Re-examining Cross-Cultural User Interface Design Indicators: An Empirical Study

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Abstract

Purpose: In the literature about cross-cultural interface design, there is a gap between general theories on cultural dimensions and the practice of interface design characteristics. This study investigates how Hofstede's cultural dimensions could influence user interface (UI) design, and how the existing cross-cultural UI design guidelines can be refined.

Method: Comprehensive interviews were conducted with ten Chinese and ten Dutch respondents who are specializing in the related field. Respondents first gave their own opinions on how culture dimensions could influence UI design, and then rated and commented on the existing guidelines. This was done from one dimension to another in random order.

Results: With good consistency, respondents showed agreement on how Hofstede's cultural dimension would influence UI design. Several UI design elements were elicited for each dimension. The majority of the existing guidelines were thought to be useful, but part of them need to be revised, and some of the guidelines were seen as less influential. Thus, combining the eliciting results and commenting results refined indicators were proposed for each dimension.

Conclusion: Results show that culture dimensions do matter in UI design. Respondents' opinions are in line with the existing cross-cultural UI design guidelines in many ways, but the existing guidelines should be refined to be more applicable. However, they are rather indicators instead of actual guidelines that should be strictly followed, since many other variables probably matter more than culture.

Key Words: user interface design, cross-cultural usability, cultural differences

1. Introduction

The interface of a popular app in Hong Kong which the local users think is quite OK might be seen as too busy and complicated by a European, even when the language has been set into English. Will cultural differences influence interface usability? The question has been dealt with since the term "usability" was defined. As given by ISO, Usability consists of "...the capability of the software product to enable specified users to achieve specified goals with effectiveness, productivity, safety and satisfaction in specified contexts of use…"(ISO/IEC FDIS 9126-1, cited in Clemmensen, 2010) In this definition, cultural differences may be seen as a "context of use." Hence, the influence of cultural differences on usability has been broadly studied, coming up with the term "Cross-cultural usability".

Cross-cultural usability is about making interfaces able to be effectively used throughout the world (Ford, 2005). In the field of localization or globalization, objective culture elements such as language and tangible symbols have been extensively addressed. However, in terms of subjective culture such as values and ethics, practitioners still do not clearly know how to deal with them. Several efforts have been made to study how cultural differences might influence UI design (e.g., Marcus & Gould 2000, 2002, 2009; Callahan, 2005; Reinecke 2008, 2010, 2013), and how to incorporate cultural differences in the planning phase of the design process (e.g. Smith et al., 2004).

Starting from Marcus (2000), who is seen as the pioneer to map Hofstede's cultural dimensions to cultural usability design, many studies focused on relationships between interface design and cultural differences, operationalized as cultural dimensions. Marcus' cultural UI design guidelines were seen as the most influential ones. Since then, plenty of studies either proposed other sets of cultural UI design indicators or empirically examined Marcus' guidelines (e.g. Khashman & Large, 2011, Reinecke 2008). The empirical outcomes were very contradictory, with positive as well as negative results. Nevertheless, no studies went back to the beginning and investigated how the indicators were brought up.

To complement the existing literature, this study is determined to go back to the more fundamental level, with two research question: 1) how useful are cultural UI design indicators? 2) if it is possible, how can cultural UI design indicators be refined? Comprehensive Interviews were conducted with 20 knowledgeable respondents from China and the Netherlands to elicit their opinions on how Hofstede's cultural dimensions might affect UI design and their comments on the usefulness of the existing guidelines.

The first part of the thesis will introduce the theoretical background and investigate related works. The following part shall introduce how the interviews were conducted and the data were analyzed. Results will be presented and explained by each cultural

dimension, followed by the discussion of the research, limitations and future work. This thesis ends with a general conclusion.

2. Literature Review

2.1. Usability and Culture

The most cited definition of usability was given by ISO, which consists of "…the capability of the software product to enable specified users to achieve specified goals with effectiveness, productivity, safety and satisfaction in specified contexts of use." (ISO/IEC FDIS 9126-1, cited in Clemmensen, 2010) Culture, as well, has many definitions in the literature with lack of an agreement on one definition. Nevertheless, as concluded by Ford and Kotzé (2005), most of the definitions of culture refer to it as influencing the way in which communication takes place. When we are using a computer or other products to perform tasks, it requires communication between the users and the system, particularly when interacting with the interfaces of the products. Consequently, we can define culture as the patterns of thinking, feeling and acting that influence the way in which people communicate between themselves and the interfaces. It is plausible that culture has influence on interface usability. Up till now, many studies on how culture might influence usability have been conducted.

The first and most obvious cultural elements of interfaces that received attention were things like text orientation, date and number formats, color and language, belonging to the "objective culture", which is visible, easy to examine and tangible (Hoft, 1996). Those elements are mostly dealt with in the field of localization or globalization. Many companies nowadays offer localized versions of their websites, translating the content into the local languages, adapting the websites to the local text orientation, number formats, etc. Globalization "improves the likelihood that users will be more productive and satisfied with computer-based products in many different locations globally"(Marcus & Armitage et al., 1999, p165-172). The field of localization has systematically developed concerning these objective cultural elements and has formed mature industrial practices.

The other side of culture, namely subjective culture, is less visible and far more complicated. Subjective culture involves "the psychological features of a culture, including assumptions, values, and patterns of thinking" (Hoft, 1996, p43). Although objective culture is important, it is believed that providing user interfaces that reflect the values, ethics, and morals of the target users is necessary as well (Russo and Boor, 1993). It is probably because of the complicity, the industry is still at the preliminary stage dealing with subjective culture.

Nevertheless, there have been many studies addressing usability in terms of culture

issues in various aspects. In terms of users, it has been widely accepted that in order to understand users' needs, developers have to get to know the specific cultural habits besides the conventional common requirements (Heimgärtner, 2014). Heimgärtner concluded that "The usability of user interfaces (UI) depends on the cultural context of use as well as on the cultural imprint of the users (age, sex, language, education, knowledge, experience, religion, self-conception, dealing with power, politics, wealth, income, infrastructure) (Heimgärtner, 2014, p39)." Wallace et al. (2013) did a survey in four countries with 144 respondents and identified significant relationships between the importance given to the usability attributes of efficiency and satisfaction and the cultural dimensions identified by Hofstede.

Heimgärtner used the standard usability engineering process in ISO 9241-210 as an example, and analyzed the impact of culture on the main steps in the usability engineering process. He showed that culture might impact process of designing utilizable interactive systems, principles of human-centered design, planning human-centered design, and human-centered design activities (Heimgärtner, 2014). The overall human-centered design process must specifically address cultural issues in order to be valid (Clemmensen, 2010).

Despite their importance of the cultural issues, cultural differences, especially subjective cultural differences, are often overlooked in user interface design (Marcus & Baumgartner, 2004). Therefore, there have been arguments in the academic world for paying more attention to the cultural issues in usability work, suggesting astonishing results could be obtained, as Marcus put it, "as more cultural analysis of user-interfaces occurs, the results may surprise many professionals who base their assumptions about usability, aesthetics, and emotional experience on previous paradigms that were culturally biased." (Marcus, 2011, p505)

2.2. Investigating Cultural Impacts on Interface Usability by Cultural Models

Studies addressing cross-cultural usability were mainly conducted in two ways, namely bottom-up and top-down method. The former focused on specific cultures or nations, while the latter started with some cultural models, aiming to find general solutions.

2.2.1. Bottom-up versus Top-down Method

Coping with impacts of cultural differences on usability, there have been two ways to conduct the studies, namely bottom-up and top-down. With the bottom-up way, researchers strive to capture cultural differences from each culture or nation, aiming to build up a certain kind of cultural difference database that serve for cross-cultural

usability work. They believe that it is possible to develop guidelines for specific cultures and contexts, and much more user-based studies will be needed in order to develop a comprehensive bank of guidelines (Smith, et al., 2004). A typical research in this way would be, for example, studying the cultural differences between America and China and then coming up cross-cultural guidelines specific for American and Chinese practitioners (e.g. Barnum & Li, 2006).

On the other hand, the top-down way normally starts with some kind of culture models that have universal meanings, aiming to achieve general guidelines that can provide implications for each culture. For example, lots of studies have tried to investigate cultural differences from the perspective of various culture models proposed by researcher such as Hall, Hoft, Hofstede etc. (e.g., Ford & Kotzé, 2005; Choi et al., 2005; Callahan, 2005; Marcus & Baumgartner, 2004).

The bottom-up way may be able to provide specific and thus clearer guidelines for cross-cultural design since it focuses on specific cultures, but those guidelines are therefore only applicable on these targeted countries. On the other side, although it is much more complicated, the top-down method could be able to develop guidelines which can provide possible universal guidance. This research will also take the top-down method to investigate the cross-cultural UI design.

2.2.2. Cultural Models

Four cultural models prevailing in the literature were identified by Hoft (1996), which were developed by Victor (1992), Hall (1959), Trompenaars (1993) and Hofstede (2001). They have been explicitly concluded in various studies (e.g. Ford, 2005), and therefore this thesis will not go into details with them again except for Hofstede's cultural dimensions which will be specifically introduced in the latter section. Here, the author uses the summary given by Ford (2005) in her thesis to have a general impression of all four cultural models:

Table 1
Examples of Cultural Models and Their Dimensions (Adapted from Ford, 2005)

Victor (1992)	Hall (1959)	Trompenaars (1993)	Hofstede (2001)
• Language • Environment and Technology • Social Organization • Contexting • Authority Conception • Nonverbal Behavior • Temporal Conception	• Speed of Messages • Context • Space • Time • Information Flow • Action Chains	• Universalism vs. Particularism • Neutral or emotional Individualism vs. Collectivism • Specific vs. Diffuse • Achievement vs. Ascription • Time • Environment	• Power Distance • Masculinity • Individualism • Uncertainty Avoidance • Long Term Orientation

2.2.3. Cultural Models' Impacts on Interface Usability

Several studies investigated how culture would influence interface usability from the perspective of culture models, either comprehensively from multiple models at the same time or from a particular model.

For example, compiling all cultural patterns or models that appeared in literature, Baumgartner collected opinions about which cultural dimensions from these models could influence user-interface design from 50 experts around the world (Baumgartner, 2004). The survey resulted in final five culture dimensions that were thought to be important by experts for user-interface design, namely context, technological development, uncertainty avoidance, time perception and authority conception. If further implied that the list of these culture dimensions can form a decision making toolkit in a localization process, and it is possible to have a diagram tool to help to decide culture adaptions necessary for localizing to a specific target country. However, in what ways does these culture dimensions influence UI design were not available in this research.

Another research was conducted on users from Korea, Japan and Finland (Choi et al., 2005), interviewing the respondents after letting them watch a video of finishing tasks with mobile data service. 52 attributes considered important by mobile data service users were elicited, and the most critical 11 attributes showed a clear correlation with characters of the users' culture in terms of uncertainty avoidance, individualism, context, and time perception. Those culture dimensions, again, came comprehensively from Hall and Hofstede.

Among the wide range of researches, it is Hofstede's culture dimensions that have been the most often used theories in relation to cross-cultural usability (Smith et al.,

2004). His model has successfully explained cultural variances found in all kinds of websites (e.g., Callahan, 2005; Chang & Tseng, 2009; Kang & Mastin, 2008; Singh & Matsuo, 2004). Moreover, studies investigating comprehensively from multiple models like the two mentioned above all have a problem: since these models are not from a single set of theory but from multiple independent theories, they have potential overlaps among dimensions from different models, for example power distance from Hofstede and authority conception from Victor, and time conception and long-term orientation. Therefore, this study would take Hofstede's cultural dimensions as the perspective for the above reasons.

2.3. Hofstede's Cultural Dimensions

Dutch cultural anthropologist Geert Hofstede proposed the culture model, which has been broadly studied in the HCI field. His cultural model covers largest number of countries compared to others (Khaddam & Vanderdonckt, 2014). By providing measures for each country on each dimension of Hofstede's model, it also quantifies those cultures. He did his research on cultural differences based on surveys and interviews with several hundred IBM employs, originally in 53 countries and later expanded to 74 countries. Using his survey, Hofstede's later studies augmented it and determined pattern of similarities and differences in how signs, rituals, heroes/heroines, and values are expressed by group members (Marcus & Hamoodi, 2009). "He conceptualized culture as 'programming of the mind', in the sense that certain reactions were more likely in certain cultures than in other ones, based on differences between basic values of the members of different cultures" (Smith et al., 2004).

Here, the author tries to conclude all of Hofstede's five cultural dimensions from (Hofstede, 2001) in a concise but comprehensive way, which will be used in the methodology part:

Power Distance

Power distance expresses the degree to which the less powerful members of a society accept and expect that power is distributed unequally. The fundamental issue here is how a society handles inequalities among people.

People in societies exhibiting high power distance accept a hierarchical order in which everybody has a place and which needs no further justification. They accept inequality and show more respect to authorities (boss, teachers, parents etc.).

In societies with low power distance, people strive to equalize the distribution of power and demand justification for inequalities of power. They see one another more as equals, regardless of their positions. They generally believe that authority and inequality should be minimized within society.

Individualism

The fundamental issue addressed by this dimension is the degree of interdependence a society maintains among its members. It has to do with whether people´s self-image is defined in terms of “I” or “We”.

The high side of this dimension, called individualism, can be defined as a preference for a loosely-knit social framework in which individuals are expected to take care of only themselves and their immediate families.

Its opposite, collectivism, represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty.

Masculinity

This dimension refers to the distribution of emotional roles between genders.

A high score (masculinity) stands for a society in which social gender roles are clearly distinct: Men are supposed to be assertive, tough, and focused on material success; women are supposed to be more modest, tender, and concerned with the quality of life. It also represents a preference in society for achievement, heroism, assertiveness and material rewards for success. Society at large is more competitive.

A low score (femininity) stands for a society in which social gender roles overlap: Both men and women are supposed to be modest, tender, and concerned with the quality of life. Femininity also stands for a preference for cooperation, modesty, caring for the weak and quality of life. Society at large is more consensus-oriented.

Uncertainty Avoidance

Uncertainty avoidance is the extent to which the members of a culture feel threatened by uncertain or unknown situations, e.g. situations that are novel, unknown, surprising, and different from usual. The basic problem involved is the degree to which a society tries to control the uncontrollable.

Countries exhibiting strong UA maintain rigid codes of belief and behavior and are intolerant of unorthodox behavior and ideas.

Weak UA societies maintain a more relaxed attitude in which practice counts more than principles.

Long Term Orientation

This dimension refers to the extent to which a culture programs its members to accept delayed gratification of their material, social, and emotional needs. It is

related to the choice of focus for people's efforts: the future or the present.

Long term orientation stands for the fostering of virtues oriented towards future rewards, in particular, perseverance and thrift.

Its opposite pole short term orientation, stands for the fostering of virtue related to the past and present, in particular, respect for tradition, preservation of "face" and fulfilling social obligations.

There have been many critics against Hofstede's cultural dimensions; one of them is that the results have been decades and therefore out of date. However, this has been responded by Hofstede. Hofstede argues that cultural values are deeply impacted in cultures over hundreds and thousands of years; therefore, he believes that even in telecommunication era these cultural values will not be dislodged (Hofstede, 2001).

