Culturally Sensitive User Interface Design: A Case Study with German and Vietnamese Users

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ABSTRACT

Considering country-specific preferences in user interface (UI) design is a time-consuming task. We present a case study with German and Vietnamese users to explore how cultural theory can be applied in early design phases to support culturally sensitive design. We present an analysis of cultural dimensions and a comparison of German and Vietnamese question-and-answer (Q&A) websites. Based on the derived insights, we developed two UI concepts of a Q&A-website that differ in information architecture, navigation structure, and visual presentation. The prototypes were assessed with 14 German and 14 Vietnamese users in a think aloud setting. We were able to draw a conclusion about our initial analysis and the differing evaluation of the participants from the two countries due to their preferences regarding information retrieval, trust, and error handling. Our analysis provides first insights into the applicability of cultural theory in UI design but also opens up questions for further research.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; • **HCI design and evaluation methods** → *User studies*;

KEYWORDS

User Interface Design, Cultural Dimensions, Culturally Sensitive Design, Hofstede, Cross-Cultural Design, User Experience

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1 INTRODUCTION

Placing users' needs at the center of the design process has been accepted as crucial to ensure commercial success and customer loyalty for a long time [1, 64]. In addition, since the turn of the century, design teams and researchers are increasingly aware that users' needs do not only circle around a usable design but favour a pleasant and emotional experience [72]. With an increasing focus on pleasurable products and hedonic design attributes beyond traditional usability aspects, user-centered design became more and more complex. Particularly in our digital and widely connected online world, where competing services are just a few clicks away, user interface (UI) designers can no longer primarily concentrate on a clickable and usable design but need to take further UI elements such as visuals, content structure, information architecture, and more into account (see Figure 1). It is not sufficient anymore to understand ergonomic human factors in design. Instead, users' evaluation of a UI today depends on many further factors, such as the emotional state, prior experiences, expectations, age, gender, and culture [69, 79]. Researchers and designers from both academia and industry use diverse tools and methods, ranging from interviews and observations to questionnaires and data logging [7, 66, 69, 80, 93] to study, understand, and consider these influencing factors.

In general, design teams can observe and measure the impact of different factors by a suitable study setup and choice of study

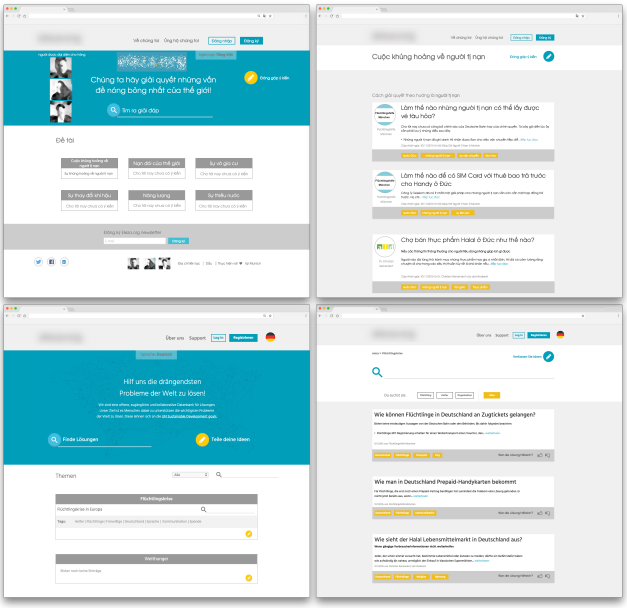

Figure 1: Screenshots of the main page (left) and an exemplary sub-page (right) of our two prototype versions targeting high Power Distance cultures (top, Vietnamese version) and low Power Distance cultures (bottom, German version). Photos and partner logos were anonymized for this paper.

