.7
10–20 countries	13	14.1
More 21	7	7.6
Total	92	100.0

Koreans resided in their home countries. Ages of respondents ranged between 16 and 54, and the highest ratio was in their 20 s (75 % of all respondents), followed by 30, 40, and 50 s. Of them, 75 % were college students and 20 % were professionals.

5.2 Reliability analysis on survey responses

Reliability analysis for the survey results was conducted to verify how well respondents understood each question item and how reliably they answered them. This analysis is an important part of this study because many questions (18) with 11 kinds of experimental stimuli were contained in the questionnaire. This study used Cronbach's Alpha to analyze reliability. The method is statistically proven through the statistical checking of internal consistency. Cronbach's Alpha came out as high as 0.810 ($0.8 \leq \alpha < 0.9$) due to the responses for all items relevant to attributes of high quality information (see bottom row of Table 6). According to the common rule of thumb for describing internal consistency using Cronbach's Alpha, if the value falls within the range of 0.8–0.9, the internal consistency is "Good"[2] [8, 26]. This result thus displays that the respondents understood each question item well and response results are reliable.

5.3 Interrelationships among attributes of high quality information

Correlation analysis is useful for determining the direction (positive/negative) and strength of a relationship between two variables. The nine selected attributes of high quality information were evaluated to understand the degree of mutual influence on each other. This study used correlation analysis with a Pearson correlation coefficient to verify

[2] Excellent: $\alpha \geq 0.9$, Good: $0.8 \leq \alpha < 0.9$, Acceptable: $0.7 \leq \alpha < 0.8$, Questionable: $0.6 \leq \alpha < 0.7$, Poor: $0.5 \leq \alpha < 0.6$, Unacceptable: $\alpha < 0.5$.

Table 6 Question items and reliability of responses (case: A01 restroom sign)

Questions	Mean SD	Cronbach's Alpha if item deleted
Interpretable	2.89	0.774
Could you recognize this as a sign for restroom?	1.638	
Accessible	3.58	0.770
How long did you take to recognize this as a restroom sign?	1.600	
Appropriate	2.70	0.763
Do you think this is appropriate for a restroom signage?	1.267	
Objective	2.61	0.778
Is this sign found objective to you?	1.057	
Attractive	3.34	0.822
Do you find this sign attractive?	1.029	
Relevant	2.40	0.827
Do you find this sign is related to the Scottish* identity?	1.015	
Complete	2.27	0.824
Do you find this sign contains meaning of restroom and Scottish* identity at the same time?	1.015	
Understandable	3.14	0.759
Does it make you understand that it is restroom?	1.370	
Errorless	2.73	0.782
How much error would be occurring to find restroom with this signage?	1.159	

Cronbach's Alpha = 0.810, $N = 92$

* Cultural background: Scottish, Hawaiian, Middle Eastern, Belgian, Hindu, Apple Company, the Science Fiction Museum, South American, Korean, Taiwanese, Universality

interrelationships among the nine attributes. Each attribute indicates a significant correlation at the $p < 0.01$ level (see bottom of Table 7). The very strongly matched (0.81–1.0) attributes in a positive relationship between two variables are "interpretable and accessible/understandable" and "relevant and complete." The next highest positive relationships (0.51–0.80) are "interpretable and appropriate/errorless," "accessible and appropriate/objective/understandable/errorless," "appropriate and objective/attractive/complete/understandable/errorless," "objective and attractive/complete/errorless," "attractive and relevant/complete/errorless," "relevant and errorless," "complete and understandable/errorless," and "understandable and errorless". The rest correlate positively (0.31–0.5) to each other. Those that were scarcely related (0.00–0.3) were not found, and there were also no attributes in the negative direction within a negative range. Thus, the results demonstrate that the nine attributes adapted from the idX group are appropriate for this study.

5.4 Ratings of restroom sign designs

Figures 3 and 4 show the mean values and standard deviations that demonstrate a link between the nine high quality information attributes and 11 restroom signs. These help to understand what are recognized as high quality information cases among the 11 restroom signs (A01–A11). While most of the respondents chose A02, A11, A09, and A08 as having higher quality information design, A01, A10, A06, and A05 were not seen as such. A02 was rated as having the highest quality information design. This was because it is not only highly creative and easy to recognize as a restroom sign, but it also takes advantage of existing universal signage (see row A02 of Table 10). The second highest was A11, which is a representative universal information design case (see row A11 of Table 10).

One notable point is that A02 earned a higher score than A11 which is a universal information design. This result indicates that information designers can solve design problems more effectively than with universal design approaches. Especially concerning the standard deviation, A11 has much wider variations than A02. This is clear evidence that the respondents' likes and dislikes varied for A11. As a result, it is highly probable that types of A02 need to be considered as a new alternative that might serve as prototypical high quality information design. As with A11, A09, and A08 received high marks as high quality information. Among all the experimental signs, A09, which has a Korean cultural context, was ranked third highest, and this result is probably related to the fact that 53 % of the respondents were South Koreans and that 10 of the 42 non-South Koreans were staying in South Korea (see Figs. 3 and 4). However, it is worth noting that the respondents answered that its pleasing, bright colors are attractive and that it is culturally appropriate (see rows A09 of Table 10).

From these responses, it can be foreseen that applying appropriate colors can help use high quality information design (also see the rows of A02, A05, and A08). At this point, information designers should not overlook that color is used in design to attract attention, indicate meaning, and enhance aesthetics, even in restroom sign design.