It should be noticed that, a new dimension, namely Indulgence has been recently added to his previous five dimensions, thus now there are six dimensions in total. However, since the sixth dimension appeared just lately, there have been few cross-cultural usability studies taking the sixth dimension into account. Therefore, this study will also limit the focus on his previous five culture dimensions.

2.4. Mapping Hofstede's Cultural Dimensions to User Interface Design

Hofstede's cultural dimensions were not initially aimed at providing cultural views on usability study, but they were broadly applied to the study of cultural usability of interfaces, especially to website interfaces design around the world. Marcus is seen as the pioneer in this regard as he is the one who first mapped Hofstede's cultural dimensions to website interface design features (Marcus & Gould, 2000), and in a series of his later researches he furthered these relations between cultural dimensions and the features of website design (Marcus, 2002; Marcus & Baumgartner, 2004; Marcus & Hamoodi, 2009; Marcus, 2011). He examined and compared the design of websites from different countries which particularly ranked the highest and lowest in each cultural dimension, and tried to find the differences and similarities in their design that are in relations with Hofstede's cultural dimensions. For example, in his study of the impact of culture on the design of Arabic Websites(Marcus & Hamoodi, 2009), he noticed the patterns that correspond to those of culture dimensions based on culture models.

Since Marcus, many researchers followed his steps and plenty of empirical studies have been done concerning the relationships between cultural dimensions and website interface design differences. For example, (Khashman & Large, 2011) used content analysis to examine organizational and graphical elements from 30 ministry websites from Egypt, Lebanon and Saudi Arabia, and found out that the element frequency scores were correlated with Hofstede's dimensions and interpreted based

mainly on the model developed by Marcus and Gould. Similarly, in Ewa Callahan's study (Callahan, 2005), which investigated cultural differences and similarities in design of university Web sites using Hofstede's model of cultural dimensions, the author also used content analysis to examine graphical elements on a sample of university home pages from Malaysia, Austria, the United States, Ecuador, Japan, Sweden, Greece and Denmark. Element frequency scores were correlated with Hofstede's indexes and interpreted on the basis of the existing literature. The results suggest that similarities and differences in Web site design can be brought out through Hofstede's cultural model. As the study found out, although computed correlations between Hofstede's scores and frequency counts of interface elements were weaker than anticipated(2 out 14 hypotheses based on dimensions model were fully supported), in most cases occurred in the hypothesized direction. Specifically, the frequency of selected categories was positively correlated with PD (power distance) and MAS (Masculine) index.

A series of Reinecke's studies further supported the correlation between cultural dimensions and interface usability, but from the perspective of users. She first proposed an approach to cultural user modeling(Reinecke & Bernstein, 2008), which allows personalizing user interfaces to an individual's cultural background using cultural dimensions indicators for interface design conclude from the previous studies (as seen in table 2). The study found out that this approach could make quit good predictions on users' interface preferences, and argued that it was possible to automate the process of localization and, therefore, to automatically personalize user interfaces for users of different cultural backgrounds. In her later studies(Reinecke & Bernstein, 2011; Reinecke & Bernstein, 2013), she mapped the adaptation rules based on those designing indicators, built up a mathematic approach to identify users' cultural dimension values and proposed an approach that can automatically adapt interfaces to individual's particular culture dimension value, thus improving the usability of interfaces.

2.4.1. Cultural User Interface Design Indicators

Through the studies like the ones mentioned above, plenty of cultural user interface design guidelines or indicators were proposed and established in terms of Hofstede's cultural dimensions, especially by the pioneers Marcus and Gould. Those guidelines were claimed to be devoted to facilitate cross-cultural interface design work. Looking into the literature, there have been several versions of summary of those indicators (e.g. Callahan, 2005; Reinecke & Bernstein, 2008; Mousavi & Khajeheian, 2012; Khashman & Large, 2011, Reinecke & Bernstein, 2013), not to mention those which divided the guidelines into each dimension.

This research will focus on the design elements on user interfaces instead of the content, therefore by examining those summaries and deleting irrelevant indicators,

a comprehensive summary about user interface design is obtained, as shown in table 2. Most of the indicators are actually from (Reinecke & Bernstein, 2013), which is a well-used and the most recent summary known to the author. While some irrelevant indicators are deleted, some are added from other summaries.

Table 2

Cultural User Interface Design Guidelines (Mainly Adapted from Reinecke & Bernstein, 2013)

Dimension	Low Score	High Score	Sources
Power distance	Different access and navigation possibilities; nonlinear navigation	Linear navigation, few links, minimize navigation possibilities	(Burgmann et al., 2006) (Marcus & Gould 2000) (Voehringer-Kuhnt, 2002)
	Data does not have to be structured	Structured data	(Marcus & Gould, 2000)
	Most information at interface level, hierarchy of information less deep	Little information at first level	(Burgmann et al., 2006) (Marcus & Gould 2000)
	Friendly error messages suggesting how to proceed	Strict error messages	(Marcus & Gould, 2000; 2001)
Individualism	Traditional colors and images	Use color to encode information	(Marcus & Gould 2000)
	High image-to-text ratio	High text-to-image ratio	(Gould et al., 2000)
	High multimodality	Low multimodality	(Hermeking, 2005)
	Colorful interface	Monotonously colored interface	(Barber & Badre, 1998)
Masculinity	Little saturation, pastel colors	Highly contrasting, bright colors	(Dormann & Chisalita,2002) (Voehringer-Kuhnt, 2002)
	Allow for exploration and different paths to navigate	Restrict navigation possibilities	(Ackerman, 2002)
	Attention gained by visual aesthetics	Graphics used for utilitarian purposes	(Marcus & Gould, 2000)
Uncertainty Avoidance	Most information at interface level, complex interfaces	Organize information hierarchically	(Burgmann et al., 2006) (Marcus & Gould, 2000; 2001) (Zahed et al., 2001)
	Nonlinear navigation	Linear navigation paths / show the position of the user	(Baumgartner 2003) (Burgmann et al., 2006) (Corbitt et al., 2002) (Kamentz et al., 2003) (Marcus & Gould, 2000; 2001)
	Code colors, typography & sound to maximize information	Use redundant cues to reduce ambiguity	(Marcus & Gould, 2000; 2001)

	Long pages with scrolling	Restrict amounts of data	(Marcus & Gould, 2000)
Long term Orientation	Reduced information density	Most information at interface level	(Marcus & Baumgartner, 2004) (Marcus and Gould, 2000)
	Content highly structured into small units	Most information at interface level	(Marcus & Gould, 2000)

2.4.2. Contradictory Empirical Results

In spite of many studies which investigated and confirmed the relationships between Hofstede's cultural dimensions and user interface design, there are also plenty of studies which failed to achieve positive results. For example, in the initial study of (Ford, 2005), the author conducted an experiment using websites which possessed different cultural features according to the guidelines proposed by Marcus, and recruiting respondents from South Africa. The results showed that there was insufficient evidence to support the hypothesis that any of the four culture dimensions tested significantly affect user performance. However, although Ford distinguished respondents by checking their culture dimension values using the same survey adopted by Hofstede, it is probably still problematic since all respondents came from the same country.

Most of the empirical studies examining the validity of those culture interface design indicators produced both positive and negative results in one study. For instance, (Chang, 2011) analyzed company websites from Global 500 list also using Hofstede's dimensions of culture, the results indicated that cultural differences existed on the websites of the Global 500 corporations, but did not exactly reflect in the direction predicted by Hofstede's model.

This study tried to search for all empirical studies in the literature which examined the validity of culture interface design indicators in terms of Hofstede's culture dimensions. The time range for the studies starts from 2000 when Marcus first proposed the guidelines, till the beginning of 2015. The results of the empirical studies are shown in table 3.

Most of the studies took the indicators proposed by Marcus; others used the indicators proposed by the authors themselves or taken from somewhere else. We can see in the table, some of them focused either especially on content of websites or design elements, while the majority of them studied content and design comprehensively. As discussed in the above, the results of the empirical studies were contradictory. While some of the dimensions were validated in some studies, they were also invalidated in other studies.

Table 3

Results of Empirical Studies Examining Existing Cross-cultural UI Design Indicators

Validated Dimension(s)	**Focus**	**Type of Study**	**Involved Countries**	**Sources**
PD MAS	Design & content	Experiment	China	(Smith et al., 2004)
PD (partly) MAS (partly) IND (correlated but not significant)	Design & content	Content analysis	Multiple countries	(Callahan, 2005)
Integrally showed strong correlation	Design	Survey	Multiple countries	(Reinecke & Bernstein, 2008)
Integrally showed improvement	Design	Experiment	Multiple Countries	(Reinecke & Bernstein, 2011)
None	Design & Content	Experiment	South Africa	(Ford, 2005)
UA	Design & Content	Survey	Iran	(Mousavi & Khajeheian, 2012)
PD (partly) MAS (partly) IND (partly) UA (partly)	Design & Content	Case study	Australia	(George & Comp, 2012)
PD MAS LTO	Content	Content analysis	USA and Japan	(Singh & Matsuo, 2004)
Integrally Validated	Design	Content analysis	USA, Germany and Japan	(Cyr & Trevor-Smith, 2004)
PD MAS IND	Pictures	Content analysis	USA and China	(Tang, 2011)
IND UA	Design & content	Content analysis	Multiple countries	(Chang, 2011)
MAS (partly) IND (partly) UA (partly) LTO (partly)	Design & content	Content analysis	Arabic countries	(Khashman & Large, 2011)
MAS	Design & content	Content analysis	USA and Arabic countries	(Abdallah & Jaleel, 2013)
MAS(partly) IND(partly) UA(partly)	Design & content	Content analysis	Egypt	(Khashman & Ménard, 2014)
PD MAS IND (partly)	Design & content	Content analysis	USA and Arabic countries	(Chun et al., 2015)

UA (partly)				
PD MAS IND	Content	Content analysis	Multiple countries	(Singh, Zhao, & Hu, 2005)
PD IND MAS (less strong) UA (less strong)	Design & content	Content analysis	Multiple countries	(Kang & Mastin, 2008)

2.5. Literature Gap and Research Questions

Reasons thought to lead to the contradictory results were various. By looking into the reasons given, generally there were three types: 1) other variables such as a small sample (Callahan, 2005), or the demographic factors of respondents (Abdallah & Jaleel, 2013) affected the results due to the study limitations; 2) the possibility that Hofstede's cultural dimensions may be invalid, as discussed in the previous section; 3) Hofstede's cultural dimensions maybe valid, but the indicators building the relationships between cultural dimensions and UI design are too vulnerable (Khaddam & Vanderdonckt, 2014). Therefore, since its overwhelming influence in the literature, this study assumes that Hofstede's cultural model is valid and deals with the third reason mentioned above, namely the validation of the cultural UI design indicators proposed by Marcus and others.

It is strange to notice that, apart from some studies which assumed another sets of indicators besides Marcus' by directly interpreting Hofstede's cultural dimensions, nearly all empirical studies in table 3 just used the indicators for investigation and none of them went back to the indicators themselves and tried to improve or refine the indicators. Some researchers argued that those indicators associating cultural markers on interface with each or some of the cultural dimensions are based on faulty assumptions (Callahan, 2005). Actually Marcus himself also "assumed" those indicators and did not give explicit explanations in any of his works. Consequently, this study shall go back to the indicators themselves and try to explicitly understand the rationale behind the indicators.

Moreover, another literature gap concerning the indicators is also found in the literature. Those indicators, together with other general UI design guidelines were argued as "western-biased" since most of the published usability guidelines were originated in the West and were based on western expertise, project experience and subjective studies (Becker, 2002). Marcus himself commented that "Western scholars may be in error to assume that there is, or should be, a universal focus on reasoning, categorization, and linear cause-and-effect explanations of situations and events" (Marcus, 2002, p26). Therefore, to avoid potential western biases, this study shall recruit respondents from both western and eastern cultures, which will be explained in the method part.

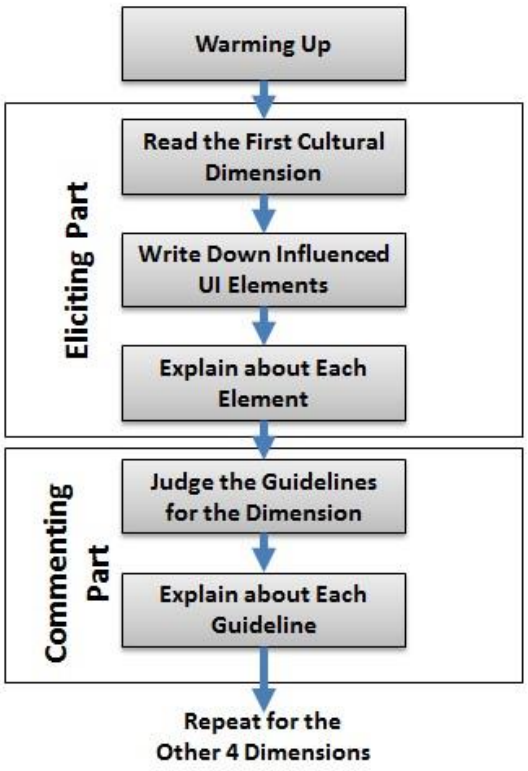
Above all, the **Research Questions** of this study are, 1) how useful are cultural UI design indicators? 2) if it is possible, how can cultural UI design indicators be refined?

3. Methodology

3.1. Design

For this study, the researcher performed comprehensive interviews in which respondents first gave opinions on how Hofstede's cultural dimensions could influence UI design, and then judged and commented on the existing cultural UI design guidelines in terms of the dimensions. A quantitative measurement was embedded in the interview for interviewees to judge the usefulness of the existing guidelines. Several materials were used in the interviews. The outline of the procedure is depicted in Figure 1.

Figure 1 Interview Procedure



3.2. Instruments and procedure

Warming up

Card sorting was used in the warming up to make respondents to be prepared for the coming interview. Given that most of the participants probably had not thought about the topic before, it might be too difficult for them to give opinions immediately, hence a warming up was first done to attract their attention on UI design elements and to provide samples they can refer to in the interview. In the warming up, they were given 10 UI samples of Chinese and Dutch websites and apps. They had to sort those samples to a Chinese group and Dutch group, each group have 5 samples. Those UI samples were selected from Dutch and Chinese websites and apps, all of which were in English version and were graphically processed to let respondents focus more on the design instead of recognizing the content. After sorting, they were asked to explain their choices to further focus on the UI elements.

Eliciting part

Formal interview started in the eliciting part. After the warming up, the interviewer introduced Hofstede's cultural dimensions theory briefly to the interviewees and then asked them to focus on the first dimension. Respondents first read the definition of the dimension given by Hofstede, which was composed more readable by making comparison of cultural performance from two sides of the dimension (see the literature review part). Then interviewees took time to think and write down possible UI elements that might be influenced by the cultural dimension, with the reference to the given UI elements captured in the guidelines, namely:

- Information hierarchy
- Navigation
- Interaction
- Content structure
- Graphic style
- Image-to-text ratio
- Color and color use
- Pop-ups
- Layout
- Multimedia use
- Information highlighting

Each of those elements was illustrated with an image example and they were printed on paper. Respondents could write down other UI elements or in other expressions, and they were allowed to take notes. Afterwards respondents gave explanation for each element they had written down.