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participants. The consideration of culture, however, usually requires time-consuming and costly ethnographic analyses [37, 76, 102]. In particular, such first-hand research is often not feasible and scalable for smaller teams and companies that do not have the chance to rely on team members from respective target countries. Consequently, numerous researchers discuss the consideration of cultural theory, particularly Hofstede's cultural dimensions [34], during the design process to cope with the increasing effort and costs [20, 44, 68, 76, 98, 100]. At the same time, further perspectives state concerns about the blind application of cultural theory in design (see, e.g., Nwokoye et al. [65]). In an age of "postcolonial computing", where culture goes beyond national boundaries, Irani et al. [38] emphasize that the core of cross-cultural considerations is engagement. In this light, we want to address the research question:

> "*How can cultural theory support a culturally sensitive UI design process?*"

To address our research question, we partnered with a small social start-up in order to identify country-specific UI design aspects of their website for the two pre-defined target countries Germany and Vietnam. We present results from (1) an analysis of cultural theory, particularly cultural dimensions according to Hofstede and colleagues [34], an analysis of German and Vietnamese question-and-answer (Q&A) websites and (2) a case study with 14 German and 14 Vietnamese participants to evaluate two UI concepts with differing information architecture, navigation structure, and visual presentation based on the previous analysis (see Figure 1).

This paper contributes an analysis of cultural theory and its application in UI design. For this purpose, we analyze cultural dimensions in the context of Human-Computer Interaction (HCI) and derive design insights for culturally sensitive UI design in a German and Vietnamese context. In addition, we discuss implications for HCI in further contexts (e.g., Africa) as well as future work for culturally sensitive design. We have chosen to establish the term *culturally sensitive design* for this work, similar to concept of value sensitive design according to Friedman et al. [21], to emphasize that we aim to foster a mindset that accounts for cultural differences during the design process.

2 BACKGROUND AND RELATED WORK

The role of culture in HCI has been widely discussed in both academia and industry. Companies in many industries have developed localization strategies for their products and marketing campaigns since a long time. In addition, academic studies underpin the impact of cultural differences on product design [74, 77]. However, a common theoretical basis and understanding of cultural aspects in HCI has not yet been established. In fact, researchers still controversially discuss how existing cultural theory can be applied in HCI (see Winschiers [98] and Ford & Kotzé [20]).

To better understand the scope of cultural issues in HCI and to embed our research question into the academic discourse we, first, summarize how the shift from a usability to a User Experience (UX) perspective changed the way we need to look at culture in HCI (see Figure 2). Second, we present basic conceptualizations of culture and some associated design approaches. Next, we reflect on how the established concept of cultural dimensions is generally applied in user-centered design processes.

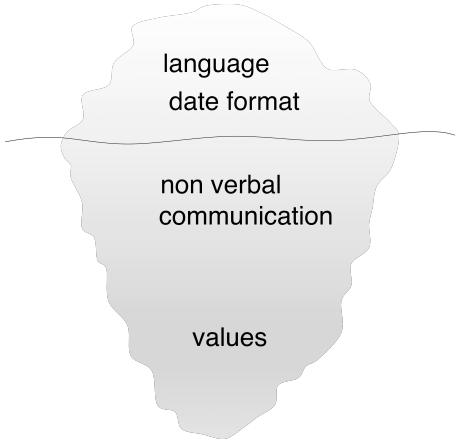

Figure 2: Different layers of culture according to Hoft [35].

2.1 From Usability to User Experience

The way we design and evaluate user interfaces has significantly changed within the last decades. Researchers and practitioners alike traditionally looked at UI from a usability perspective based on the credo that "to measure is to know" (see Law et al. [50]). As a result, the field of HCI was initially driven by engineers, designers, and researchers that focused on the analysis of a product's characteristics (e.g., functionality, ergonomics) [9, 48]. In fact, before the turn of the century, UI design was primarily based on a set of selected design heuristics, e.g., consistency, feedback mechanisms, and error prevention (see Nielsen & Molich [61]). Nowadays, however, usability is generally taken for granted while pleasurable and hedonic product attributes became crucial for customer loyalty and product success [5, 8, 72]. Consequently, the field of HCI and UI design is recently guided by a much more general understanding about users' experiences. Yet, definitions and evaluation approaches of the resulting concept of UX still range from a psychological perspective on human needs (see Hassenzahl [30] and Sheldon et al. [84]) to a task-oriented perspective on users' goals and motivation [31]. In addition, the shift from a usability to a UX-focused UI design process forces UI designers to take further aspects into account. Besides the experience during the actual interaction, UX can also be influenced by prior experiences or expectations. Furthermore, UX is unique to an individual user and rooted in a cultural context [79]. In this work, we base our analysis of culturally sensitive UI design on the differentiation of pragmatic and hedonic aspects - including both experience- and task-oriented product characteristics - according to Hassenzahl [30].