This study utilized a paired t test to find whether the difference of average values of cultural context-oriented information design and universal information design is statistically meaningful. Table 8 shows the results of the paired t test between the cultural context-oriented restroom signs (A01, A02, A03, A04, A05, A06, A07, A08, A09, A10) and universal restroom sign (A11). It shows that seven pairs' matching specimens' significant probabilities

Table 7 Dimension-level correlations

		Mean_ Interpretable_ A01_A11	Mean_ Accessible_ A01_A11	Mean_ Appropriate_ A01_A11	Mean_ Objective_ A01_A11	Mean_ Attractive_ A01_A11	Mean_ Relevant_ A01_A11	Mean_ Complete_ A01_A11	Mean_ Understandable_ A01_A11	Mean_ Errorless_ A01_A11
Mean_Interpretable_A01_A11	Pearson correlation	1								
	Sig. (2-tailed)									
	N	92								
Mean_Accessible_A01_A11	Pearson correlation	.810**	1							
	Sig. (2-tailed)	.000								
	N	92	92							
Mean_Appropriate_A01_A11	Pearson correlation	.797**	.746**	1						
	Sig, (2-tailed)	.000	.000							
	N	92	92	92						
Mean_Objective_A01_A11	Pearson correlation	.492**	.536**	.611**	1					
	Sig. (2-tailed)	.000	.000	.000						
	N	92	92	92	92					
Mean_Attractive_A01_A11	Pearson correlation	.412**	.463**	.605**	.597**	1				
	Sig, (2-tailed)	.000	.000	.000	.000					
	N	92	92	92	92	92				
Mean_Relevant_A01_A11	Pearson correlation	385**	.357**	.538**	486**	.602**	1			
	Sig. (2-tailed)	.000	.000	.000	.000	.000				
	N	92	92	92	92	92	92			
Mean_Complete_A01_A11	Pearson correlation	430**	.441**	.632**	.530**	.620**	.850**	1		
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000			
	N	92	92	92	92	92	92	92		
Mean_Understandable_A01_A11	Pearson correlation	.821**	.744**	.792**	.457**	.435**	.492**	.584**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		
	N	92	92	92	92	92	92	92	92	
Mean_Errorless_A01_A11	Pearson correlation	.690**	.679**	.709**	.543**	.532**	500**	.576**	.681**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	
	N	92	92	92	92	92	92	92	92	92

** Correlation is significant at the 0.01 level (2-tailed)

Fig. 3 Ratings of restroom signs within total respondents ($n = 92$)

Total (n=92)	Mean	Std. D.
Mean_A01	1.5000	.71867
Mean_A02	3.4565	.90679
Mean_A03	2.7826	.95878
Mean_A04	2.5435	1.34584
Mean_A05	2.0761	.91668
Mean_A06	2.0109	.83198
Mean_A07	2.5543	1.16132
Mean_A08	2.8913	1.04257
Mean_A09	3.2283	1.10048
Mean_A10	1.5435	.71734
Mean_A11	3.2826	1.47749

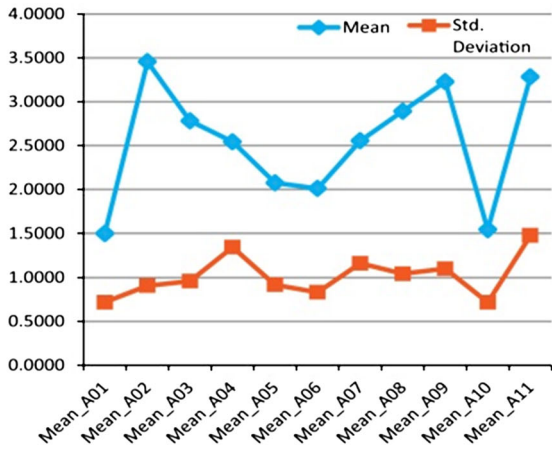
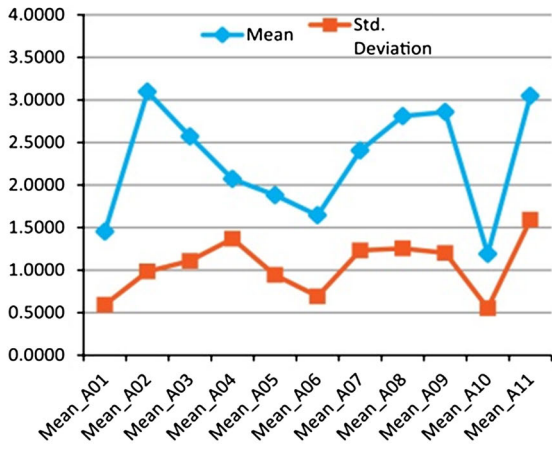


Fig. 4 Ratings of restroom signs within foreign respondents ($n = 42$)

Foreigner (n=42)	Mean	Std. D.
Mean_A01	1.4524	.59274
Mean_A02	3.0952	.98301
Mean_A03	2.5714	1.10747
Mean_A04	2.0714	1.36851
Mean_A05	1.8810	.94230
Mean_A06	1.6429	.69217
Mean_A07	2.4048	1.23089
Mean_A08	2.8095	1.25403
Mean_A09	2.8571	1.20104
Mean_A10	1.1905	.55163
Mean_A11	3.0476	1.59194



were below 0.05 and that three pairs' probabilities were over 0.05 (see right-hand column of Table 8). This means all of seven pairs' (A01 and A11, A02 and A11, A03 and A11, A04 and A11, A05 and A11, A06 and A11, A07 and A11, and A10 and A11) differences of average values were statistically meaningful, with a 95 % reliability level. It was therefore concluded that cultural context-oriented information design and universal design markedly differ regarding interrelation of the attributes of high quality information.