Commenting part

The interview was continued in the commenting part, but embedded with a small questionnaire.

After the respondent wrote down the influenced elements for the dimension and gave explanation, they were first presented with the existing guidelines for the dimension and asked to rate them on a 7-point Likert scale from "1 = not useful at all" to "7 = completely useful" (See Appendix A). Then they had to explain their rating for each guideline.

Those cultural UI design guidelines had to be first collected from the literature. This study used the ones well concluded by Reinecke (Reinecke & Bernstein, 2013), which displayed in the theory part in table 3. Two items were deleted from the guidelines because they were seen as more about content than design. One is "Support is only rarely needed" in cultures with low power distance and "Provide strong support with the help of wizards" in cultures with high power distance. The other is "Websites often contain images showing a country's leader or the whole nation" in high power distant cultures and "Images show people in their daily lives" in the counterparts.

When the first dimension was done, the interview moved to next cultural dimension, and repeated the above procedure. Five dimensions were conducted separately in random sequence. At last, each interviewee was invited to give a brief conclusion about the topic, by asking questions like "Can you reflect the topic and give a brief conclusion?"

The eliciting part, in which respondents gave their own opinions on how each cultural dimension might influence UI design, was conducted before the commenting part in case respondents' opinions might be influenced by the given guidelines. And respondents were asked to focus on one dimension each time to avoid interrelations among dimensions and reduce difficulty. For each dimension a specific example of comparison between Chinese value and Dutch value on the dimension was provided for reference to decrease the difficulty. However, during the process they were required to think generally based on the definition of the dimension and not to just focus on the difference between China and the Netherlands.

3.3. Respondents

As discussed in the literature review part, in order to avoid the potential "western biased" results, 10 of the 20 interviewees were recruited from China and the other half from the Netherlands. All respondents have expertise in user interface, for Dutch participants were master students specializing in Human Media Interaction, Technical Communication and Industrial Design from the University of Twente and their Chinese counterparts were master students specializing in Interaction Design from

the School of Software and Microelectronics Peking University.

The interviews were conducted face to face, using Chinese with Chinese interviewees and English with Dutch interviewees. Given the high popularity of English in the Netherlands and that University of Twente uses English in class, Dutch respondents should be seen as having no problem with English interview. All respondents were voluntarily recruited through the researcher's relations in two universities.

3.4. Pretest

For quality control, pilot test was conducted before actual interviews on a Chinese and a European master student in the related field from University of Twente. The instruments were found to be sufficient for the target group in terms of comprehensiveness, structure and wording. Therefore, actual interviews were conducted in the Netherlands and China respectively for each country's participants following the procedure.

The communications between the interviewer and the interviewees were conducted in a natural and spontaneous way: respondents were encouraged to be free to ask any questions about the topic. To motivate respondent to give sound arguments for their opinions, previous respondents' opinions were orally provided when disagreement with the present respondent was noticed and let the respondent to reflect on that. So as when disagreement noticed in one respondent's own opinions between certain dimensions.

All materials used in the interviews were first made in English for Dutch participants and then made in Chinese version after translated and back-translated and revised for Chinese participants. Each interview took around 1 hour and a half or so in average. The researcher obtained each participant's agreement ahead of time to record the entire interview by an audio recorder. Reviewing the recordings, all 10 interviews with Dutch respondents were transcribed verbatim, and all 10 interviews with Chinese respondents were translated into English for analyzing in next phase.

3.5. Data Analysis

The eliciting part of the raw data, namely respondents' opinions on which and how user-interface elements might be influenced by culture dimensions, was first broken down orderly by nationality, dimension and element written down by the respondent. The commenting part generated quantitative data as well as qualitative data. The quantitative data of how respondents graded each guideline was then entered into SPSS, and the qualitative data of why they gave a certain point to the guideline was broken down by each guideline.

To ensure reliability, two independent coders were working together on the data from the eliciting part, namely UI elements given by interviewees for each dimension. For each element, the first coder captured the attributes for the two opposing sides to the dimension, for example how navigation should/would be designed in high power distant cultures and low power distant ones. The attributes for both sides of each dimension were actually quite explicitly described in respondents' explanations since respondents were encouraged to do so during the interviews. Captured attributes were required to be put as original as what respondents described as possible, whereas repeated descriptions were also deleted. The second coder examined the attributes by referring to the original transcripts and gave suggestions for revision. Then the first coder received the revisions and decided whether to accept or not. Revised attributes were then finally attained by the researcher. There were, however, elements which met the following three standards seen as invalid and then not taken:

1. Respondent failed to give explanation for the element. For example, one said: "*...But I thought it's a bit difficult. It's just I can imagine there can be some difference... but I thought it was really hard*."
2. Respondent himself nullified the element he had written down. For example, one interviewee said: "*...Or maybe it's just totally the other way around. I don't know*." Or, said by another "*...I really don't think there are relations. Sorry.*" "*...I thought about something, but that doesn't make sense*."
3. Respondent focused on factors other than design, such as content and product (function). For instance, "*...For information hierarchy, since masculinity means... for masculine societies they might need to use the limited information to highlight success... so they might highlight information about success.*"

Beyond the standards, probably some elements were weakly argued, but for feasibility as well as reliability, this study would still put them in the results, because first of all, after deleting those explanations which met above standards there were just a few explanations thought to be weak by coders; and secondly, the research would just examine the agreement and tendency among the respondents.

In addition, some similar elements were combined into one since participants thought they were the same and frequently referred to them as one element. Therefore, information hierarchy & structure were combined by information hierarchy and content structure, visuals by color and color use and graphic style and other effects such as animation, prompts by pop-ups and system messages.

For the commenting part, the quantitative data was first run in SPSS to gain the general impression of how many points each guideline was scored, or, in other words, how useful each guideline was thought by participants from both cultures. Whether there was difference in two groups could also be seen by running the Mann-Whitney U Test. The details of this part will be given in the results. Besides the quantitative data, the explanations given by respondents for grading each guideline were

examined to see how did respondent agree or disagree with the guideline.

4. Results

Though captured after the eliciting part, the quantitative results about how respondents from both cultures valued those cultural UI design guidelines were most easily available by running the data in SPSS. Mean score of each guideline was first run for each country's respondents. As shown in table 4, mean scores given by the Chinese group and the Dutch group are actually generally very close, except that the Chinese group grade the 1st Masculinity guideline and the 1st Long Term Orientation guideline more than 1 point higher than the Dutch group in the 7-point Likert scale, while the Dutch group agree with the third and the fourth Power Distance guidelines more than the Chinese group do. However, the result of Mann-Whitney U Test (see Appendix A) comparing two cultural groups shows that there is no significant difference ($p > 0.5$) between two groups for any guideline. Therefore, above all, it is not difficult to conclude that the Chinese interviewees held same attitudes towards these cultural UI design guidelines to that of the Dutch group. Detailed quantitative results are going to be presented for each dimension in the following section.

Table 4

Mean Difference between Groups

Guidelines	Dutch Group	Chinese Group
PD1	4.90(1.66)	5.40(1.35)
PD2	3.70(1.64)	4.50(1.90)
PD3	4.70(2.00)	3.60(1.71)
PD4	6.00(0.94)	4.50(2.22)
PD5	4.50(2.07)	4.80(1.99)
IND1	5.20(1.62)	5.90(0.99)
IND2	2.80(1.48)	2.60(1.17)
IND3	4.60(1.35)	5.40(1.65)
IND4	4.10(1.60)	4.80(1.87)
MAS1	5.00(2.21)	6.20(0.79)
MAS2	5.60(0.84)	4.90(1.60)
MAS3	6.20(0.42)	6.30(0.67)
UA1	5.00(1.70)	5.40(2.17)
UA2	5.80(0.92)	6.10(0.88)
UA3	5.10(1.52)	6.00(1.56)
UA4	5.40(1.84)	5.20(1.75)
LTO1	3.90(2.18)	5.00(1.83)
LTO2	4.10(1.73)	4.20(1.81)

Note. The data is displayed in mean (std. deviation), and is based on 7-point Likert scale from "1 = Not useful at all" to "7 = Completely useful".

Through thorough observation, no obvious difference was actually found in the elements proposed in the eliciting part by interviewees from China and the Netherlands either, which was in line with the quantitative result displayed just now. Therefore, the results in the eliciting part, as well as the results in commenting part are going to be presented without distinguishing two respondent groups. The following text will present the results by each cultural dimension.

4.1. Power Distance

4.1.1. Eliciting Part

Generally, all interviewees thought that the dimension of power distance could influence user interface design, although one respondent thought it might influence structure of websites but gave up to propose any element since she was not sure about that. Most of the respondents thought different social structures or hierarchies in cultures of two sides of the dimension, namely cultures with high power distance were more structured and had more hierarchies in societies while cultures with low power distance were less hierarchically structured, could influence how information was structured and formed on websites and apps. They also thought the degree of equality in two different cultures would affect the way designers presented information. As shown in table 5, eight elements in total were thought to be influenced in different degrees. The following paragraphs are going to present how each element was thought to be influenced.

Table 5

Elements Thought to be influenced by Power Distance

Elements	**Frequency**
Information hierarchy & structure	8
Visuals	8
Prompts	6
Layout	5
Navigation	4
Interaction	4
Image-to-text ratio	4
General style	4

Note. The detailed attributes captured for each element are displayed in Appendix C.

Information hierarchy & structure

As we can see from table 5, information hierarchy and structure as an element was thought to be most influenced in the way that in high power distant cultures information was more strictly structured, especially there were kind of fixed or pre-defined structures, while in low power distant cultures information was

structured more freely with more variance. For example, one interviewee said, "*…It might be like organizational structure of the company… Yes, for them(people in low PD), it's probably like if I want to find something I will go according to the priority of the content, while here (in high power distance societies) you will have to first tell the importance of the information in a certain organization.*" Another respondent also thought: "*…Maybe also, if they have a more structured society in a way, they also have better content structure*."

Although it was less structured in low power distant cultures, it did not necessarily mean it was messy. Instead it was thought to be simpler, emptier or more intuitive because the high equality in low power distant cultures drove the interfaces to be more accessible to everyone. For instance, one said: "*…When the power distance is low, the website will also be structured, be made in such a way that is usable and the information can be found by everyone who is using the website because it's made for everyone.*" Actually, on the contrary, information in high power distant countries were expected to be more complicated structured and to be presented in deeper layers with abundance, as one mentioned: "*…because if you have high power distance there are more layers in society so I think also in information hierarchy there must be more layers, or if you don't have any layers (in society), you just don't have layers in your websites*."

Above all, in cultures with high power distance information was thought to be more strictly structured with more complexity, abundance and deeper layers, while in cultures with low power distance, information was thought to be more freely structured with simplicity and less layers.

Visuals

Though quite some interviewees proposed visuals, no identical tendency or agreement was seen from them, as the attributes they gave were actually contradictory. Therefore, this element was not accepted in the final results.

On the one hand, some interviewees expected that visuals such as graphics or multimedia effects in high power distant cultures were more practical, while in low power distant cultures they were more appealing and aesthetic, because they believed that in high power distant cultures websites just focused on the quality of the information, while websites in low power cultures wanted to make visuals more user-friendly and accessible to everyone, thus more aesthetic. As one put it, "*…like with low power distance, designers would use certain graphics and colors that evoke the feeling that they want their users to have generally like positive feelings, while with high power distance, there might be less color use less graphic use and just a bit more focus on the information.*" On the other hand, some other respondents thought the other way around, with visuals to be more abundant and colorful in high power distant cultures and cleaner and simpler on the other side of the dimension. For example, one said: "*…High power distant societies need more things like*

multimedia use to enrich the interfaces. (Why?) I think when people have less (rights), they are eager to have more (elements). So is with the color use. Above all, for these elements, they need more abundant things to motivate them. ...If the culture has more equality, people will not have a strong desire for these things, and believe the information is the most important thing instead of these garish things."

Prompts

In terms prompts, interviewees who proposed the element congruously believed that there would be more prompts on interfaces in cultures with high power distance, whereas prompts were less on the low score side. And prompts in cultures with high power distance were presented in a way that was more aggressive. They expected that was because people in countries with high power distance were used to receive this kind of information in more authoritative way. For example, one Dutch respondent said: "*…because the power distance in the Netherlands is quite low, so we are not used to be forced or told by someone else what to look at or what to see... If power distance is high, people are easier to accept that someone else tells them what to look at.*" Another Chinese interviewee also agreed: "*…I think websites with high power distance like using pop-ups more, because they would like to pop up information they think is important, because they just want users to look at the information they want them to look at... without letting you know, it just pops up, no matter if you like or dislike it.*"

Layout

Similar to information hierarchy & structure, layout was thought to be more hierarchically contrasting in high power distant cultures in a more pushing way, whereas in low power distant cultures it was more equalized. As said by one respondent: "*…Since you have more important positions on the website and also less important positions, more important and obvious positions would be used for more important content and inconspicuous positions for less important information in high power distance countries, while in countries with low power distance content is more equalized on the websites.*" Though one respondent gave the attributes the other way around, she did actually explain in terms of the general accessibility of the design: "*…in societies with lower power distance they try to make everything accessible and nice, enjoyable for the users... because the company feels that they should explain more. And in society where people feel they are more important than others, they would think, well, just deal with it.*"

Navigation

Similarly, navigation was also thought to be more strictly structured with more complexity in high power distant cultures, while in low power distant cultures it was more freely structured with simplicity, allowing users to have more control.

For example, one respondent said "*…Maybe in high power distance societies they value navigation like hierarchical structure more, because they are also more used to that. Maybe the way they are thinking is more structured, that way, so they may find it easier to use that kind of navigation and that kind of structure*." In terms of navigation control, another respondent mentioned: "*…the linear navigation, this unchangeable way might not be well accepted by low power distant people. They probably prefer to, for example, be able to adjust the sequence, (because) it's kind of less authoritative.*"

Interaction

Same as the previous two elements, interaction in high power distant cultures was expected to be more content-centered and more difficult to use, while in low power distant cultures was more user-centered and thus more friendly. As one respondent said, "*…For interaction, I think is societies with high power distance users might have lower requirements, because they might have weaker self-consciousness. On the other hand for people who have stronger self-cognition, they think they don't want to waste time, so they have higher requirements towards interaction. And they need those user-centered designs.*"

Image-to-text ratio and general style

For image-to-text ratio, all proposers believed that there was lower image-to-text ratio, i.e. more text than images, on websites in cultures with high power distance. However, looking into the explanations given by respondents, respondents interpreted it in different directions such as information amount, inequality between designers and users and criticism by users. For example, one respondent interpreted that "*…Well I think if you give many information... I think that's kind of showing your power. If it is high power distance, I think there is many text, because people get manipulated or influenced by the text they see. And with images, I think images can be interpreted in very multiple ways. Therefore I think images relate to low power distance.*" Therefore, the element of image-to-text ratio was not taken into the final results.