2.2 Culture in the Context of HCI

At the same time when HCI researchers and practitioners started to shift from a usability to a UX mindset, a discussion about the role of culture when designing for international user groups started to arise [62]. However, the landscape of cultural theory in the context of HCI is controversially discussed and lacks a common understanding or guidelines [36, 78]. Definitions of culture range from *"a system of meaning that underlies routine and behaviour in everyday working life"* [10] over *"race and ethnicity as well as other variables*

[...] manifested in customary behaviours, assumptions and values, patterns of thinking and communication style" [11] to *"the collective programming of the mind that distinguishes the members of one group or category of people from another"* [32]. A common denominator of these perspectives is the existence of visible, conscious variables (e.g., number formatting, currency, time, date formats, and language) and abstract, unconscious variables of culture (e.g., nonverbal communication, a sense of time, and physical distances) [36]. The iceberg meta model from Hoft [35] illustrates the different layers of culture (see Figure 2).

In the field of HCI and UI design, the multilayered nature of the concept of culture can be associated with traditional usability and in-depth UX considerations. While visible layers, i.e., language, meaning of colors, etc., can easily be adapted to create country- or culture-specific designs [6], the consideration of the abstract invisible layers (i.e., values) and its impact on UI design generally requires more time and resources [78]. Furthermore, the concept of culture can be addressed and studied on different levels, such as the national, regional, gender, generation, social class, or corporate level [33]. In this paper, we focus on the concept of national cultures, because research has evidenced its impact on the perception of what constitutes good design [78].

2.3 Cross-Cultural Design Approaches

With a change of design criteria from task-oriented usability heuristics to hedonic experience attributes, the method toolkit of designers and researchers grew proportionally in order to cope with the increasing complexity and dynamics of the design processes [7, 70]. Different methods or approaches are certainly more suitable in distinct contexts and situations. Nevertheless, Battarbee & Koskinen [8] cluster three general approaches for the consideration of UX in design process:

- *Measuring approaches* that base their analysis on quantifiable aspects of UX, e.g., emotion detection and self-reporting.
- *Empathic approaches* that aim to truly understand users' needs through meaningful user-designer relationships.
- *Pragmatist approaches* that focus on the application of theoretical frameworks and models.

In cross-cultural UI design, measuring approaches are usually based on quantitative analyses of different cultures through, e.g., log analysis (e.g., Lachner et al. [47]), evaluation of website aesthetics (e.g., Nordhoff et al. [63]), or international survey studies (e.g., Al-Shamaileh & Sutcliffe [3], Reinecke & Gajos [77], or Walsh & Nurkka [95]). An inherent limitation of such studies is the difficulty to understand why certain differences occur. In contrast, empathic approaches, such as ethnographic interviews (see, e.g., Schneider et al. [82]) or qualitative lab studies (e.g., Athinen et al. [2]) can provide rich stories and insights. However, such approaches are unavoidably time-consuming and costly or require further validation [37, 76, 97, 102]. Nevertheless, measuring-focused remote studies are often used in settings, in which on-site studies would be challenging to conduct due to the distance between researchers and study participants. Examples include the exploration of UX of a learning service in South Africa by researchers based in Finland and the UK [92] or the analysis of websites in Muslim countries by Malaysian researchers [59]. Empathy-focused ethnographic studies are often favored in settings that require high ethical considerations, such as for research related to minorities or developing countries, e.g., the analysis of usability in Namibia [98], the investigation of apartheid-era narratives in South Africa [49], the evaluation of digital mobile maps in sub-Saharan Africa [88], or the study of mobile banking of low-literate, low-income users [58].