Figure 5 presents descriptive statistics of each of the 11 experimental stimuli and a matrix between means and standard deviations. As stated above, the majority of respondents selected A02 as having the highest quality information design, followed by A11 and A09. Although A11 (universal information design case) is in the mean value result perceived as having high quality information design, the standard deviation is extremely large, which explains that respondents' likes and dislikes vary, as mentioned before. The respondent who rated A11 extremely negatively described it as boring, unattractive, and uninteresting (see row A11 of Table 10). Evidently, the universal design concept might not always be recognized as a correct answer. Contrastingly, for A02, respondents' likes and dislikes vary comparatively little, which implies the needs of a differentiated information design method by combining advantages of both culturally and universally oriented approaches. This method was named the "Goldilocksical information design" method. The name Goldilocks comes from the fairy tale, *The Story of the Three Bears*. Extracted from the story setting, the so-called Goldilocks principle means pursuing neither too much nor too little, but "just right," and is commonly used today in academic fields such as economics, astronomy, biology, and pedagogy. For example, in astronomy, a habitable or life zone is called a Goldilocks region because it is an area of space in which a planet is just the right distance from its home star so that its surface is neither too hot nor too cold to support life.

5.5 Ratings of restroom sign designs according to each attribute of high quality information

Table 9 shows the priority order of the 11 restroom signs according to the attributes of high quality information. Figure 6 is a visual depiction of Table 9, distinguishing the two highest and lowest priorities. Figure 7 is also the result of the two highest and lowest priorities of each attribute. Figure 6, however, results from the question with a 6-point Likert scale (Strongly disagree, Disagree, Disagree somewhat, Undecided, Agree somewhat, Agree, Strongly agree) for phase 1. Figure 7 shows the responses of the questions with a nominal scale (e.g., most difficult, easiest) for phase 2 (see Table 2). Comparing these two figures, the response results are similar in most cases except those for appropriateness, objectivity, attractiveness, and relevance. A11 (universal information design case) received the highest rating in most cases of high quality information attributes. For cultural context-oriented information design cases, A02 and A04 ranked highly in most attributes in both Figs. 6 and 7. A09 also received a relatively high score for the attributes of attractiveness and relevance.

A04 received a high rating in eight attributes (see Fig. 7), but was comparatively low in the average of the total of nine attributes' ratings (Fig. 5). This is because each respondent's attitude toward it differed. It is possible to assume that the images of naked children in A04 can be interpreted as controversial (see positive and negative row of A04 in Table 10). In line with this thinking, it can be explained why it received relatively positive responses for appropriateness, objectivity, and relevance regarding the question of nominal scales in Fig. 7. At least what is equally clear is that both A04 and A09 are strong in terms of attractiveness and relevance.

A10 with verbal language (Chinese) and A01 with animal image (chicken) are reviewed as very poor quality information cases. It can be recognized that the way of independently using verbal language for signage design is a poor scheme. A10, A06, and A11 ranked poorly for attractiveness. Conspicuous is that although A11 was highly ranked in most cases, it is vulnerable in attractiveness.

5.6 Results of evaluation on the 11 stimuli

Table 10 summarizes respondents' subjective evaluations of each sign. This is used for explaining and interpreting the phenomenon occurring in Figs. 5, 6 and 7. Although there was a wide range in respondents' responses, only the relatively meaningful details are shown in Table 10 in summary. Conclusions that can be drawn from the results of subjective evaluation on each sign are as follows.

Apart from the nine attributes of high quality information mentioned in the previous sections, there were several design conditions the respondents commonly chose as positive cases in terms of high quality information.

First, it might be able to stimulate human emotion in a positive direction (for A01, A02, A03, A04, A05, A06, A07, A08, and A09). For example, it needs to be interesting, funny, humorous, charming, or artistic. Second, it might be able to enable people to properly reflect cultural identity and, at the same time, the result of reflecting the cultural identity might be attractive to a user of a different cultural background (for A02, A07, A08, A09, and A10). Third, it might be treated as an aesthetically creative or innovative object beyond the universal aspects (for A02, A05, A06, A07, and A08).

The results of the subjective evaluation on each sign also provide several conditions wherein the respondents assessed the information signs as cases of poor information. The conditions are closely linked with the following. First, it might cause users from different cultures confusion or frustration due to excessive metaphorical expression semantically, which is only understandable for those of the same cultural context concerning the expression (A01, A05, and A10). Second, it might be confrontational or offensive semantically in many contexts. For A01, "chick" can be considered pejorative, or at the very least demeaning. For A04, the children's naked images can be quite disturbing. Third, it might not be creative but rather too commonplace (A11). Fourth, it might be stereotypical with preconceptions derived from the past, which might not be able to draw upon or reflect contemporary phenomena (A03, A09, and A11). For instance, women do not necessarily need to be portrayed in dresses on restroom signs. In South Korea these days, in a similar vein, few women wear the *hanbok* traditional Korean dress and use a *binyeo*—a traditional Korean ornamental hairpin (A09). Last, it might not be able to create any visual aesthetics because of its neutral color scheme (A03, A04, A10, and A11). Therefore, once again, it is necessary to understand that color plays an important role in attracting attention, denoting meaning, and enhancing aesthetics.

6 Potential for cultural context-oriented information design

Some of the key findings can help with shaping information design guidelines. The similar issues commonly referred to in both positive and negative conditions concerning high quality information are as follows (see Table 10).