General style is in line with the accepted elements: most of the interviews mentioned that because of the difference of equality degrees, interfaces in low power distant cultures were generally more user-centered. For example, an interviewee explained: "*…When you have a high power distance, the designers might just design the website and think less about how you can navigate it, and have this attitude that the users have to figure it out themselves, while with low power distance designers really think about if it all makes sense, and if a person who is less capable of technology can navigate their website… Yeah, they are more user-centered definitely.*"

Conclusion

Above all, five independent elements were thought to be influenced by the dimension of power distance and all of them showed consistency in explanations:

- Information hierarchy & structure was expected to be more strictly structured with more complexity, abundance and deeper layers in cultures with high power distance, while in cultures with low power distance it was more freely structured with simplicity and less layers.
- Navigation on high score side of the dimension was also more strictly structured with more complexity, while on low score side it was more freely structured with simplicity, allowing users to have more control.
- Layout was thought to be more hierarchically contrasting on the high score side, while on low score side it was equally distributed.
- In high power distant cultures prompts were more used and more aggressively presented; while in low power distant cultures there were less prompts which were more friendly worded.
- Interaction in cultures with high power distance was more content centered and easy to use, while in cultures with low power distance interaction was more user-centered and more complicatedly designed.

4.1.2. Commenting Part

One-sample t-test was run to determine whether recruited interviewees thought each guideline for the dimension of power distance is useful, defined as above the middle score of 4.0. The results are shown below in table 6. The following text is going to explain the results by each guideline.

Table 6
Means for Guidelines for Power Distance

	Mean (St.d)	t	df	p
PD1	5.15 (1.50)	3.437	19	.003
PD2	4.10 (1.77)	.252	19	.804
PD3	4.15 (1.90)	.353	19	.728
PD4	5.25 (1.83)	3.052	19	.007
PD5	4.65 (1.98)	1.468	19	.159

Note. The Data is based on 7-point Likert scale, from "1=Not useful at all" to "7=Completely useful".

PD1

As shown in table 6, for PD1 guideline, i.e. **"Different access and navigation possibilities; nonlinear navigation"** on low score side versus **"Linear navigation, few links, minimize navigation possibilities"** on high score side, mean score (M = 5.15,

SD = 1.50) was higher than the middle score of 4.0, a statistically mean difference of 1.15, t(19) = 3.437, p = 0.003. The guideline was seen as somewhat useful by interviewees.

This guideline is actually quite similar to the elements of information hierarchy & structure and navigation proposed by interviewees in the eliciting part, which was also mentioned by many respondents. Looking into the explanations, those agreed with it (score >= 5) thought that because of the difference of equality degrees or how people see authorities, users in low power distant cultures have more freedom on websites or app, while users in high power distant cultures tend to accept what is given. For example, one respondent said: "*...because (in cultures with low PD) you provide for more navigation possibilities, people can decide for their own… Yeah, you focus on different kinds of people and try to be equal.*"

However, even for those who agreed with it, linear navigation was seen as could also be used on websites in low power distant societies because that could provide clarity for the site, as one interviewee mentioned: "*...Yeah what I can like is simple site which provides many clarity in the beginning, so minimizing links, minimizing possibilities provides many clarity for the user of the site.*" Accordingly, another one said: "*...Even there is high power distance it could be still useful to provide different access and navigation possibilities.*"

For those who disagreed with it (score <= 3), basically they thought it was not related to power distance but rather depended on the information amount and the type of websites. They expected that linear navigation and minimizing navigation possibilities actually provided some kind clarity for users, which was more appreciated by Dutch users with lower power distance, so were few links. Multiple navigation possibilities, on the other hand, could result to confusing navigation. For instance, one respondent explained: "*…The first one I already think like, I don't know if that's useful because I really like one way to navigate myself, if there are multiple ways I might… So I kind of like the simple, few links as well. I mean I guess it would be useful but… (But you disagree here right?) Yeah, well I think, like the minimalized navigation possibilities are also better for all.*" "*...I think this one is not very useful. Navigation choice is like navigation entrance, I think it depends on the structure of the website, and depends on the amount of information.*" said by another respondent.

Above all, basically, interviewees thought this guideline for power distance was useful. They agreed that in high power distant cultures navigation is more strictly structured, while low power distant societies' users shall have more free structures. However, different access and navigation possibilities could also be useful for high power distant users, and clarity or simplicity was actually more appreciated by users in cultures with low power distance.

PD2

As seen in table 6, for PD2 guideline, i.e. **"Data does not have to be structured"** in low power distant cultures versus **"Structured data"** in high power distant cultures, mean score (M = 4.10, SD = 1.77) was near to the middle score of 4.0, without statistically mean difference, t(19) = 0.252, p = 0.804. The guideline was seen as "neither useful nor useless".

Examining the reasons, those who agreed with it thought that is was also similar to the information hierarchy & structure in that in societies with high power distance, things were prone to be made more rigorously structured, and interfaces were more solemn, making the websites or apps look more authoritative, thus more trustworthy. In societies with low power distance, on the other hand, though websites were also structured in some way, generally they had more freedom and maybe unstructured designs, and sometime they were not as structured as they should be. As said by one interviewee, "*…Yes I think that is, because, what I have said, it's just more freedom, where you see there's more freedom in different kinds of UI design and you not always have that skilled people would think about data very deep, so you get data which is not as structured as that granted certain frame beforehand… I see some sites where I have idea that information is not as structured as it should be.*"

In addition, a very interesting explanation was given by one respondent, believing that in cultures with low power distance websites should not have pre-defined structures on the websites, but should be intuitive when presented immediately to users, who did not need to have familiarity with the structure of the website. "*…Maybe with high power distance websites, because it's more structured, you have to know where to click: it's always, on these websites, under this menu or something like that. (Okay, there is some saying that data is always better to be structured rather than not structured. What you think about that?) I don't think that's always needed, because if you have an easy-to-use website, people can find solution to their questions or answers to their questions in all kinds of ways. They shouldn't be forced to click through a menu... You want to make website people can use right away without having to know how to use it.* "

However, another part of respondents believed that data was always better to be structured anyway, and it was not related to power distance but the website itself. For example, "*…This one, data have to be structured or not structured is entirely depending on the need of the content. It depends on the amount of data. If you have a large amount of data, it's impossible to not to be structured. If you put it randomly, users will not be able to find the information. So I think it's not useful at all.*" Even when explanation from those who agreed with it was given, some still believe there was at least kind of inner structure anyway on websites in low power distant cultures.

Above all, interviewees held the view that though more strictly structured in high

power distant cultures, data was always better to be structured somehow anyway, but in cultures with low power distance it could be freer and more intuitive.

PD3

As shown in table 6, for PD3 guideline, i.e. **"Most information at interface level, hierarchy of information less deep"** in low power distant cultures versus **"Little information at first level"** in high power distant cultures, mean score (M = 4.15, SD = 1.90) was near to the middle score of 4.0, without statistically mean difference, t(19) = 0.353, p = 0.728. The guideline was seen as "neither useless nor useful".

Looking into the explanations given, what respondents agreed was that on websites or apps in cultures with low power distance information was presented immediately with less layers, while on the high score side content is more controlled with deeper hierarchy. However, they doubt the way it was worded, because they believed that in terms of the general information amount websites, on high score side it was more abundant and busier, and although most information was presented at the (first) interface level, it did not have to be detailed information but outlined or most important information, as long as users could immediately know what was on the site. For example, one respondent interpreted: "*…Yeah so you can find everything you need on the homepage, and here you have to search first and go very deep into the site. (Do think for low power distance, this also means that there will be much information on the first level that it's kind of messy there.) No not necessarily, because you think even though you can find everything that there is on the site, it doesn't have to be everything everything. It's more like this group is here, this group is here and this group is here: all you can find on the page.*"

Besides those who thought it was not related to this dimension but rather to practical factors such as the amount of information or what the website was about, what respondents disagreed was that it was actually the other way around considering the reality: Chinese websites (with high power distance) had bigger amount of information and were busier on the front page, while Dutch websites were emptier. For instance, mentioned by one interviewee: "*I think this one is the other way around too, because if I look at the sites you know, the higher ones, Chinese websites, have many information on the page and we have less.*" and "*…I don't agree with this because I think it's the other way around. Because low power distance users will think first of four don't give me that much information.*" said by another.

One respondent directly point out it was not well worded, since the description was not structured in parallel, namely "at first level" versus "at interface level". Therefore, above all, respondents believed that most information should be presented immediately with less deep hierarchy on the low score side, while on the other side information was presented with deeper hierarchy and abundance in a more controlled way. This is also similar to the eliciting part.

PD 4

As shown in table 6, for PD4 guideline, i.e. **"Friendly error messages suggesting how to proceed"** on low score side versus **"Strict error messages"** on high score side, mean score (M = 5.25, SD = 1.83) was higher than the middle score of 4.0, a statistically mean difference of 1.25, t(19) = 3.052, p = 0.007. The guideline was seen as slightly useful by interviewees.

Examining the explanations given, what respondents agreed was that in societies with high power distance more serious error messages would be more accepted by users, as they accepted authority more and messages worded more serious would be seen as more authoritative and thus more reliable, but not to the extent of terrifying. On the other hand, on the low score side, if you provided strict error messages users would get annoyed and might be frustrated. For instance, one respondent explained: "*…And the final two, I agree with them because those are very general with like being really friendly, about user-friendliness, while here it's functional.*" and "*…This one I think high power distance users are used to authoritative social environment, so they expect error messages to be more serious, otherwise there will feel strange*."

However, quite some respondents did not agree, as it actually depended on what kind of website is was, such as government website, commercial website or antivirus app, instead of on power distance. And even in cultures with high power distance error messages were to be friendly because that would bring better user experience, and it was just kind of machine over there instead of some authority, even though maybe older generation might get more used to serious ones. For example, on interviewee said: "*…For error messages, I think for current designs, basically all error messages now are friendly. Websites and applications on mobile phones are all trying to avoid serious error messages and pop-ups with punishments, because they are not user-friendly.*" In addition, it was thought to be always nice to tell users how to proceed, rather than just present codes telling you what was wrong.

Above all, using the word given by a respondent, error messages in high power distant cultures were thought to be more functional, while they were more friendly on websites or apps in cultures with low power distance.

PD5

As displayed in table 6, for PD5 guideline, i.e. **"Asymmetry"** in low power distant cultures versus **"Symmetry"** in high power distant cultures, mean score (M = 4.65, SD = 1.98) was slightly higher than the middle score of 4.0, but without statistically mean difference, t(19) = 1.468, p = 01.59. The guideline was basically seen as "neither useless nor useful".

Looking into the reasons, what respondents agreed was that, similar to the PD2 about structured data, because there was more hierarchy in societies with high

power distance while more freedom in low power distant societies, it was more structured on interfaces on the high score side while more versatile or creative on the low score side, resulting symmetry versus asymmetry.

However, in those who agreed with it (grading above 4), quite some thought it was too absolute. And what people disagreed was also similar to the structured data thing in that they believed it was always nice to have symmetry on websites, since human brain just accepts symmetry better. As said by one respondent: "*...I think it's also more like a (design choices). Probably symmetry usually is good, but it's like, also I think, a design choice. I would say people usually like symmetry. I don't think cultural differences are very influencing here, because your brain just likes symmetry. It's just that human beings like symmetry.*"

For the issue of freedom on the low score side, some of them believed that with symmetry there could also be many varieties and creativeness, although in this cases it was not that obvious, like what one respondent said: "*…I mean there are various degrees of symmetry. I think you can also be very creative with symmetry and still make it look good. I don't really see symmetry as something that prevents you from being creative. If you can be creative and also symmetric it's even better*."

Above all, symmetry was thought to be good to both sides of the dimension, while on the side of low power distance there would be more versatile and in cultures with high power distance it would be more structured.

4.1.3. Conclusion

Above all, interviewees' opinions on the existing guidelines in the commenting part were generally quite in line with the eliciting part. Therefore, incorporated with the eliciting part, the author would take the adventure to propose refined UI design indicators for the dimension of power distance, as shown below:

Table 7

Refined UI Design Indicators for Power Distance

Elements	Low Score	High score
Information hierarchy & structure	Information is more freely structured with simplicity in less deep hierarchy	Information is more strictly structured with more complexity, abundance in deeper
Navigation	More freely structured with simplicity, allowing users to have more control	More strictly structured with more complexity
Layout	More equally distributed	More hierarchically contrasting
Prompts	Less prompts which are more friendly worded	More frequently used and more aggressively presented

Interaction	More user-centered and easy to use	More content-centered and more complicatedly designed

4.2. Masculinity

4.2.1. Eliciting Part high

The dimension of Masculinity was thought to have strong and most influence on visuals (especially colors and graphics), as well as certain influence on navigation. Probably because of its dominant influence on visuals, respondents went more detailed with visuals compared to other dimension: most respondents proposed colors separately from graphics and might gave these two independent elements at the same time. However, still several respondents proposed them as a whole. Thus we have the visuals in three categories, namely visuals (colors), visuals (graphics) and visuals (general), as shown in table 8. The following text is going to present how each element was thought to be influenced.

Table 8

Elements Thought to be influenced by Masculinity

Elements	Frequency
Visuals (color)	14
Visuals (graphics)	8
Visuals (general)	7
Navigation	3
Layout	2
Prompts	2
Information hierarchy & structure	1
Information highlighting	1
Image-to-text ratio	1
General style	1

Note. The detailed attributes captured for each element are displayed in Appendix C.

Visuals

In terms of colors, respondents mostly thought in cultures with low masculinity pastel colors were more used, which seemed soft and calm, and neutral colors were more used on websites with less distinction between genders (e.g. pink for women, black for men). On the other hand, in cultures with high masculinity, stronger and highly saturated colors are used, and there were stronger distinction between genders. Although for websites or apps specially aiming for single gender it might be less the case, the difference was still thought to exist. For example, one respondent said: "*…It's actually very clear or easy to explain. I think that in case of low score, the colors and graphics used are in such a way that everybody few comfortable with. In*

case of high score, it's more made for men. You also see now for example at the "showering" website stuff, everything format is made dark and tougher... I think in low score it's made in such a way, for example it's green. (Not very strong colors.) No you don't see that is really made for women or for men, except that (projects especially for men)."

In terms of graphics, in feminine cultures graphics were thought to have more curves like boarder-radius and more aesthetic, which also seemed to be softer and neutral, while in masculine cultures graphics were thought to have more straight lines like rectangles and more practical. There was also thought to be less distinction between genders in feminine cultures and stronger distinction in masculine cultures. For example, a respondent explained: "*…The graphic style, this is a good example I think, because this is more about aesthetics, so more femininity, while this is masculinity, so, like the colors, hard, direct and just 'use this picture and that's it.' It's very practical.*"

The attributes given when considering the visuals as a whole, in which colors and graphics were described together, showed the same tendencies as the above ones. In addition, there were other detailed elements belonging to visuals such as interaction effects and multimedia use. They, again, also showed same tendencies: in feminine cultures visuals are more stylish, focusing more on playfulness, while in masculine cultures they were more practical, emphasizing more on information quality, as said by one interviewee, "*…I think it is more goal-oriented in masculine societies... Yes. It focuses on efficiency, and won't use redundant actions... And femininity has more effects, and is more immersive*."