Pragmatic approaches based on theoretical frameworks have gained increasing interest in the HCI community in recent years. More and more researchers study the applicability of cultural dimensions in UX and UI design [52, 54, 75, 96]. Cultural dimensions are individual traits that characterize a culture's preferred reaction to general societal problems that are common to all cultures [32]. Several sociologists and anthropologists derived distinct cultural dimensions that have been established in academic research since then, namely Edward Hall [27–29], Geert Hofstede and colleagues [33], Kluckhohn & Strodtbeck [45], Shalom Schwartz [83], David Victor [94], and Trompenaars & Hampden-Turner [90]. Previous cultural considerations in HCI mainly builds upon the study of cultural dimensions according to Hofstede et al. [33] as their work represents the most comprehensive cross-cultural study that is mainly used in HCI (see, e.g., [52, 54, 67, 75, 76, 100]). Hofstede et al. [34] describe six cultural dimensions:

- *Power Distance (PD):* The degree to which hierarchy and an unequal distribution of power is accepted in a society.
- *Individualism vs. Collectivism (ID):* Preference towards a loosely-knit vs. tightly-knit social framework.
- *Masculinity vs. Femininity (MAS):* The balance to which societies strive for status (masculine) or modesty (feminine).
- *Uncertainty Avoidance (UA):* The degree to which societies feel uncomfortable with uncertain situations.
- *Long Term vs. Short Term Orientation (LTO):* Preference towards traditions (short term) or societal change (long term).
- *Indulgence vs. Restraint (IN):* The extent of vitality and fun (indulgence) vs. strict social norms (restraint).

Kahn et al. [43], for example, use Hofstede's cultural dimensions as an inspiration to develop automotive human-machine interfaces (HMI) for users from the UK and India, George et al. [23] identify differing preferences in web design for Australia as a whole and an indigenous Australian group in 2010 and validate ethnographic results with theoretical insights in 2012 [22], Jaramillo-Bernal et al. [41] develop a design framework based on Hofstede's dimensions, Yeo [103] uses Hofstede's dimensions to explain cultural differences in software development processes, Gould et al. [25] derive design guidelines for Malaysian and US websites from Hofstede's dimension website design, and Suadamara et al. [89] describe a process to integrate Hofstede's dimensions into the Technology Acceptance Model (TAM) according to Evers & Day [18].

2.4 Reflection on Cultural Dimensions for HCI

Our overall goal is to apply cultural theory in such a way that it supports the conceptual model of designers (or the represented model) to better understand how users from other cultures might interpret the way a product should be used, i.e., their mental models (see Cooper et al. [15]). While ethnographic on-site studies or internationally staffed design teams might best allow to validate the associated design elements, not every team can afford this due to

team size, time pressure, or costs. However, as the understanding of the concept of UX differs between different cultures [74], we argue that it is inevitable for good design to be aware of cultural differences and culturally sensitive design elements. An understanding of cultural theory represents a cost-efficient and sustainable way to eventually develop a culturally sensitive design process.

In general, as Hofstede's cultural dimensions represent dichotomous scales, studies such as the work from Mimouni & MacDonald [60], Reinecke & Bernstein [76], and Walsh & Nurkka [95] showcase that UI designs should differ in relation to the relative scale values. In contrast, Ford & Kotzé [20] and Ford & Gelderblom [19] argue that the design of a UI can generally be improved simply by focusing on high values for distinct cultural dimensions. The latter two, however, base their study on the analysis of a website's usability and human performance, whereas we additionally focus on further UX-oriented aspects. Although Marcus & Hamoodi [55] observed inconsistent cases for Hofstede's cultural dimensions, the work of Hofstede and colleagues has experienced most attention in HCI in recent years [76]. Consequently, we decided to base our evaluation study and associated research question on Hofstede's work. However, the majority of cross-cultural HCI studies focuses on post-hoc analyses of existing websites to draw a conclusion on the relation between culture and design (see, e.g., Gevorgyan & Porter [24] or Oliveira et al. [67]). In contrast, we want to investigate how we can translate theoretical insights derived from the analysis of cultural dimensions into the development of new UI designs to ultimately embed cultural theory in the design process.

3 A CASE STUDY FOR CULTURALLY SENSITIVE UI DESIGN

The goal of this paper is to understand how cultural theory can be used to support a culturally sensitive design process. In line with our research question, we analyzed the theoretical background to understand the design space of culturally sensitive UI design and derived design hypotheses to create two UI prototypes that focused on different cultural aspects. We aimed to investigate if and how cultural dimensions are a suitable starting point to design culturally sensitive interfaces. Our study results show that German and Vietnamese participants varied in their evaluation of selected design elements that we considered as culturally sensitive already during the conceptualization of the UI design.