First, the degree of emotional stimulation on human sensibilities, such as joy, pleasure, boredom, and lack of

Table 8 Paired samples test (A01, A02, A03, A04, A05, A06, A07, A08, A09, A10 versus A10)

		Paired difference					*t*	*df*	Sig. (2-tailed)
		Mean	SD	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
Pair 1	Mean_A01–Mean_A11	−1.78261	1.59550	.16634	−2.11303	−1.45219	−10.716	91	.000
Pair 2	Mean_A02–Mean_A11	.17391	1.55915	.16255	−.14898	.49680	1.070	91	.288
Pair 3	Mean_A03–Mean_A11	−.50000	1.68705	.17589	−.84938	−.15062	−2.843	91	.006
Pair 4	Mean_A04–Mean_A11	−.73913	1.84492	.19235	−1.12120	−.35706	−3.843	91	.000
Pair 5	Mean_A05–Mean_A11	−1.20652	1.74493	.18192	−1.56789	−.84516	−6.632	91	.000
Pair 6	Mean_AO6–Mean_A11	−1.27174	1.61792	.16868	−1.60680	−.93668	−7.539	91	.000
Pair 7	Mean_A07–Mean_A11	−.72826	1.84035	.19187	−1.10939	−.34714	−3.796	91	.000
Pair 8	Mean_A08–Mean_A11	−.39130	1.67041	.17415	−.73724	−.04537	−2.247	91	.027
Pair 9	Mean_A09–Mean_A11	−.05435	1.60606	.16744	−.38695	.27826	−.325	91	.746
Pair 10	Mean_A10–Mean_A11	−1.73913	1.54685	.16127	−2,05947	−1.41879	−10.784	91	.000

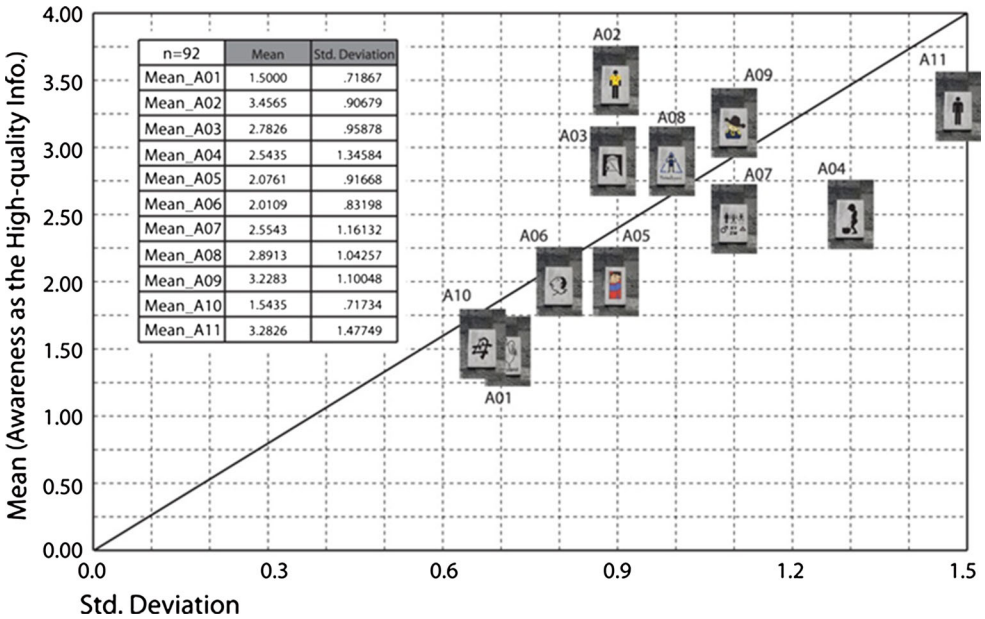


Fig. 5 Reltion matrix of information design priority and standard deviation of answered average

interest, might play an important role in the decision-making process for determining whether information is adequate or inadequate. Information designers therefore need to use positive emotion trigger stimuli. These include anything that causes pleasure or evokes a positive emotional response. Negative emotion that triggers stimuli, which include anything that causes pain, sorrow, anger, or evokes other negative emotional responses, should not be associated.

Second, one of the crucial variables to classify for information to be adequate or inadequate is whether the degree of reflecting cultural identity is appropriate. Information designers should, if possible, reflect one of the unique factors of cultural significance of a specific culture for visualizing information and create results attractive to users from different cultures. Here, excessive application of semantic metaphors in adapting the cultural significance for information visualization should be minimized to the extent possible for users from different cultural contexts.

Last, the degree of aesthetically creative expression of information might be a factor for determining whether the information is adequate or inadequate. The general visualization method of universally stereotyped information design that usually displays high figure-ground contrast and simple iconic representation has advantages for typically increasing user accessibility. It will, however, occasionally cause lack of aesthetics in information. Aesthetics play an important role in how information design meets user needs.

Table 9 Mean and standard deviation of restroom information design according to each attribute of high quality