Above all, in term of visuals, in feminine cultures colors should be more pastel and neutral, graphics more aesthetic and have more curves, visuals generally more neutral between genders, while in masculine cultures there were more highly saturated and strong colors, graphics were more practical with more straight lines, visuals generally more distinctive between genders.

Navigation

Navigation in masculine societies was thought to be more direct to the point with limited options, while in feminine cultures there were more navigation possibilities. They believed that, in masculine cultures, males play the dominant role, and it was males' mindset that preferred directness and being straight to the point. For example, one respondent thought "*...In societies with high masculinity, navigation must be clearer, and should be more structured... Yeah it should just be linear, like straightforward to the point*."

Other elements

Due to low frequency, other elements namely layout, prompts, information hierarchy, and image-to-text ratio were not taken into as the elements for final indicators.

Nevertheless, they do show some of consistency to the elements stated above, so does the general style proposed. For example, on the masculine side, information was thought to be presented more directly and in serious way, whereas on the feminine side it was more friendly, soft, allowing for more options.

Conclusion

Above all, two independent elements were thought to be influenced by the dimension of masculinity:

- In term of visuals, in feminine cultures colors should be more pastel and neutral, graphics more aesthetic and have more curves, visuals generally more neutral between genders, while in masculine cultures there were more highly saturated and strong colors, graphics were more practical with more straight lines, visuals generally more distinctive between genders.
- Navigation in masculine societies was thought to be more direct to the point with limited options, while in feminine cultures there were more navigation possibilities.

4.2.2. Commenting Part

The quantitative results for this dimension are shown below in table 9. The following text is going to explain the results by each guideline.

Table 9
Means for Guidelines for Masculinity

	Mean (St.d)	t	df	p
MAS1	5.60 (1.73)	4.138	19	.001
MAS2	5.25 (1.29)	4.324	19	.000
MAS3	6.25 (0.55)	18.291	19	.000

Note. The Data is based on 7-point Likert scale, from "1=Not useful at all" to "7=Completely useful".

MAS1

As shown in table 9, for MAS1 guideline, i.e. **"Little saturation, pastel colors"** on low score side versus **"Highly contrasting, bright colors"** on high score side, mean score (M = 5.65, SD = 1.73) was much higher than the middle score of 4.0, a statistically mean difference of 1.65, t(19) = 4.138, p = 0.001. The guideline was seen as useful by interviewees.

This guideline was actually quite in line with what interviewees said for visuals in the eliciting part, with respect to colors. Most of them had thought of it in the eliciting part. However, even for those who agreed with it, several of them doubt the

expression “bright colors”. They thought that in masculine cultures there would be more highly contrasting and highly saturated colors, or strong colors, but not necessarily bright colors. For example, one respondent said: “*...I don't agree completely with bright colors, because I don't think black is bright color. But it's highly contrasting color.*” And “*...Things like what I’ve thought about: if you have more femininity you have more pastel soft colors. I think the color is different, but not necessarily bright. I think not necessarily these colors, but different, so harder colors, male colors. So I think it’s the useful side*.” said by another.

Three out of twenty respondents disagreed with it (score <= 3). Two of them also had problem with “bright colors”, as one of the respondent said: “*...The first one I don't agree on that, because you see women like bright colors more than men, and I don't know many men would like bright colors.*” One respondent thought it has no relation to masculinity, but more to the project.

Above all, generally they agreed that in feminine cultures and they will be more pastel colors, while in masculine cultures more highly contrasting and highly saturated would be used, but not necessarily bright colors.

MAS2

As shown in table 9, for MAS2 guideline, i.e. **“Allow for exploration and different paths to navigate”** on low score side versus **“Restrict navigation possibilities”** on high score side, mean score (M = 5.25, SD = 1.29) was higher than the middle score of 4.0, a statistically mean difference of 1.25, t(19) = 4.138, p = 0.000. The guideline was seen as somewhat useful by interviewees.

This guideline is about navigation, and is actually also very in line with the eliciting part. Examining the explanations, what participants agreed was that, in masculine cultures, since males played the dominant roles and they were more goal-oriented and straight to the point, so they would have limited navigation possibilities. On the other hand in feminine cultures, they were more relaxed about pursuing goals, so more navigation options were welcomed. For example, one respondent said: “*...I think it makes sense, because high masculinity implies pursuing material success, meaning they want practical things: you just give me want you want and I do not need other unrelated things. Restricting navigation possibility might mean pushing information to users in a way that is less friendly: you get what you've read.*”

In addition, they also expected that, in masculine cultures interface designs would cater more for males, while in feminine cultures they would cater for both genders, so they needed more varieties to satisfied needs from both genders, as one participant put it: “*...I think when you have feminine culture you have bigger target group (in terms of genders), so it’s more about exploration than men, most of the time. And I think when a site is more focused on masculinity, it’s more about, yeah, men always want some kind of practical use. And masculinity is always about*

straightforward things, achieving certain goals."

Those who disagreed thought that because they saw no difference in two different cultures in terms of navigation. They expected that users in masculine cultures would also want to try different ways and play the dominant role. It was more related to the content instead of masculinity: "*…I can't see any difference between masculine and feminine societies in terms of this aspect. …I think it depends on the content. If the content is more important, it will be put on the first level navigation, and less important one on the second level.*" Therefore, they seem to have the problem with the expression "restrict", since they thought you should not restrict what males want to do in masculine societies because they were more dominant.

Above all, generally interviewees agreed that in feminine cultures there would be more navigation possibilities allowing for exploration, while in masculine cultures navigation was expected to be more direct with restrained options.

MAS3

As shown in table 9, for MAS3 guideline, i.e. **"Attention gained by visual aesthetics"** on low score side versus **"Graphics used for utilitarian purposes"** on high score side, mean score (M = 6.25, SD = 0.55) was much higher than the middle score of 4.0, a statistically mean difference of 2.25, t(19) = 18.291, p = 0.000. Therefore, with the highest score gained in the guidelines for all the five dimensions, the guideline was seen as very useful by interviewees.

This guideline was actually also in line with the eliciting part in terms of graphics for the element of visuals. And examining the explanations given, most of them said that it was what they thought in the eliciting part. For example, a typical explanation was like "*...And this is also right. Cool. Because masculine societies have preference for success, so people strive for efficiency and practicality. So they want things given to them to be practical, and don't care about other things... In feminine societies, people pursue beauty. (So besides usefulness) they will also consider other things.*"

However, it seemed also easy to have problems with the expression in this dimension in that, for the side of femininity, it should also emphasize on practical use and then at the same time provide aesthetics, as one respondent put it: "*...This side definitely emphasize on practical use, but this side I think it's also based on practical use and then at the same time they pay attention to aesthetics.*"

4.2.3. Conclusion

For the dimension of masculinity, the commenting part showed great consistency to the eliciting part, and the existing guidelines were thought to be most useful compared to other four dimensions, although some specific detailed expressions

used in the guidelines were doubted by participants. Therefore, incorporated with the eliciting part, the refined indicators for the dimension of masculinity were proposed as below:

Table 10

Refined UI Design Indicators for Masculinity

Elements	Low Score	High score
Visuals	Visuals generally more neutral between genders; more pastel and soft colors; graphics more aesthetic and have more curves	Visuals generally more distinctive between genders; more highly saturated and strong colors; graphics more utilitarian with more straight lines
Navigation	Allow for navigation with more navigation possibilities and paths	More direct, restrained navigation possibilities.

4.3. Individualism

4.3.1. Eliciting Part

As shown in table 11, similar to Masculinity, the dimension of Individualism was also thought to have strong influence on visuals (especially colors and graphics), and most of them also proposed colors separately from graphics. Some others proposed the general visuals and multimedia use. In addition, interaction was also proposed with high frequency. Interviewees mostly attributed the influence on these two elements to two reasons by the dimension, namely the convergency in collectivistic cultures versus divergency in individualistic cultures, and the willingness to help each other in collectivistic cultures versus the willingness to be independent in individualistic cultures. Other elements were thought to be less influenced or had conflicts attributes. The following paragraphs are going to present how each element was thought to be influenced.

Table 11

Elements Thought to be influenced by Individualism

Elements	Frequency
Visuals (color)	7
Visuals (graphics)	8
Visuals (multimedia use)	2
Visuals (general)	2
Interaction	10
Layout	4
Prompts	3
Information hierarchy & structure	2
Information highlighting	1

Navigation	1
General style	1

Note. The detailed attributes captured for each element are displayed in Appendix C.

Visuals

In terms of colors, respondents mostly expected that in cultures with high individualism colors used were more stylish and personalized and tended to be simpler, whereas in collectivistic cultures, colors used were more conserved and more similar to peers', and the interfaces seemed to be more colorful. For example, one respondent interpreted that: "*...Individualism uses lucid and lively colors, while collectivism uses colors that are accepted by the general population. It's like specificity and generality. Normally the general population would hardly accept flashy colors, but some people like to display their characteristics and they are different from others, so they will like to use distinctive colors.*"

With respect to graphics, it is similar to colors that most respondents thought in individualistic cultures graphics were more personalized, and on the other hand in collectivistic cultures graphics were more standardized and mediocre. For instance, one interviewee said: "*...With individualism, then the graphic styles are more personalized and displaying individual characters, while with collectivism, the graphic styles are more traditional.*" and "*...The sites in Holland are more like individualistic, because they are made by a creator, and the creator likes it and it has a style. And I think the Asian sites are also in a style, but more that everyone agrees with it.*" said by another.

Visuals in terms of multimedia use were much less frequently proposed, and the attributes given to it thing to be contradictory, thus it was discarded. The visuals proposed in general showed same tendency as colors and graphics.

Interaction

For interaction, respondents showed the agreement that in cultures with low individualism it would be more complex and provide more guidance for users, whereas in individualistic cultures interaction was simpler with less help. For instance, a respondent remarked that: "*...if it's more like the collectivist side, I feel it will make it to guide you better. Whereas individualism is more like taking care of yourself… Because the individualism is more you just take care of yourself, and the collectivism is more of take care of each other.*" And "*...what it says is that people care a lot only by themselves and maybe there is influence for the websites in a way the designers say 'we've built the website', and they say to user 'go find by yourself'. And it provides the user with not as much help… What I see from the Chinese culture is that they are really focusing on helping other people also in the technology development*." said by another.

Layout

Although several respondents proposed layout as an influenced element, the attributes given to it did not show clear tendency. Instead, conflicts in the attributes and explanations were found in those respondents. Two out of four respondents believed that important information was more outstanding in individualistic cultures, and it was less contrasting and more compromised in collectivistic cultures. However, another respondent gave the opposite attributes, and the last respondent proposed different pair. Therefore, the element of layout was not taken in the final results.

Prompts

Similar to interaction, interviewees who proposed prompts believed that in collectivistic cultures there would be more prompts providing help and the prompts were more complex, while on the other hand in individualistic cultures there were less prompts and were to be simpler. For example, one respondent explained that: "*... Pop-ups are also of the same idea. If there's a problem, if it's the collectivist side there is faster pop up to give help and suggestions for how to proceed. And individualism I can imagine maybe it's less, because you just have to find it out yourself or try again.*"

Other elements

Due to low frequency, other elements namely information hierarchy, information highlighting and navigation were not taken into as the elements for final indicators. Nevertheless, examining the attributes given to those elements, the same tendency as the above ones was also found, i.e. in individualistic cultures these elements tended to be simpler, while in collectivistic cultures they were thought to be more complex.

Conclusion

Above all, with similar tendency, three independent elements were thought to be influenced by the dimension of individualism:

- In terms of visuals, in cultures with high individualism, namely individualistic cultures, colors and graphics were expected to be more stylish and personalized with simplicity. On the other hand, in cultures with low individualism, namely collectivistic cultures, colors and graphics were thought to be more traditional and similar to each other; interfaces seemed to be more colorful.
- Interaction in collectivistic cultures would be more complex and provide more guidance for users, whereas in individualistic cultures interaction was simpler with less help.
- In collectivistic cultures, there would be more prompts providing help, whereas in individualistic cultures there will be less prompts.

4.3.2. Commenting Part

The quantitative results for this dimension are shown below in table 12. The following text is going to explain the results by each guideline.

Table 12
Means for Guidelines for Individualism

	Mean (St.d)	t	df	p
IND1	5.55 (1.36)	5.111	19	.000
IND2	2.70 (1.30)	-4.466	19	.000
IND3	5.00 (1.52)	2.939	19	.008
IND4	4.45 (1.73)	1.162	19	.259

Note. The Data is based on 7-point Likert scale, from "1=Not useful at all" to "7=Completely useful".

IND1

As shown in table 12, for IND1 guideline, i.e. **"Traditional colors and images"** on low score side versus **"Use color to encode information"** on high score side, mean score (M = 5.55, SD = 1.36) was much higher than the middle score of 4.0, a statistically mean difference of 1.55, t(19) = 5.111, p = 0.000. The guideline was seen as rather useful by interviewees.

This guideline is actually somewhat similar to the element of visuals in the eliciting part. Examining the comments given, besides those in line with what proposed in the eliciting part, respondents agreed that compared to collectivistic cultures websites in individualistic cultures tended to use colors more creatively to show their characteristics. For example, one respondent said that: "*... I can imagine an example in the Netherlands they are more focused on one target group, on many different people, they visit your site; they use color to encode information to guide the user as much as possible in the direction they want*." While for collectivistic interfaces, another respondent explained: "*...Collectivistic users are probably prone to choose established and general colors.*"

However, there were some interviewees reserved their agreement towards this guideline, because they thought it was not absolute: "*...I think it's also for low score websites you can do a lot with colors, so it shouldn't be too traditional.*" In addition, one respondent had the problem with the expression, and thought that the two attributes were not parallel to each other: "*...These are two completely different things. They actually, say use color more practically, more for… Yeah, I don't see this one.*"

IND2

As seen in table 12, for IND2 guideline, i.e. **"High image-to-text ratio"** on low score side versus **"High text-to-image ratio"** on high score side, mean score (M = 2.70, SD = 1.30) was much lower than the middle score of 4.0, a statistically mean difference of 1.30, t(19) = -4.466, p = 0.000. The guideline was seen as not useful by interviewees.

Look into the reasons, those who disagreed with it mostly remarked that they could not see any relation between image-to-text ratio and individualism and kept neutral about it, or they actually even thought the other way around, since according to the reality, Dutch websites had more images while China's websites had more text. For example, one participant remarked that: "*...Yes I think in Netherlands we use more images... in China maybe they use less images, so I don't really agree with that. And I don't think on Dutch websites we include that much text, much more text than images.*" Many of the rest believed that image-to-text ratio depended much more on other factors rather than individualism: "*...The image to text ratio is mainly based on what kind of information you want to convey. I think that depends on the definition of the product. You can't say that if it's individual reason there will be more images than text.*"

Only one respondent scored five, namely slightly useful, because he thought that images were easier to convey general meanings thus were more suitable for collectivism, but this is quite personal.