3.1 Background and Setting

At the beginning of this project we partnered with a social start-up that offers an online Q&A-website. The website allows people from around the world to share and discuss solutions for global social issues, e.g., refugee crisis, global warming, or world hunger. Users and visitors can freely access the platform to (1) browse and click through different topics, questions, and answers for different topics and (2) comment on or start a new discussion. As the platform aims to address users and contributors from various countries, the goal of our partner was to identify culturally sensitive design elements for future development. In order not to interfere with the ongoing UI design and development process we decided to make our own adapted version of this site and study the impact of culture in UI design in a well-controlled setting. In addition we decided to narrow down the scope of this study to eventually derive concrete design insights and specific starting points for future work. Consequently, together with our partner, we decided to limit our case study to the investigation of Germany and Vietnam. Representing two empirically diverse cultures, we considered Germany and Vietnam as suitable comparison countries for this project. In addition, due to existing collaborations and the authors' personal backgrounds we were able to recruit suitable study participants from both countries for our evaluation study.

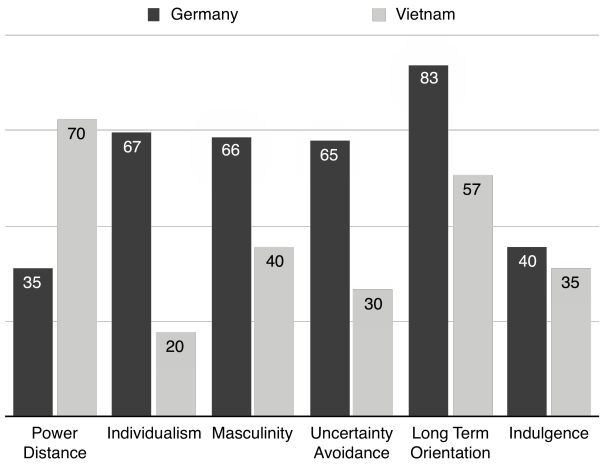

Figure 3: Values for Germany and Vietnam in the six cultural dimensions according to Hofstede et al. [34] (values can range from 0, low, to 100, high).

3.2 Design Hypotheses from Cultural Theory

Our case study was divided into several different steps to address our research question in a structured manner. Below, we describe the reasoning behind the initial analysis of cultural dimensions.

3.2.1 Procedure. As a first step, we analyzed established cultural dimensions (as presented above) and decided to base our case study on the dimensions according to Hofstede and colleagues [34]. In this case study, we consider cultural dimensions as a means to enhance designers' mental models that enable a better understanding of culture to ultimately support the development of a culturally sensitive UI for our partner's Q&A-website. We focused on only one cultural dimension, namely Power Distance (PD), to decrease the complexity of our hypotheses and the associated UI designs. We chose PD for our case study as the two target countries Germany and Vietnam differ significantly in their PD values and Mimouni & MacDonald [60] evidenced that PD has an influence on UI design.

We used the framework of Marcus & Gould [54] (that previous studies, e.g., Alexander et al. [4], have also used to evaluate existing websites in a cross-cultural context) as a starting point for the development of culturally sensitive UI prototypes. More precisely, we translated the design guidelines related to Hofstede's cultural dimensions according to Marcus & Gould [53, 54] into website elements for cultures with a high (e.g., Vietnam) and a low value (e.g., Germany) for PD (see Figure 3).

Table 1: Design aspects for high and low PD cultures according to Marcus & Gould [53].