Interpretable	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	2.93	5.07	3.90	5.61	3.20	3.45	4.01	4.54	4.70	2.36	5.88
SD	1.656	.899	1.241	.662	1.216	1.133	1.464	1.199	.958	1.387	.574
Accessible	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	3.59	5.59	4.37	5.79	3.90	3.90	4.45	4.97	5.12	2.80	5.98
SD	1.584	.698	1.211	.504	1.258	1.258	1.287	1.114	.993	1.743	.147
Appropriate	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	2.73	4.72	3.86	4.58	3.32	3.40	3.53	4.27	4.30	2.28	5.70
SD	1.268	.894	1.001	1.454	1.016	.984	1.386	1.060	1.003	1.113	.691
Objective	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	2.61	4.24	3.49	4.49	3.25	3.25	3.45	3.98	3.80	2.29	5.30
SD	1.048	1.042	1.064	1.311	1.012	1.001	1.235	.937	1.019	1.144	1.211
Attractive	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	3.35	4.07	3.65	3.87	3.38	3.07	3.23	3.84	4.15	2.58	3.67
SD	1.026	.823	1.063	1.521	1.108	1.184	1.384	1.092	.876	1.141	1.392
Relevant	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	2.39	4.68	4.86	2.82	2.83	2.23	3.81	3.64	4.89	2.80	5.18
SD	1.005	1.079	.989	1.460	1.210	1.049	1.491	1.371	1.346	1.353	1.366
Complete	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	2.26	4.51	4.11	2.86	2.73	2.84	3.79	3.52	4.49	2.97	5.41
SD	1.004	1.064	1.288	1.457	1.178	1.312	1.426	1.305	1.387	1.586	.985
Understandable	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	3.16	4.99	3.84	5.58	3.26	3.36	4.07	4.42	4.46	2.53	5.77
SD	1.361	.896	1.207	.759	1.221	1.135	1.444	1.260	1.073	1.346	.613
Errorless	A-01	A-02	A-03	A-04	A-05	A-06	A-07	A-08	A-09	A-10	A-11
Mean	2.74	4.79	3.71	5.42	3.19	3.47	4.07	4.42	4.59	2.30	5.77
SD	1.153	.908	1.271	.867	1.374	1.362	1.459	1.303	1.174	1.264	3.019

Aesthetically good information design is more effective at fostering positive attitudes than unaesthetic, and makes users more tolerant of design problems. Such positive relationships with information design might evoke feelings of affection, loyalty, and patience [22].

In addition to the discussion above, Tables 11 and 12 summarize the overall advantages and disadvantages of cultural context-oriented and universal information design. In the tables' first rows, these pros and cons are directly associated within attributes of high quality information. The advantages and disadvantages in the second rows are obtained based on the major results of the open-ended evaluation that are related within the respondents' subjective satisfaction (see also Table 10). The contents shown in Tables 11 and 12 are applied for the criteria to identify the possibilities of cultural context-oriented information design.

Cultural context-oriented information design showed advantages in attractiveness in most cases. With the exception of including a particular native verbal language or animal images, it also has advantages in interpretability, accessibility, understandability, and lack of errors. These are called cognitive aspects because cognition is a group of mental processes including attention, memory, understanding, and problem solving. Yet it revealed disadvantages in appropriateness and objectivity, which can be called the pragmatic/rational aspects of information design (see first row of Table 11).

Conversely, in the results of subjective (open-ended) evaluation, though the properties of being confusing, overdecorative, and unclear were related to the disadvantages of cultural context-oriented information design, it also showed advantages in the properties of being beautiful, attractive, interesting, culturally appropriate, creative, aesthetically pleasing, humorous, funny, and original (see second row of Table 11). From these facts, it can be argued that cultural context-oriented information design has a strongly positive impact on the properties of being attractive, interesting, humorous, and funny, which are closely associated with the human emotional experience in the process of thinking, decision making, taking action, and social relationships. Emotion is often the driving force behind motivation and positive or negative feelings. Thus, it needs to be recognized that these emotional properties