IND3

As shown in table 12, for IND3 guideline, i.e. **"High multimodality"** on low score side versus **"Low multimodality"** on high score side, mean score (M = 5.00, SD = 1.52) was higher than the middle score of 4.0, a statistically mean difference of 1.00, t(19) = 2.939, p = 0.008. The guideline was seen as slightly useful by interviewees.

Those who agreed with this guideline thought it was in line with what they had said in the eliciting part that in collectivistic cultures interaction would be more complex with more help, whereas in individualistic cultures interaction was to be simpler with less help. For instance, "*...As we discussed before, high multimodality is used for collectivist cultures, because of, as it says here, modes involving the five human senses (definition). I think in individualistic society, we don't use that; we just want to know what we need to know... We do not use all of our sense: we just want to keep it simple.*"

Some participants kept neutral about it, because they thought that multimodality was quite a new and had not been maturely used and therefore it could be both way. For example, one respondent remarked that: "*... I think there's not much research in that for how we can add multimodality to a site in an efficient way. You have some sites that struggling with that, but I haven't seen a good example of how to insert*

elements."

Others disagreed with it because the see no relations or they thought the other way around, since high multimodality could provide more options and personalized features for users, which was favored more by users with higher individualism. In addition, based on the reality, one participant marked that the complexity on Chinese websites were actually due to the generally lower level design industry instead of because of high multimodality.

IND4

As seen in table 12, for IND4 guideline, i.e. **"Colorful interface"** on low score side versus **"Monotonously colored interface"** on high score side, mean score (M = 4.45, SD = 1.73) was near to the middle score of 4.0, without statistically mean difference, t(19) = 1.162, p = 0.259. The guideline was seen as "neither useless nor useful".

Looking into the reasons, what participants agreed was that in collectivistic cultures colorful interface was in line with the comprehensiveness and they expected that websites in collectivistic cultures had to cater for more general user groups. And on the other hand, monotonously colored interface was thought to be somewhat in line with simplicity, for example the interface of Apple's website which is mostly grey and white. For instance, one interviewee explained that: "*...I agree with the colorful interface and it's because its position is less clear... They have to satisfy the general taste: if a product is less clearly positioned, maybe it targets at the masses.*"

What participants disagreed was that, first of all, it was not necessarily monotonously colored interface for individualistic cultures but more about neutral or safe colors that will not be strongly liked or disliked by individuals. Secondly, and most importantly, they would not think this was not related to individualism but more to specific websites as long as they look beautiful. For example, a respondent remarked: "*...Monotonous interface or not has nothing to do with individualism or collectivism: it's mainly about whether it's nice or not. So I think there is no strong relation between individualism and monotonous interface.*"

4.3.3. Conclusion

For the dimension of individualism, two existing guidelines in commenting part showed good consistency to the eliciting part, one guideline was discarded, and the last guideline partly showed consistency but was doubted with its expression. Generally, in individualistic cultures elements on the interfaces were thought to be more standardized and traditional with more complexity, while in individualistic cultures they were expected to be more personalized with simplicity. Therefore, incorporated with the eliciting part, the refined indicators for the dimension of individualism were proposed as below:

Table 13

Refined UI Design Indicators for Individualism

Elements	Low Score	High score
Visuals	Colors and graphics more traditional and similar to each other; interfaces more colorful	Colors and graphics more personalized and creatively used with simplicity; use color to encode information
Interaction	More complex with more guidance for users	Simpler with less help
Prompts	More prompts providing help	Less prompts

4.4. Uncertainty Avoidance

4.4.1. Eliciting Part

The dimension of uncertainty avoidance was also thought to be very influential, especially on how information was displayed and constructed on the interface. Therefore, information hierarchy & structure, layout, navigation and interaction seemed to be most obviously influenced, as shown in table 14. The following paragraphs are going to present how each element was thought to be influenced.

Table 14

Elements Thought to be influenced by Uncertainty Avoidance

Elements	Frequency
Information hierarchy & structure	12
Layout	11
Navigation	10
Interaction	7
Visuals	6
Prompts	1
Prompts	1
Image-to-text ratio	1
General style	1

Note. The detailed attributes captured for each element are displayed in Appendix C.

Information hierarchy & structure

Information hierarchy and structure as an element was thought to be most influenced by the participants. Looking at the attributes captured, respondent showed tendency to agree on that in cultures with high uncertainty avoidance information hierarchy & structure was to be more standardized, more structured and clear, and categories were more distinct to each other, whereas in cultures with low

uncertainty avoidance information hierarchy & structure had more variance and complexity, categories had overlaps. For example, a Dutch participant remarked that: "*...Yeah, you (with low uncertainty avoidance) are compromising more. Now I get it. Sometimes you accept thing as just they are, while we (with high uncertainty avoidance) are criticizing everything… as UA is defined here, we would expect that content will be structured in the same way that you are familiar with in high UA.*" And another Chinese participant said: "*... (For high uncertainty users) for example if you want to define a sub-tag, you shall be very rigorous about which main tag it belongs to. The other group of people might think either you put swimming suits under spots category or close category is acceptable.*"

Layout

Similar to information hierarchy & structure, layout in cultures with high uncertainty avoidance was also thought to be more standardized, similar and clearer, while on the other hand in cultures with low uncertainty avoidance layout was easier to change according to practical situations and more complex. That was because, as respondents interpreted from the definition, people in societies with strong uncertainty avoidance maintained rigid codes of belief and behavior, whereas in societies with weak uncertainty avoidance people maintained a more relaxed attitude in which practice counts more than principles. For instance, one respondent interpreted that: "*...People in strong UA societies, they prefer, well, not structured layout, but the same layout. I think it is standardization: that's the right word... Whereas, in weak UA, layout, it doesn't matter, 'we will manage it'.*" And another respondent explained that: "*...For layout, I think websites with stronger uncertainty avoidance might entirely follow the guidelines of current or previous theories. For example if the margin is said to be 20 then it is made 20. Websites with weak uncertainty avoidance are more relaxed about that.*"

Navigation

Besides also being more standardized, navigation in societies with high uncertainty avoidance was thought to be more about direct and linear navigation, while in societies with low uncertainty avoidance navigation was thought to be less standardized and had more navigation options. For example, one Dutch participant mentioned that: "*...I do think there is standardization in navigation (in strong UA). As I said also before (in the warming up), the navigation pane (on Dutch websites) is all on the left, or all on the top, if it is somewhere else, then it's difficult for strong UA people to switch to the fact that the navigation pane is somewhere else.*" And another Chinese respondent remarked that: "*...With high uncertainty avoidance, the navigation should be very clear and the position of the users is more obviously shown. So it's very clear and direct... Navigation in high uncertainty avoidance societies is more fixed, while ours is more fickle.*"

Interaction

Similarly again, interaction in cultures with high uncertainty avoidance was thought to be more standardized and very direct, whereas in cultures with weak uncertainty avoidance interaction was more various and experimental. Looking into the explanations, one respondent said that: "*...because say there are multiple ways of interaction on the websites (in cultures with low uncertainty avoidance). For me if one thing works, like mouse and keyboard, there could be other way, say speech recognition something like that, I might be hesitating to use that. Instead, I would just use mouse and keyboard, because I know it works. If you feel less threatened by in certain situations you will maybe want to try it more.*"

Visuals and other elements

Although the element of visuals was also proposed several times, but they actually referred to different things like colors, graphics and multimedia, and they do not show clear tendency. Therefore, the element of visuals was not taken into the final results, so were the other elements because of their low frequencies.

Conclusion

Above all, all the accepted four elements that were thought to be influenced by the dimension of uncertainty avoidance showed great tendency, and they are almost all about how information is presented and structured on the interface. Generally, in cultures with high uncertainty avoidance these elements were thought to be more standardized and clearer, because users were more strict on rules and were rejecting uncertain situations. On the other hand, elements in cultures with weak uncertainty avoidance were thought to be more various and complex, since these users were more tolerant of uncertainty situations, and were more ready to change according to practical situations. To sum up:

- Information hierarchy & structure in cultures with high uncertainty avoidance was to be more standardized, more structured and clear, and categories were more distinct to each other, whereas in cultures with low uncertainty avoidance information hierarchy & structure had more variance and complexity, categories had overlaps.
- Layout in cultures with high uncertainty avoidance was also thought to be more standardized, similar and clearer, while on the other hand in cultures with low uncertainty avoidance layout was easier to change according to practical situations and more complex.
- Navigation in societies with high uncertainty avoidance was thought to be more about direct and linear navigation, while in societies with low uncertainty avoidance navigation was thought to be less standardized and had more navigation options.
- Interaction in cultures with high uncertainty avoidance was thought to be more

standardized and very direct, whereas in cultures with weak uncertainty avoidance interaction was more various and complex.

4.4.2. Commenting Part

The quantitative results for this dimension are shown below in table 15. The following text is going to explain the results by each guideline.

Table 15
Means for Guidelines for Uncertainty Avoidance

	Mean (St.d)	t	df	p
UA1	5.20 (1.91)	2.812	19	.011
UA2	5.95 (0.89)	9.831	19	.000
UA3	5.55 (1.57)	4.410	19	.000
UA4	5.30 (1.75)	3.322	19	.004

Note. The Data is based on 7-point Likert scale, from "1=Not useful at all" to "7=Completely useful".

UA1

As shown in table 15, for UA1 guideline, i.e. **"Most information at interface level, complex interfaces"** on low score side versus **"Organize information hierarchically"** on high score side, mean score (M = 5.20, SD = 1.92) was higher than the middle score of 4.0, a statistically mean difference of 1.20, t(19) = 2.812, p = 0.011. The guideline was seen as somewhat useful by interviewees.

This guideline was seen partly in line with the "information hierarchy & structure" in the eliciting part. What respondents agreed with was that in cultures with low uncertainty avoidance, the interface was more complex, stuffed with much information, whereas in cultures with strong uncertainty avoidance information was to be more structured and standardized.

However, quite a few participants disagreed with it, because first of all, they had a problem with the expression "at interface level" and referred to it as the first interface level, claiming that in cultures with high uncertainty avoidance should put most information on the front page. This did not necessarily mean that interface would be crowded, but on the other hand could allow users see what the website was about immediately and do not have to click into deeper layers. For example, a respondent explained that: "*...but I think if you have most information at interface level as well, it's also good for high uncertainty avoidance… So if you're really uncertain about going deep into the website it would be useful to have most information at the interface level…*" Secondly, they believe that although in cultures with high uncertainty avoidance interface is more structured, it was always good to organize information hierarchically. In addition, the rest who didn't agree saw no

relationships between uncertainty avoidance and information hierarchy.

UA2

As seen in table 15, for UA2 guideline, i.e. **"Nonlinear navigation"** on low score side versus **"Linear navigation paths / show the position of the user"** on high score side, mean score (M = 5.95, SD = 0.89) was much higher than the middle score of 4.0, a statistically mean difference of 1.95, t(19) = 9.831, p = 0.000. The guideline was seen as very useful by interviewees.

This guideline is actually quite in line with what participants said about navigation in the eliciting part, in which they expected that navigation in countries with low uncertainty avoidance there were more navigation options, whereas in countries with high uncertainty avoidance navigation was direct, and there was more the linear navigation.

What respondents disagreed with was that, although there was the tendency, in cultures with low uncertainty avoidance, users would also benefit if the navigation was more structured, and linear navigation could be welcome in both cultures. For instance, one respondent put it: "⋯*But these two (linear navigation paths / show the position of the user) could also be implemented on the low uncertainty avoidance websites, because I don't think it has negative influence on the week uncertainty avoidance websites.*"

UA3

As seen in table 15, for UA3 guideline, i.e. **"Code colors, typography & sound to maximize information"** on low score side versus **"Use redundant cues to reduce ambiguity"** on high score side, mean score (M = 5.55, SD = 1.59) was higher than the middle score of 4.0, a statistically mean difference of 1.55, t(19) = 4.410, p = 0.000. The guideline was seen as useful by interviewees.

Examining the explanations, respondents agreed with that in cultures with high uncertainty avoidance it was all about simplicity and therefore reducing ambiguity is very important, whereas in cultures with low uncertainty avoidance users were more tolerant with complex interfaces and therefore the interfaces seem to be busier and for crowded. For example, one respondent remarked: "... *You don't want contradiction, you don't want to show someone irrelevant information. For example, I don't care whether or not my text is red, or my font is what kind of type. I just want the same font, same color, and same typography. So here we come to what we have said before, simplicity. Simplicity is the key here.*"

However, quite some respondents had problem with understanding the expression for the low score side and argued that instead of maximizing information using colors, typography and sound would actually distract users. They thought that, there was

more information on the interface on the low score side, but not necessarily in these ways. One respondent pointed out that the attribute on the low score side was purely bad design, and another saw no relations to the dimension.

UA4

As seen in table 15, for UA4 guideline, i.e. **"Long pages with scrolling"** on low score side versus **"Restrict amounts of data"** on high score side, mean score (M = 5.30, SD = 1.75) was higher than the middle score of 4.0, a statistically mean difference of 1.30, t(19) = 4.410, p = 0.004. The guideline was also seen as useful by interviewees.

Looking into the reasons given, respondents agreed with that, on the one hand in cultures with high uncertainty avoidance, users wanted simple interfaces and would not like too much information, and long pages with scrolling would be rejected by them since that would create uncertainty. On the other hand, in cultures with low uncertainty avoidance, users were more tolerant with complex interfaces; they might be even more engaged with the interface if it was more abundant. For example, one respondent put it: "*...(On the high score side) you will have a risk that you miss some information, and you will like to avoid that because you will be uncertain about the information you didn't scroll to. (On the low score side) Well, because I think they will be more, yeah, more engaged when they can go through more complex websites.*"

However, quite a few respondents thought that long pages with scrolling had much to do with the content of websites or apps, because sometimes you have no choice due to the large amount of content you had to present, like news websites, or Facebook. Some others argued that long pages with scrolling were not often seen in these days.

Interestingly, the respondent pointed out that nowadays there was kind of shift, because he thought that you could see many websites in Europe (which generally has higher uncertainty avoidance) that have long pages. Nevertheless, although the pages were long, the content was actually shown in the same structure we use scrolled each time.

4.4.3. Conclusion

Generally, all of the four existing guidelines for the dimension of uncertainty avoidance showed consistency to the elements elicited in the previous part, although respondents had some problems for some detailed expressions. Therefore, incorporated with the eliciting part, the refined indicators for the dimension of uncertainty avoidance were proposed as below:

Table 16

Refined UI Design Indicators for Uncertainty Avoidance

Elements	Low Score	High score
Information hierarchy & structure	Have more variance and complexity; categories had overlaps; more abundant information	More standardized, more structured and clearer; categories to be more distinct to each other; restrict amount of data
Layout	Easier to change according to practical situations; more complex	More standardized, similar and clearer; use redundant cues to reduce ambiguity
Navigation	More navigation options	More direct and linear navigation
Interaction	More various and complex	Standardized and direct

4.5. Long Term Orientation

4.5.1. Eliciting Part

In the eliciting part, the dimension of long term orientation seemed to have the weakest influence in all of the five dimensions, which is actually in line with the quantitative results (represented in next fraction). For the eliciting part, five Dutch participants and four of Chinese respondents (highest number in all five dimensions) said that it was difficult to come up with any elements that might be influenced by the dimension of Long Term Orientation. In these participants, four of them gave no element at all. However, looking at the elements proposed by interviewees (shown in table 17), there were some elements that thought to be influenced by this dimension. Tendencies were found, especially on the elements of visuals and information hierarchy & structure. The following paragraphs are going to present how each element was thought to be influenced.