	Low PD	High PD
Metaphor	Objects that represent free choice and equality	Objects that represent hierarchy and distance
Mental Model	Simple, informal, less structured, organized	Complex, highly organized and categorized
Navigation	Flexible paths, multiple choices	Restricted access, predefined paths
Interaction	Helpful error messages, keywords	Severe error message
Presentation	Pictures of groups, individuals, established symbols, informal language	Pictures of leaders, logos, official symbols, formal language

3.2.2 Design Hypotheses. Based on Hofstede's cultural dimensions, Germany and Vietnam can be considered culturally diverse (see Figure 3). With higher scores for individualism, masculinity, uncertainty avoidance, and long term orientation, Germany can be seen as a country where self-actualization is strongly believed, performance is highly valued, systematic overview in thinking, presenting, and planning is preferred, and where people believe that truth is dependent on context and time. In addition, a participate communication style is common, leadership can be challenged and people tend towards cynicism and pessimism - characterized by a lower value for power distance and indulgence. In Vietnam, people similarly tend towards cynicism and pessimism (high value for indulgence) and generally base truth on context and time (high value for long term orientation). In contrast, Vietnamese accept hierarchical order and inequalities (low value for power distance), foster strong relationships (low value for individualism, i.e., collectivistic culture), value equality and well-being (low value for masculinity, i.e., feminine culture), and have a low preference for avoiding uncertainties [34]. For this case study and our focus on Power Distance, we are mainly interested in how preferences regarding hierarchical structures (i.e., PD) may impact UI design. Marcus & Gould [53, 54] analyzed how relative differences in a culture's perception with regards to cultural dimensions can be translated into UI design elements. Based on their work, we can derive the hypothesis that low PD cultures (e.g., Germany) value informally organized and categorized data, overview, flexible navigation, helpful error messages, and graphics representing groups rather than selected leaders, whereas high PD cultures (e.g., Vietnam) prefer complex structures, pre-defined navigation paths, direct error messages, symbols, logos, and graphics that represent leaders (see Table 1). We used these guidelines as a starting point for the development of two distinct interfaces of a Q&A-website.

3.3 Benchmark with existing Q&A-Websites

As a next step, we analyzed existing German and Vietnamese Q&A websites in order to enrich our theoretical insights and calibrate our perspective on how to translate theoretical insights into concrete design elements.

Table 2: Websites for our benchmark analysis.

German websites	Vietnamese websites
www.gutefrage.net	www.webtretho.com/forum
www.chefkoch.de	www.tinhte.vn/forums
www.computerbase.de	www.vforum.vn
www.motor-talk.de	www.sinhvienit.net/home
www.android-hilfe.de	www.vozforum.org
www.forum.chip.de	www.otofun.net/forums
www.hifi-forum.de	www.violet.vn
www.fotocommunity.de/forum	www.hdvietnam.com
www.board.gulli.com	www.ttvnol.com
www.wer-weiss-was.de	www.lamchame.com/forum

3.3.1 Procedure. We selected frequently used online forums in Germany and Vietnam, as such websites best represent our partner's platform. We manually searched for forums using the search engine Google and the search queries *most common/popular/visited forums/question-and-answer websites in Germany/Vietnam* and *German/Vietnamese forums/question-and-answer websites* to first identify compiled lists of suitable websites. After identifying popular Q&A-websites, we ranked them according to the number of website visits as stated at https://www.similarweb.com/. In this ranking, we only considered websites that had more than 60% local website visitors. Finally, we decided to analyze the top ten websites in detail (see Table 2). For this analysis, we looked at all selected websites and manually derived design characteristics of each website according to the framework of Marcus & Gould [53], i.e., metaphor, mental model, navigation, interaction, and presentation.

In general, our website analysis served as a reference, calibration of our mental model, and comparison of the design insights that we derived from our analysis of cultural dimensions according to Marcus & Gould [54]. We did not aim to holistically describe significant differences and similarities of German and Vietnamese websites in this step. Consequently, we only manually analyzed a few selected websites for each country.

3.3.2 Status quo of German and Vietnamese Q&A-websites. Our analysis of existing websites allowed us to better understand familiar design elements for German and Vietnamese users. Table 2 gives an overview of all German and Vietnamese websites that we have analyzed in this step. We used the same framework, i.e., the analysis of metaphors, mental model, navigation, interaction, and presentation according to Marcus & Gould [53], as before. Also, we focused again on the analysis of design elements associated with the cultural dimension PD.