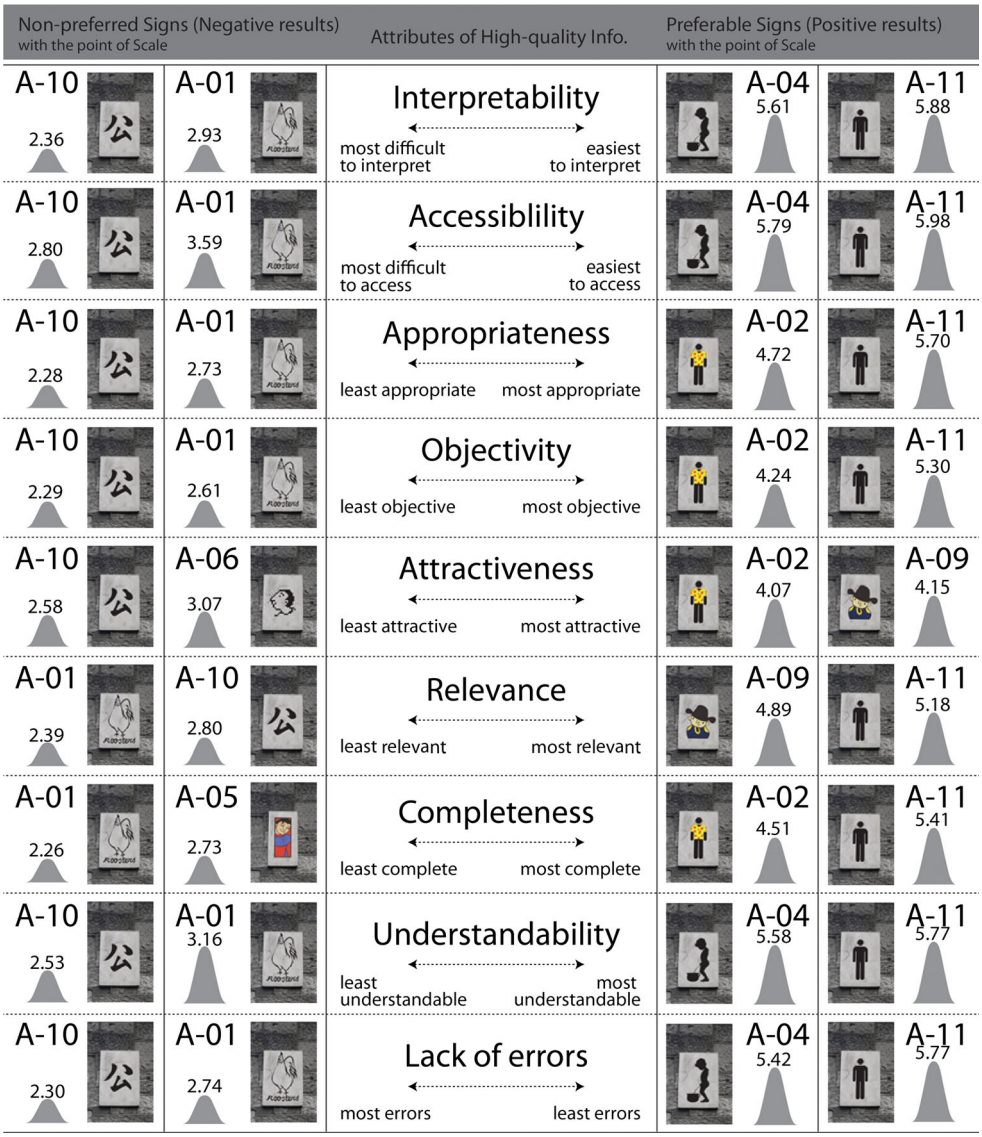


Fig. 6 Two highest and lowest priorities of each attribute regarding question with 6-point Likert scale

are as important as appropriateness and objectivity, which can be treated as pragmatic/rational aspects of information design practices as stated above.

In summary, despite the deficiencies of cultural context-oriented information design in the pragmatic/rational aspects concerning conveying meanings of information appropriately and objectively, it has a great deal of potential value in terms of the cognitive, aesthetic experience, and emotional experience aspects. Because the intensity and duration of an individual's concentration on information can be determined by the quality of the aesthetic experience, information designers need to consider the aesthetic experience aspects as leverage for making information beautiful, creative, or innovative. Additionally, the emotional experience aspects that influence users' affective domains to engage the way users react emotionally to information affect their subjective and conscious experience, which is primarily characterized by mental expressions or states.

These findings can be applied for establishing information design insight as follows. When information designers struggle with the balance between culturally sensitive and universally available information, a convergence strategy that combines the cognitive, pragmatic/rational, aesthetic experience, and emotional experience aspects might be used. In the first instance, the externally typical characteristics of universal design archetypes, such as general appearance simply described using iconic representation, may be utilized as a framework for displaying the pragmatic/rational aspects. The visually creative or differentiated factors adapted in a specific cultural identity (e.g., facial expressions, motions, gestures, costumes, traditional architecture, or culturally adapted images) can also be partially applied as a sub-scheme for implementing the

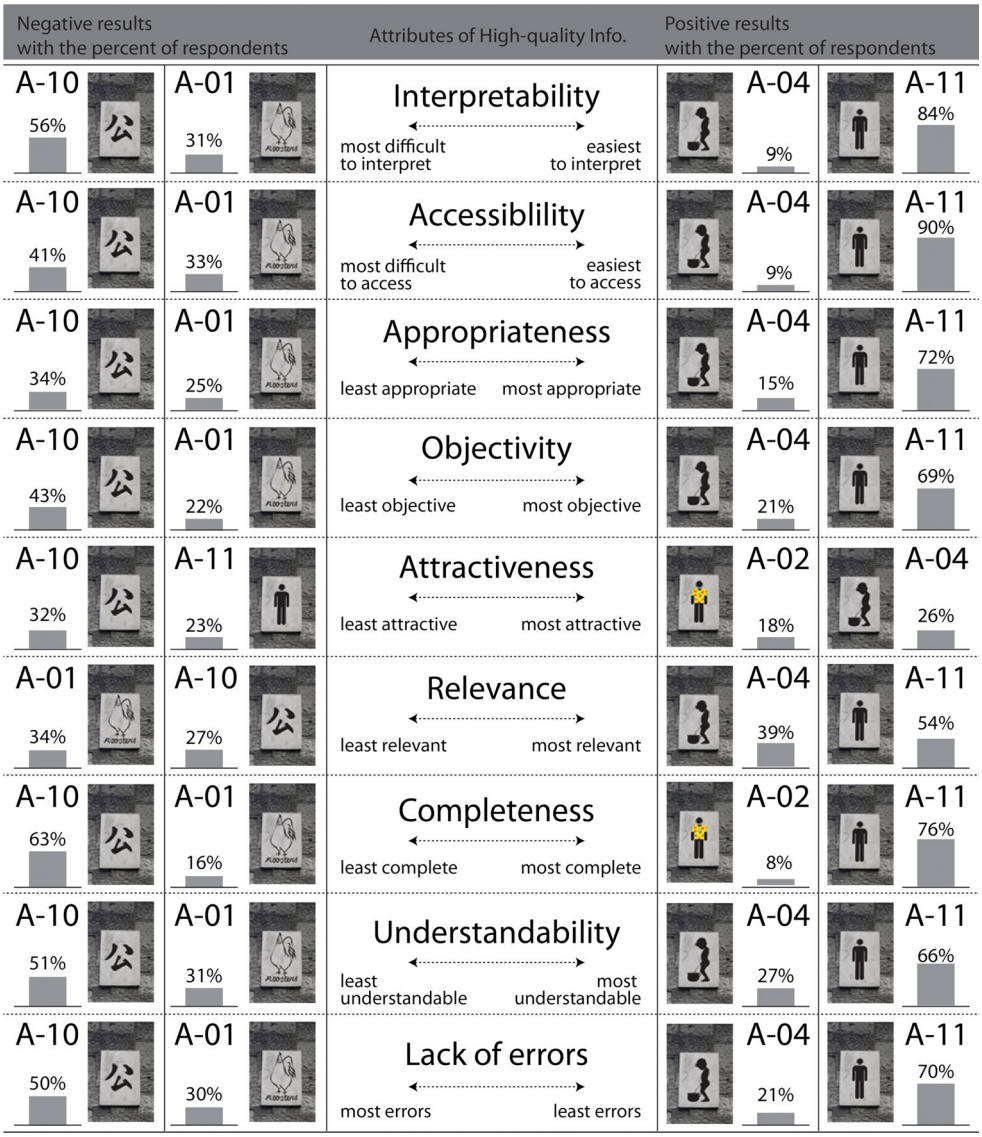


Fig. 7 Two highest and lowest priorities of each attribute regarding question with nominal scale

aesthetic experience aspects. Third, the emotional experience aspects can be added for the semantic priming effect by presenting visual cues about myriad human emotions like joy, anger, sorrow, and happiness. Last, verification is needed on whether the degree of boosting cognitive aspects that include interpretability, accessibility, understandability, and lack of errors is appropriate.