Table 17

Elements Thought to be influenced by Long Term Orientation

Elements	Frequency
Visuals	7
Information hierarchy & structure	5
Navigation	2
Prompts	2
Interaction	1
Image-to-text ratio	1
General Style	1

Note. The detailed attributes captured for each element are displayed in Appendix C.

Visuals

Visuals were thought to be most influenced by the dimension of long-term orientation, in a way that in short-term oriented cultures visuals were to be more dynamic and attractive, while in long term oriented cultures visuals were relatively more calm and mediocre. They expected that this was because in cultures with short-term orientation people focused on the present and were easier to make decisions immediately instead of waiting and exploring, while people in long-term oriented cultures were more willing to take time to think and explore. For example, one respondent said for short-term oriented websites: "*... It has dynamic looks, like lots of colors, like red and vibrant colors, they're more like short-term, because that gives a feeling of fast moving company… I can imagine they will have different types of colors, graphic styles that are robust*." On the other hand, for long term oriented cultures, "*...The graphics are more abstract, and in the other one is more detailed and clear, because if you look at more to the future then people would probably understand what you mean if they do it again, perhaps in somewhere else already.*"

Information hierarchy & structure

Information hierarchy & structure was also thought to be quite influenced since it was about how to present information in term of time consuming. In addition, websites with long term orientation were thought to prone to preserve information to be used in longer time phase. Therefore in long term oriented cultures, websites were thought to have more abundant and elaborate information with deeper hierarchy while in short term oriented cultures there should be restrained amount of information with fewer layers. For example, in terms of time-consuming, one respondent interpreted: "*…I think that with long-term oriented culture you can have websites that have more like elaborate navigation and hierarchy... While with more short-term vision you don't want to have to elaborate user interface but you want to give what they need quickly, and you don't let other elements which can be almost anything like graphics.*"

Other elements

For other elements proposed for this dimension, namely navigation, prompts, interaction and image-to-text ratio, because there was lack of tendency for each of these elements due to their low frequencies, they were not to be taken into the final indicators as independent influenced elements. However, with careful observation, we could see that attributes described for navigation, prompts and interaction were actually quite in line with information hierarchy & structure, in the way that there were more simplicity and directness in cultures with short term orientation while more abundance and complexity in cultures with long term orientation. It was actually also the same with the general style, although it is not an independent element.

Conclusion

Above all, two independent elements were thought to be influenced by the dimension of long term orientation:

- Visuals in Long term oriented cultures were thought to be more calm and mediocre, while in Short term oriented cultures they were more dynamic and stirring.
- More abundant and elaborate information with deeper hierarchy were expected in cultures with long term orientation, while restrained amount of information with less layers were expected in cultures with short term orientation.

4.5.2. Commenting Part

The quantitative results for this dimension are shown below in table 18. The following text is going to explain the results by each guideline.

Table 18
Means for Guidelines for Long Term Orientation

	Mean (St.d)	t	df	p
LTO1	4.45 (2.04)	.987	19	.336
LTO2	4.15 (1.73)	.389	19	.702

Note. The Data is based on 7-point Likert scale, from "1=Not useful at all" to "7=Completely useful".

LTO1

As seen in table 18, for LTO1 guideline, i.e. **"Reduced information density"** in Short term oriented cultures versus **"Most information at interface level"** in Long term oriented cultures, mean score (M = 4.45, SD = 2.04) was slightly higher than the middle score of 4.0, but without statistically mean difference, t(19) = 0.987, p = 0.336. The guideline was seen as "neither useless nor useful".

Looking into the reasons given by participants, what they mostly did agree with was that in short term oriented cultures, information should be restrained while in long term oriented countries websites should contain larger amount of information which is also more elaborate. This is a line with what said about information structure in the eliciting part. For example, one respondent mentioned that: "*…Yeah the amount of information, I've already mentioned that more information in the long-term and less information and more pictures in the short-term.*"

Besides several of them saw no relations to the dimension, those who disagreed with it thought that in short term oriented cultures most information (not necessarily

detailed and elaborate) should be able to be seen at the first level, for the reason that short term oriented people wanted to get information immediately, while long term oriented users hoped to have more comprehensive information. Actually, participants were quite confused with the expression for the long term orientation part, for whether it referred to "at the first interface level" or generally on the whole website. They accepted that there would be more information on websites in cultures with long term orientation, while less in cultures with short term orientation. For instance, one respondent said "*…For this one, I think I don't know how information density is related to long-term orientation. I think they are talking about different things. (Maybe it is talking about whether or not the page is very full and has dense information.) But I still think it's not useful.*"

Above all, interviewees believed that thought information amount should be restrained on websites in cultures with short term orientation, information show be directly seen on the first interface level, while in cultures with long term orientation there would be more abundant and more elaborate information.

LTO2

As seen in table 18, for LTO2 guideline, i.e. **"Content highly structured into small units"** in Short term oriented cultures versus **"Content can be arranged around a focal area"** in Long term oriented cultures, mean score (M = 4.15, SD = 7.04) was near to the middle score of 4.0, without statistically mean difference, t(19) = 0.987, p = 0.336. Same as LTO2, the guideline was seen as "neither useless nor useful".

Examining the explanations given by respondents, what they agreed was that content being highly constructed into small units was probably a kind of simplicity, which was more preferred by short term oriented users, whereas content being arranged around a focal area allowed for more comprehensive relations among the information, which could be liked by long term oriented users. For example, interpreted by on respondent: "*…Yes of course, if I am short oriented, and I go to website and want to buy a car, or watch, or, I don't know, a house, there are small units, because there is one button for a car, one button for watch, one button for a house. This is very much about simplicity: I don't want to think, I just want to click. That's the idea. This, around a focal area, you can say, stuff for your house, and then you can choose around the focus area besides the most important things.*"

For those who disagreed, besides several of them saw no relations to the dimension, some of them saw it the other way around because they expected in short term oriented cultures instead of in long term ones content should be arranged around a focal area, since it was a better way to provide the most important information more quickly. For example, "*…This one I disagree, because for short term orientation 'content highly constructed in small unit', which is not in line with what I have said. I think long term orientation, instead, will not have focal area, because everybody's focus is more, that's the same. And in a short-term orientation, you will have to*

highlight your important content."

Above all, respondents did not agree on this specific way of presenting information in cultures on two sides of the dimension. What they did thought consistently was still that in cultures with short term orientation you should present information quickly and directly, whereas in cultures with long term orientation information was more comprehensive.

4.5.3. Conclusion

For LTO1 and LTO2 participants showed the agreement that, in terms of information, users in short-term oriented cultures preferred direct information and less complicated information structures so that they could get the information they wanted as quickly as possible, while users in long-term oriented cultures might want more abundant and elaborate information because that brought them sense of safety.

Therefore, combined with the eliciting part, the refined indicators for the dimension of long term orientation were proposed as below:

Table 19

Refined UI Design Indicators for Long Term Orientation

Elements	Low Score	High score
Visuals	More dynamic and stirring.	More calm and mediocre
Navigation	Restrained amount of information immediately displayed with less layers	More abundant and elaborate information with deeper hierarchy

5. Discussion

5.1. Cultural Differences Do Matter

Although most of the interviewed respondents expressed that the topic was quite challenging for them since they had never thought about it, they did think culture could have influence on UI design in different degrees. The eliciting part gained quite fruitful results, and the elements proposed by respondents show good consistency in each culture dimensions. Consistency was also found between the elements proposed in the eliciting part and the existing guidelines used in the commenting part. For example, in the dimension of power distance and masculinity the UI design elements in existing guidelines were all covered by the propositions in the eliciting part. In addition, when making a conclusion for the topic, all interviewees expressed

that if there were cultural UI design guidelines it would be helpful for the industry, although the existing guidelines must be more convincing. Many of the respondents mentioned that the interview was quite inspiring for their future work. Therefore, based on the results, this study argues that culture dimensions do have influence on UI design.

5.2. Unevenness and Conflicts among the Dimensions

First of all, five dimensions showed uneven and different impacts on UI design according to respondents' explanations. The dimension of power distance and uncertainty avoidance were believed to be most influential, with the former influencing five elements and the latter four; both were thought to be mostly related to how information was presented and structured. The dimension of masculinity and individualism were also influential, but mostly on visuals and styles of interface, namely the appearance. The dimension of long-term orientation was thought to be least influential, both in eliciting part and commenting part. This is in line with the fact that, the dimension of long-term orientation was formulated by Hofstede much later than the first four dimensions and was tested on another set of countries, and therefore he was often excluded in mending studies (Callahan, 2005).

In addition, it is true, and was also often mentioned by respondents that, there are conflicts between some dimensions when applied to real countries, especially between the dimension of uncertainty avoidance and other dimensions. For example, China with low uncertainty avoidance was expected to have more navigation options and information less structured, whereas China also had high power distance which should result in restricting navigation and more strictly structured interfaces. Respondents pointed out if they put those attributes proposed in one dimension to another, there might be conflicts. This is one of the reasons why this study wanted respondents to focus one dimension at a time.

This was also in line with the literature. For example, Marcus pointed out that: "When Hofstede and Bond developed a survey especially for Asia and evaluated earlier data, they found out long-term orientation canceled out some of the effects of masculinity and uncertainty avoidance" (Marcus & Gould, 2000, p19). And Hofstede suggested "uncertainty avoidance to be only relevant to Western cultures and this is vindicated in the fact that this factor was not found to be significant at all for Chinese users" (Smith et al., 2004, p79). Therefore, the interrelations and the conflicts among the dimensions are beyond this study, and shall be addressed in the future work.

5.3. Existing Guidelines Need to Be Re-examined and Refined

The majority of the existing guidelines were thought to be useful by respondents

from China and the Netherlands, and two of the guidelines were scored as "very useful". However, many of these useful guidelines were thought to be inappropriately worded and thus had to be revised. 6 out of the 18 guidelines were thought to be neither useless nor useful. One guideline was thought to be very useless. Those useful part of the guidelines were mostly covered by the elements proposed in the eliciting part, and therefore could be seen as having relatively solid basis. For those disagreed parts, respondents thought they were either unrelated to the culture dimensions or was not true due to the reality. Therefore, maybe this could explain why the previous empirical studies based guidelines like these resulted in contradictory outcomes, which confirms that it is worthwhile to re-examined those guidelines from the beginning and refine the guidelines. This study does contribute to that.

5.4. Indicators Rather than Guidelines

Although all respondents believed that culture dimensions do have influence on UI design, and the indicators proposed could provide help, they were not absolute guidelines that practitioners should strictly follow. Instead, we should use those indicators based on specific situations, because there were other variables that were more important than culture, such as commercial consideration, the specific content or specific target groups. Especially, Chinese respondents pointed out that some UI design attributes resembling Chinese websites and apps on one side of the dimensions were actually bad designs instead of featured designs, because they believed that UI design and together with the IT industry in China was less developed compared to Western countries. Therefore, these attributes could be changed.

Similarly, some respondents believed that human brains were the same, which would prefer, for instance, simplicity and symmetry rather than complexity and asymmetry. However, respondents also argued that, those design attributes already formed user habits in the local cultures. For example, they remarked that due to cultural reasons as well as habits, users in some cultures would prefer complexity than simplicity, because that would be seen as more authoritative and they would be more engaged with say multiple navigation possibilities. This probably could explain why sometimes following the cultural dimensions seems to be at odds with what we assume to know about user-friendly design.

Above all, it is more reasonable to see those relationships between culture dimensions and UI design as indicators rather than guidelines. Other variables beside culture might affect UI design more, and those indicators should be critically applied in the design process. As suggested by (Khaddam & Vanderdonckt, 2014), we need to think about the need for customization, modification and adaptation when we use them.

6. Limitations and Suggestions for Future Research

Although carefully designed and executed, this study still has some limitations. Firstly, only a small number of respondents were recruited for interviews, therefore there might be other indicators that were missed and the proposed indicators in this research could not be seen as exclusive. Furthermore, due to the same reason, apart from some UI design elements showed obvious tendency and big frequency, some elements with smaller frequency might be less convincing though tendency among elements was examined. In addition, even though respondents are specializing in the related field, except for several of them who have internship experiences or practices in the field (according to their explanations for some elements in the interviews), they generally do not have much practical experiences. Hence, their opinions might be a little different from those from experienced practitioners.

The future work should further investigate the validity of those refined indicators through empirical studies, for example, also suggested by some respondents, to conduct experiments based on the indicators and see how they work. Secondly, the interrelations and conflicts among the cultural dimensions should be dealt with in order to obtain more ready-to-use indicators.

7. Conclusion

The definition of usability implies that usability might be influenced by culture. Therefore, the relationships between culture and interface usability have been studied since long time ago. Many efforts have been made to build those relationships between culture and UI design in terms of culture models, among which Hofstede's cultural dimensions were mostly used. Several UI design indicators were proposed and since then lots of empirical studies were conducted to examine those indicators, the outcomes were contradictory, with positive results as well as negative results. Rare to no studies went back to the beginning and investigated how the indicators were brought up. Therefore, this study recruited 20 knowledgeable respondents from China and the Netherlands to elicit their opinions are relationships between Hofstede's cultural dimensions and UI design, and later let them to comment on the existing guidelines. With good consistency, results showed that cultural dimensions do influence UI design in various ways. The majority of the existing guidelines were thought to be useful, but part of them need to be revised, and some of the guidelines were seen as less influential. Thus, combining the eliciting results and commenting results reflect indicators were proposed for each dimension. Those indicators shall not be seen as absolute facts, but should be critically applied in the design process, taking other variables into consideration as well.

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Appendices

Appendix A: Existing Guidelines 7-point Likert Scale Used in the Interview

Figure 2

Power Distance		
Low Score	**High Score**	**Not useful at all → Completely Useful**
Different access and navigation possibilities; nonlinear* navigation	Few links, minimize navigation possibilities; linear navigation,	☐☐☐☐☐☐☐
Data does not have to be structured	Structured data	☐☐☐☐☐☐☐
Most information at interface level, hierarchy of information less deep	Little information at first level	☐☐☐☐☐☐☐
Friendly error messages suggesting how to proceed	Strict error messages	☐☐☐☐☐☐☐
Asymmetry	Symmetry	☐☐☐☐☐☐☐

***Linear navigation:** The idea behind linear navigation is that the visitor is enticed to follow the pages in a predefined order or sequence that you have chosen.