We recognized that, e.g., leading organizations, administrators or moderators are rarely prominently presented on German Q&A-websites. The websites are rather targeted towards the general user base (e.g., gutefrage.net), both in the structure of the websites and the visual presentation. However, contrasting with our theoretical hypotheses we saw that in our sample set most of the websites

were highly structured with many sub-levels and topic categories. Yet, the general navigation structure offered several flexible paths, including search feature(s), drop-down menus, and direct links to, e.g., related content (e.g., computerbase.de). Mimouni & MacDonald [60] describe similar insights for website navigation in relation to cultural dimensions in their analysis of American and Arabic websites. The language used on the selected websites was generally polite and error messages even provided helpful comments in many cases (e.g., wer-weiss-was.de).

Q&A-websites that are popular in Vietnam, in contrast, generally did emphasize moderators and administrators (e.g., webtretho.com highlights admins for each topic), navigation paths are less flexible and related content is rarely linked (e.g., vozforums.com). Furthermore, information is usually highly structured, e.g., into categories and sub-categories. However, we could not derive differing insights with regards to a distinct formulation of error messages or language.

3.4 Culturally Sensitive Prototype Design

Based on the derived insights from our theoretical analysis, we developed two UI prototypes that differed in navigation structure, visual presentation, and language. In addition, we particularly focused on content structure and the design of error messages as our comparison of cross-cultural design heuristics and existing Q&A-websites pointed out mixed results.

3.4.1 Procedure. We aimed to design two distinct yet similar UIs based on design elements for (1) a high and (2) a low value for PD according to Marcus & Gould [54]. We primarily focused on the translation of theoretical design insights to address our overall research question yet used our benchmark analysis of existing websites to align the overall structure and presentation of the prototype concepts to familiar Q&A-websites. Both UI prototypes were translated into a German and a Vietnamese website by native speakers resulting in four different versions (see Figure 1). The information architecture, visual design, and navigation structure were not changed for the two Vietnamese or the two German versions. All prototypes were designed using the design software Axure[1].

3.4.2 Prototypes. We used the existing design and corporate identity (e.g., colors, font, etc.) of our collaboration partner for both prototypes to avoid biases but adapted selected elements according to our previous analysis. Our partner's website focuses on different social issues and global problems. For our case study, we decided to only focus on the topic 'refugee crisis', as it was the a key topic of our partner's strategy at the time of the study, as well as a topic of global interest. Furthermore, we created and used a number of test profiles and articles to provide a suitable amount of content.

For the first version, we focused on high Power Distance elements. We aimed to prominently position the administrators (in our case the founders of the platform), used pictures and logos of organizations represented on the website, and added only a few selected interaction possibilities (e.g., search for a solution, create an article). The main topics on the home page were arranged in a grid format. However, articles for a distinct topic were only listed one after another without further filter options. The error message for a login and a search task that we used in our case study did not

[1]https://www.axure.com/

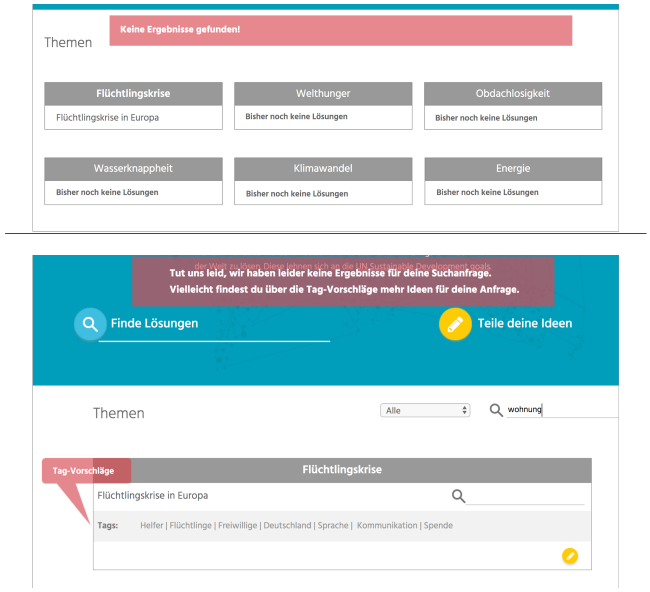

Figure 4: Different types of error messages in our two German UI prototypes, without (top) and with (bottom) further information (Vietnamese error messages were translated accordingly).