In this case, the characteristics of universal design archetypes as a pragmatic/rational aspect can be used as the "convenient lure" that lets information users easily access information because its universal features create relatively higher familiarity. The aesthetic experience aspects can also be used for presenting the hidden cultural knowledge of information design. That is, information designers can let users access the macro-level of information, which renders the big picture through considering the pragmatic/rational aspects, and the specific cultural factors can be applied as the micro-level of information that enables individuals to access information from idiosyncratic perspectives (aesthetic experience aspects). It is expected, in some cases, that one can attain better results by changing the two kinds of execution orders in a way that first considers the aesthetic experience aspects and then the pragmatic/rational aspects. Whichever of these two ways, it is important that the aesthetic experience aspects are always highlighted not as the final goal but as the part of the interim process for design. Because the cultural reality of information lies deeper than the perceptual reality of users' experiences, the reflection of aesthetic experience aspects is the final goal of information design. Issues such as accessibility or objectivity can then appear as other problems.

If the four types of aspects—cognitive, pragmatic/rational, aesthetic experience, and emotional experience—

Table 10 Major results of open-ended questions

Stimuli	Opinions	
A01	Positive	Light-hearted. Funny, Humorous, Original. Country theme
	Negative	It is a bit ugly. Not obvious
		Confusing. Unclear. Illegible
		The term "chick" can be considered pejorative, or in the very least demeaning
		I find the association with women and chickens slightly offensive
		The illustrations are not effective to bring across the message of toilets
		Where is the relation between the chick/rooster and the human or the restroom? Why exactly these animals? The word "chicks" is offensive to me
		I think there is a problem with stereotypes of gender by using these images of animals
		Some women are VERY sensitive to slang words. Chicks are baby chickens
A02	Positive	Yes, it the image shows some innovation from the usual pictogram
		It's very creative and easy to recognize as a restroom sign
		It ties in very well to Hawaiian culture
		Easily understood as it takes advantage of existing "international" signage
		Colorful illustrations that is also rich in local cultural flavors
		The addition of clothes somehow charming. Cheerful. Recognizable but with a colorful twist. Clear. Understandable. Easy to understand; Like the colors
		Humorous. Different. Bright colors are good. Easy to understand
		Very cute and bright- easy to notice
	Negative	It may be offensive to native Hawaiians to be stereotyped to Hawaiian shirts and lays
A03	Positive	The images have a nice style. Local cultural elements in the signage
	Negative	May be complicated for foreign users who do not have prior understanding of local culture
		They look like portraits—not how I commonly think of toilet signs
		Doesn't communicate "restroom" to me
		Maybe negative in some strict Islamic Middle Eastern countries (Yemen, Saudi Arabia, Iran, Iraq for example) because the woman's face needs to be completely covered
A04	Positive	Funny. Cute. Clear. Simple. Elegant. Interesting. Humorous. Attractive. Easily understood
		If it weren't children represented, then it would be offensive
	Negative	It's quite confrontational, and I don't think it will be appropriate in many contexts
		Is the nakedness acceptable in all cultures?
		Using children is not good
		Some people will find this offensive
		Very little distinction between male and female images. Both have a headdress
		The drawings aren't distinct enough unless you are from that culture
		I think both images are creepy
		Could be offensive if placed in an area frequented by children
A05	Positive	Nice imagery. Colorful. Nice colors
		Nice vibrant colors
		Interesting. Artistic. Aesthetics
	Negative	It's hard to identify as a bathroom
		It's not very attractive or creative, nor does it clearly express Hindu culture
		Didn't understand the cultural reference
		The signage is not effective to convey message of a toilet
		Too much detail, it isn't very obvious that they are monkeys
		The male sign is a little gender neutral
		The faces and clothing design on the figures made it so I didn't really know if they were male or female