Individualism		
Low Score	**High Score**	**Not useful at all → Completely Useful**
Traditional colors and images	Use color to encode information	☐☐☐☐☐☐☐
High image-to-text ratio	High text-to-image ratio	☐☐☐☐☐☐☐
High multimodality *(interaction)	Low multimodality (interaction)	☐☐☐☐☐☐☐
Colorful interface	Monotonously colored interface	☐☐☐☐☐☐☐

***Multimodality:** Multimodal human-computer interaction refers to the "interaction with the virtual and physical environment through natural modes of communication", i. e. the modes involving the five human senses (input such as speech, handwriting, hand gesture and gaze; output such as speech synthesis, smart graphics and others modalities).

Masculinity		
Low Score	**High Score**	**Not useful at all → Completely Useful**
Little saturation, pastel colors*	Highly contrasting, bright colors	☐☐☐☐☐☐☐
Allow for exploration and different paths to navigate	Restrict navigation possibilities	☐☐☐☐☐☐☐
Attention gained by visual aesthetics	Graphics used for utilitarian purposes	☐☐☐☐☐☐☐

***Pastel color:** Color that is delicate and pale.

Uncertainty Avoidance		
Low Score	**High Score**	**Not useful at all → Completely Useful**
Most information at interface level, complex interfaces	Organize information hierarchically	☐☐☐☐☐☐☐
Nonlinear navigation	Linear navigation paths / show the position of the user	☐☐☐☐☐☐☐
Code colors, typography & sound to maximize information	Use redundant cues to reduce ambiguity	☐☐☐☐☐☐☐
Long pages with scrolling	Restrict amounts of data	☐☐☐☐☐☐☐

Long Term Orientation		
Low Score	**High Score**	**Not useful at all → Completely Useful**
Reduced information density	Most information at interface level	☐☐☐☐☐☐☐
Content highly structured into small units	Content can be arranged around a focal area	☐☐☐☐☐☐☐

Appendix B: Mann-Whitney U Test Results Comparing Means of Two Groups

Table 20

Mann-Whitney U Test Results

Guidelines	Sig.
PD1	0.481
PD2	0.247
PD3	0.190
PD4	0.165
PD5	0.796
IND1	0.315
IND2	0.796
IND3	0.218
IND4	0.315
MAS1	0.353
MAS2	0.436
MAS3	0.684
UA1	0.393
UA2	0.436
UA3	0.123
UA4	0.579
LTO1	0.247
LTO2	0.912

Appendix C: Elements and Attributes Elicited for Each Dimension

Table 21

Elements Thought to be Influenced by Power Distance

Elements	Low Score	High score
Information hierarchy & structure	Less structured	More structured and organized
Information hierarchy & structure	Less structured	More strictly structured
Information hierarchy & structure	More freedom, variance.	More structured
Information hierarchy & structure	More equally structured	More fixed structures according to the importance of the information in an organization
Information hierarchy & structure	More intuitive	More complicatedly structured. Structures are pre-defined and scripted.
Information hierarchy & structure	Less deep with fewer layers	Deeper with more layers
Information hierarchy & structure	Morel logical, simple	Abundant information
Information hierarchy & structure	Emptier, most information outlined on the first level	Abundant information
Navigation	More options	More structured
Navigation	Allow for user-participation, more customizable	More fixed structures, more linear navigation
Navigation	Simpler	More complex
Navigation	Easier	More complicated, need to have experience to use
Layout	Content is more equalized	Important information more prominent
Layout	More similar(equalized)	More contrasting
Layout	More freedom	Rigorous
Layout	More relaxed, not pushing	Pushing
Layout	More contrasting	Less contrasting
Prompts	Less pop-ups	More pop-ups
Prompts	Less pop-ups	More pop-ups
Prompts	Less pop-ups	More pop-ups
Prompts	Ads are on the side or no pop-ups	More interrupting pop-ups shown in front of the screen
Prompts	Less pop-ups	Get pop-ups easily
Prompts	Less prominent, important information first	More prominent even to interrupting

Visuals	More graphics, graphics are more aesthetic.	More practical
Visuals	More attractive, beautiful and colorful	More practical
Visuals	More interaction and multimedia use are more accessible and enjoyable	Less interaction and multimedia use; let users to understand the information themselves
Visuals	Multimedia use is calm	More active and lively
Visuals	Creative, personalized	Traditional, conserved, more similar to peers' design
Visuals	More appealing, cleaner, simpler	More abundant, colorful
Visuals	More practical	More abundant, lively, garish to motivate users
Visuals	More cold colors	More warm colors
Image-to-text ratio	More intuitive images	More descriptive text
Image-to-text ratio	More images	More text
Image-to-text ratio	More images	More text
Image-to-text ratio	Less text, more images	More text, less images.
Interaction	More user-centered	Content-centered
Interaction	More user friendly	More difficult to use
Interaction	More user-centered, more friendly	More content-centered, more similar and standardized
Interaction	Allow more engagement for users, high multimodality	Single way, low multimodality
General style	More user-centered	Users to be easier to accept the way it is
General style	More user-centered	More content-centered
General style	More varieties	Follow trends
General style	Less solemn	More solemn

Table 22

Elements Thought to be Influenced by Masculinity

Elements	Low Score	High score
Visuals (color)	Generally softer, less distinctive between genders	Hard colors for men, soft colors for women
Visuals (color)	More neutral	More distinctive between genders, typical colors for male or female
Visuals (color)	Soft colors, less contrast in colors	Hard colors
Visuals (color)	Neutral colors	More distinctive between genders
Visuals (color)	Less distinctive, accepted by both male and female	Distinctive colors between genders
Visuals (color)	Less distinctive between genders	Obvious distinction between genders
Visuals (color)	Softer, less aggressive colors	More high saturated colors
Visuals (color)	Calm and simple colors	Humane and lively colors
Visuals (color)	Soft colors	Strong colors
Visuals (color)	Pastel and low saturated colors	Deeper colors
Visuals (color)	Less conventions specifically for males for females, more general colors	More distinctive between genders
Visuals (color)	More soft colors, less distinctive between genders	More distinctive between genders
Visuals (color)	More neutral	Shaper distinction between two genders
Visuals (color)	Pastel colors	Bright colors, high contrast
Visuals (graphics)	More about aesthetics	More practical
Visuals (graphics)	More soft, more boarder-radius	More rectangular
Visuals (graphics)	Girlish graphics	
Visuals (graphics)	Neutral, more curved, round boarders.	More straight figures like rectangles.
Visuals (graphics)	More curves	More rectangles
Visuals (graphics)	Focus more on enjoyment	Focus on important information
Visuals (graphics)	More curves	More rough graphics such as rectangles and triangles
Visuals (graphics)	Consider both genders, more neutral colors and graphics	Easier to go single way for genders, stereotyped
Visuals(general)	Less distinctive between genders, more neutral	More stereotyped for genders, more distinctive between genders
Visuals(general)		Information focused, practical and straight to the point, less playfulness
Visuals(general)	Soft	Tough style
Visuals(general)	More compromised colors, neutral ways	Strong distinction

Visuals(general)	More effects, more immersive	Focus on efficiency, more practical
Visuals(general)	Nice, modest, neutral, practical	To be impressive, to be competitive.
Visuals(general)	More stylish	Simple, for practical use
navigation	Have more possibilities	Use single way interaction
navigation		Clearer, more structured, linear, straight to the point
navigation	Milder attitude with more options	More utilitarian, limited options
Layout	Have more playfulness, more friendly	Display key points very quickly, e.g. enlarging font
Layout		Large place for most important thing, important things more outstanding
Pop-ups	More friendly	More aggressive
Pop-ups	Friendly	Serious
Information hierarchy	Deeper hierarchy	Less deep hierarchy, more direct
Information highlighting	Less contrasting	Important information to be very clear-cut
Image-to-text ratio	More images	More text
General	More modest	More impressive

Table 23

Elements Thought to be Influenced by Individualism

Elements	**Low Score**	**High score**
Visuals (colors)	Conserved colors	Stylish, novel colors
Visuals (colors)	Warm colors	Cold colors
Visuals (colors)	More standardized and tend to be similar	Value more individual style
Visuals (colors)	More similar colors	Safe and neutral colors
Visuals (colors)	More colorful	Fewer colors
Visuals (colors)	Universal colors	More different colors
Visuals (colors)	Use colors that are accepted by the general population	Use lucid and lively colors
Visuals (graphics)	More conserved	More flaunting and more characteristic
Visuals (graphics)	More traditional and less personalized	More personalized, displaying individual characteristics.
Visuals (graphics)	Follow peers' design; universal	More original
Visuals (graphics)	More mediocre and comprised	
Visuals (graphics)	More standardized (similar)	More customized
Visuals (graphics)	More complex and a little more garish	Pursue for Clarity
Visuals (graphics)	More standardized (similar)	More varieties
Visuals (graphics)	More standardized (similar)	More customized
Visuals (multimedia use)	More varieties to satisfy on the same page various user groups	Less varieties on the same page
Visuals (multimedia use)	More similar	More varieties
Visuals (general)	More popularized, compromised	More personalized, free styled
Visuals (general)	More conserved, less dynamic effects	
Interaction	More guidance, more options	Simple, less help
Interaction	More options to click	Direct
Interaction	More stylized	More personalized
Interaction	Comprehensive, multiple options	Simple, restrict options
Interaction	Follow peers' design; universal	More original
Interaction		More interaction options
Interaction	More help and guidance	Less help
Interaction	More standardized	More varieties
Interaction	More guidance	Less guidance
Interaction	Provide more help to users	Less preset help solutions.
Layout	More compromised	Important information to be more prominent
Layout	Collective and important	More equalized

	information at more obvious positions	
Layout	Less outstanding	Information to be more contrasting
Layout	More tolerant of messy things	More ordered and clearer
Prompts	More prompts (feedback)	Less prompts(feedback)
Prompts	Have various elements, less logical	More calm and rational
Prompts	More supporting prompts	Less prompts
Information hierarchy	More abundant and comprehensive information	Restrained information
Information hierarchy	A lot of information, long front page	Simplified, retrained information volume
Information highlighting	Highlight important information for users	Information more equalized
Navigation	More elaborate with better guide	Easier to use, less guidance
General style	More standardized	More customized and personalized, information more precise

Table 24

Elements Thought to be Influenced by Uncertainty Avoidance

Elements	Low Score	High score
Information hierarchy & structure	Can be less familiar	More familiar
Information hierarchy & structure	More tolerant with unstandardized and unfamiliar things	More similar and familiar; strict to design rules.
Information hierarchy & structure	More complex	Simpler
Information hierarchy & structure	Less structured and less standardized	
Information hierarchy & structure	More tolerant with unstandardized and unfamiliar things	More similar and familiar; strict to design rules.
Information hierarchy & structure	Can be deeper layers	Less deep layers
Information hierarchy & structure	A lot of information on the interfaces, more complex	Restrict data amount, simpler and clear
Information hierarchy & structure		More rigorously structured
Information hierarchy & structure	Categories have overlaps	Categories are distinct
Information hierarchy & structure	Categories have overlaps	Categories are distinct and more logically categorized
Information hierarchy & structure		Rigorously structured
Information hierarchy & structure	Focus on practical functions, lack of rigorous logic chain, change frequently	Logically rigorous and clear, steady
Layout	Can be less standardized	More standardized
Layout	More tolerant with unstandardized and unfamiliar things	More standardized and familiar
layout	Can be more experimental	More familiar
Layout	More tolerant with unstandardized and unfamiliar things	More similar and familiar; strict to design rules.
Layout	More experimental, more complex	More standardized and familiar, easy to use
Layout	Allow for more varieties	More similar and familiar
Layout	Easy to change by practical situations	Strict to design rules and standards
Layout	More complex	Simpler and clearer
layout	Less standardized and more changing	More standardized and steady
Layout	Easier with design guidelines, more various	Entirely follow design guidelines, more formal

Layout	Without prominence	Clear and have prominence
Navigation	Can be less standardized	More standardized
Navigation	Less strict rules about navigation	More standardized
Navigation	More tolerant with unstandardized and unfamiliar things	More similar and familiar; strict to design rules.
Navigation	Less standardized or familiar	More standardized or familiar
Navigation	Less controllable with more non-linear navigation	More controllable with more linear navigation, breadcrumbs
Navigation	Multiply corresponding navigation, more options	Clear, strict navigation
Navigation	Less guidance, non linear	More guidance, linear
Navigation	More variations	clear and direct, show position of the users, more fixed
Navigation	Have multiple options and freedom	Guide you to follow a certain sequence
Navigation	Multiple entrances for next step, more random	Limited links for next step, step by step
Interaction	More tolerant with unstandardized and unfamiliar things	More standardized and familiar
Interaction	More experimental, more complex	More standardized and familiar, easy to use
Interaction	Multiple interaction ways	Direct, simple, limited interaction ways
Interaction	Give less guiding feedbacks when meet no results	Give more guiding feedbacks when meets no results
Interaction	Less strict to standards	Strict to design rules and standards
Interaction	More complex and various	Simpler and more standardized with other websites
Interaction	A lot of changes based on specific situations	Stick to design guidelines, steady
Visuals	Less strict to color use principals or standards	Strict to color use principals or standards
Visuals	More warm colors	More cold colors
Visuals	Warm and lively colors	More solemn and serious
Visuals	Graphics more descriptive	Graphics to be clear, simple, straight to the point
Visuals	More extraordinary	More formal
Visuals	Allow less control over multimedia playing	Allow more control over multimedia playing
Prompts	Open to all kinds of tones	More serious and solemn
Prompts	More pop-ups	Less pop-ups
Image-to-text ratio	More images than text	More text than images
General style	Only focus on quality of the content	More focus on pleasance, intuitiveness

Table 25

Elements Thought to be Influenced by Long Term Orientation by Interviewees

Elements	Low Score	High score
Visuals	Bright colors, flashy things	Calm, steady visuals
Visuals	Dynamic, vibrant visuals	Stable, calm visuals
Visuals	Fancy, renewing, attractive	Restrained use of visuals; visuals are more traditional
Visuals	More detailed and clear; follow current fashion instead of trying new styles.	More abstract; try new styles
Visuals	More fancy, showy and enthusiastic	
Visuals	More dynamic, attractive	More calm
Visuals	More intuitive, dynamic visuals	Less passionate visuals, interfaces are more calm
Information hierarchy & structure	More direct with less layers	More elaborate with more layers
Information hierarchy & structure	Restrained amount of information	Abundant and thorough information
Information hierarchy & structure	Less information with fewer layers	More and comprehensive information with deeper hierarchy
Information hierarchy & structure	Restrained hierarchy with fewer layers	
Information hierarchy & structure	More intuitive, show the most important things immediately	Have fixed structures for information
Navigation	Less linear navigation	Linear navigation
Navigation	Direct navigation	Allow for exploration
Prompts	Less pop-ups	More pop-ups
Prompts	Less prompts	More prompts to involve users into the process
Interaction	Lower multimodality to make it simpler	Higher multimodality that allows for exploration
Image-to-text ratio	More auxiliary images	More direct text
General Style	Novel and fashionable	Traditional and steady