Table 10 continued

Stimuli	Opinions	
A06	Positive	Cute. Historic. Meaningful. Interesting. Clever
		It's pretty creative
	Negative	The pixelation makes it difficult to see clearly
		Non-computer people might be confused
		Images don't clearly distinguish between man and woman
		Woman's face could be a man with a ponytail
		Did not get the reference to apple but understood computer reference
		Pixelated illustrations can portray unfinished artwork, poor quality of printing or crudeness in service. The boy sign isn't distinctly MALE
		Don't see a relation to restrooms
		I thought it was vaguely to do with computer graphics but made no association with Apple
A07	Positive	Witty and so creative. Ambitious, experimental design
		It's interesting, fun, and chic. Original. Appropriate
		It made me laugh
		It took me a second to understand, but when I understood I loved it
		I think people who like sci-fi would enjoy it
	Negative	Much too cluttered and busy. Too much information to digest for users. Overloaded with details. Too many images to convey information. Busy
A08	Positive	Colorful signage. Artistic
		Nice colors and clearly understandable
		Interesting. Creative. Fun
		Clearly understandable. Easy distinction between women and men
		This would be very appropriate in a Latin restaurant
	Negative	It is not attractive
		Use of a vernacular language complicates the user
A09	Positive	The bright colors are attractive. Very cute. Creative. Pretty. Clean. Understandable
		It is culturally appropriate
	Negative	Boring. Predictable. Stereotyping Misogynistic
		It's a little too cartoony
		I couldn't recognize the Hanbok (I've never seen a girl in Hanbok with a stick in her hair)
A10	Positive	Clear for someone who speaks the language
	Negative	Would have no idea if you couldn't speak Taiwanese
		Not attractive colors (just black & white). Too abstract message. Confusing
		Doesn't work at all for anyone who can't read Mandarin
		There is an expectation that the people can read Chinese characters
		I couldn't recognize the script meaning at all
		Only people familiar with this language would be able to understand
		It's only useful for someone who speaks the native language
A11	Positive	Universal. Simple. Clear. Understandable. Clean & Direct message. Common
		Highly recognizable symbols
		To me this is a universal symbol and clearly understood
	Negative	Too Boring. Not pretty. Uninteresting
		Graphic assumes traditional gendering, i.e., women wearing dresses
		Women don't necessarily wear dresses, inappropriate
		The separation of gender into two categories excludes many people who are transgender or intersex or gender queer

Table 11 Overall advantages and disadvantages: cultural context-oriented information design

	Advantages	Disadvantages
Within the Attributes of High quality Info	Attractive—in most cases	Less appropriate
	Interpretable—if it does not have native verbal language or animal images	Nonobjective
	Accessible—if it does not have native verbal language or animal images	
	Understandable—if it does not have native verbal language or animal images	
	Errorless—if it does not have native verbal language or animal images	
Within Respondents' subjective satisfaction	Beautiful	Confusing
	Attractive	Over-decorative
	Interesting	Unclear
	Culturally appropriate	
	Creative	
	Aesthetics	
	Humorous	
	Funny	
	Original	

Table 12 Overall advantages and disadvantages: universal information design

	Advantages	Disadvantages
Within the Attributes of High quality information	Interpretable—in most cases	Less attractive
	Accessible—in most cases	
	Appropriate—in terms of reasonable	
	Objective—in most cases	
	Relevant—as a universal sign	
	Understandable—in most cases	
	Errorless—in most cases	
Within Respondents' subjective satisfaction	Simple	Boring
	Clear	Uninteresting
	Direct message	Less attractive
Other	Likes and dislikes clearly varies depending on the characteristics of the individual user	

are in harmony, the results of information can be considerably striking and powerful for most users regardless of their cultural backgrounds. At the least, information design falling within certain margins between the pragmatic/rational and the aesthetic experience should be avoided because what is needed in this era should neither be too far away from, nor too close to, the concept of universal information design only or to the concept of cultural context-oriented information design alone. Such information design can be called a concept that is neither too far away from, nor too close to, something and inspires harmony as "Goldilocksical information design".

7 Conclusions

This study empirically investigated the values of cultural context-oriented information design in the information design area. To understand the relationship between cultural context-oriented information and information design, the attributes of high quality information were identified through a literature review. The open-card-sorting method and in-depth interviews were conducted to identify whether the final nine attributes of high quality information are suitable for signage information design. Through a paired *t* test in connection of the attributes, a substantial and striking difference of average values between the universal and the cultural context-oriented information design was found. The survey was also conducted to examine the relationship between the two types of information design and the nine attributes. In addition to the survey, respondents' open-ended evaluation of the designs was conducted to faithfully interpret the results of the previous survey stage and identify the properties of high quality information that is difficult to locate in the previous survey stage.

It was found that from these surveys, the attributes and properties of information design regarding restroom signs are divided into four aspects: cognitive, pragmatic/rational, aesthetic experience, and emotional experience. Each of the design approaches, cultural context-oriented and universal, also has advantages and disadvantages within these four aspects. Especially with regard to the potential value of cultural context-oriented information design, which is the main purpose of this study, the conclusions described in the following were obtained.

Even though cultural context-oriented information design is relatively poor in pragmatic/rational aspects concerning appropriate and objective conveyance of meanings of information, it has a striking value in most cases in terms of aesthetic and emotional experience. The aesthetic experience aspects are important for making information beautiful, creative, or innovative and the emotional experience aspects affect information users' subjective and conscious experience, such as in being attractive, interesting, humorous, funny, joyful, pleased, bored, or uninterested. Additionally, under some restrictive conditions, cultural context-oriented information design also has the strengths of cognitive aspects such as the attributes of interpretability, accessibility, understandability, and lack of errors. To enhance the cognitive aspects of cultural context-oriented information, information

designers may need to consider ways that harmonize the text message of, for instance, "men, women," "gentlemen, ladies," and "male, female" along with specific cultural identities.

If one wishes to combine the benefits from each advantage of cultural context-oriented information design and universal information design, it is necessary to understand that the typical features of the latter can be used as the "convenient lure" to allow information users to easily access information. Moreover, one should also consider that the aesthetic experience aspect that is one of the representative strengths of cultural context-oriented information design can be used for presenting the "hidden cultural knowledge" of information design.

These findings extend current knowledge of information design for the age of glocalization to consider Goldilocksical information design, which is neither too far from nor too near to only one situation between two extremes. It can also be argued that the greatest significance of these research results is in expanding of the role of information design, which not only concerns how to design information simultaneously considering cultural diversity and universalism, but also in what ways and to what extent can information designers maintain their role in the age of glocalization. Future work should therefore include systematic approaches and methods to establish and implement Goldilocksical information design by counterbalancing weaknesses and maximizing the virtue of cultural context-oriented information design.

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