provide further helpful information in this design (see Figure 4). Also, the introduction about the platform at the main page was written formally and in a succinct style. We did not consider Marcus & Gould's [53] guideline for Mental Models (i.e., flat or highly structured UI) as we had defined our case study around one focus topic, and hence lacked enough content and categories that would have been necessary to be structured accordingly. In sum, the first version (high PD) was mainly defined by the following elements:

- Administrators are prominently presented
- Few alternative navigation paths
- Error messages are short and direct
- Language is formal and distanced

The second version was based on low Power Distance characteristics. In this version, we did not add photos of the administrators on the home page or logos of organizations but provided additional navigation elements, such as links to different sub-categories as well as tags, filters, and breadcrumbs. The selected topics on the home page were arranged as a list to have enough space to add additional search bars and tags. In sum, the second version (low Power Distance) was based on the following parameters:

- No focus on authority figures
- Many alternative navigation paths
- Error messages provide further information
- Language is informal and personal

3.5 Evaluation and Results

We conducted a think-aloud study to evaluate how study participants from Vietnam and Germany perceived the two different

UI prototypes. Based on our research question we wanted to understand how the feedback of the study participants differed and whether we would be able to anticipate these differences through the previous analysis of cultural theory.

3.5.1 Study participants. In total, we recruited 14 study participants from Germany and 14 from Vietnam for our think-aloud study through the network and mailing lists of two collaborating universities in Germany and Vietnam. We decided to pursue a qualitative approach as it allows to understand the reasoning behind users' experiences and related design issues. This represents a substantial aspect to understand if we properly applied cultural theory for our UI design, and hence suitably addressed our research question (see Law et al. [50]). For our study, we only accepted study participants that have not yet lived abroad (either privately or work/study related) for longer than for 6 months. In total, we had 60% male and 40% female study participants with an average age of 23.6 years. Table 3 shows an overview of all study participants as well as the average age and gender distribution per country.

3.5.2 Think-aloud procedure. We conducted a within-subjects think-aloud study with a 2 *UI design (high PD vs. low PD)* x 2 *nationality (German vs. Vietnamese)* design. To avoid language effects, we presented both prototype versions (i.e., high and low PD versions) to all study participants in their native language. Also, we randomized the order in which the participants evaluated both prototypes to avoid biases. We were able to run the study with Vietnamese participants on-site in the facilities of the Vietnamese university that supported us for participant recruiting. The Vietnamese study participants were invited to a study room and used one of the authors' laptop to interact with the prototypes. To stay within our time schedule we were forced to interview the German participants remotely using the IP telephone and screen sharing service Skype as none of the authors was in Germany at the time the study was conducted. However, we wanted to ensure and hence prioritized that all study participants were situated in a familiar environment, i.e., their home country. For this remote study, we sent all HTML files of the German prototypes to the participants and let them interact with the prototype on their own laptop or computer. In addition, to cope with an initially low response rate for our first call for participation, German participants took part in a $60 shopping voucher lottery. Vietnamese study participants did not receive a compensation as we had many returns within a short time for our first call for participation hence we had conducted the interviews already before the second call for participation for German users.

During the study, we asked all participants to think out loud while they interacted with the prototypes and performed several tasks. First, they were asked to browse through the start screen and then look for an answer for a given topic. Second, they were told to log in into a default user account and, third, enter a search term in the prototype's search bar. In these two cases, an error message appeared that differed for both versions, i.e., for the low and high PD version. Fourth, they were asked to describe which version they preferred in general after evaluating both the low PD and high PD version before they filled out a questionnaire about their personal data. Once again, we conducted the think-aloud study with every study participant in their mother tongue. However, four Vietnamese study participants wished to conduct the study in English. The Vietnamese think-aloud studies lasted between 40 and 55 minutes with an average of 45 minutes, the studies with German participants lasted between 30 and 45 minutes with an average of 34 minutes.

Table 3: Demographic data of study participants.

	Vietnam	**Germany**
n	14	14
Gender	(m) 64% (f) 36%	(m) 57% (f) 43%
Age Range *Average*	19 - 24 yrs 21 yrs	20 - 31 yrs 26 yrs

3.5.3 Data analysis. All think-aloud sessions were recorded, transcribed, analyzed through grounded theory, and finally translated from German and Vietnamese to English for this paper. The two authors who conducted the think-aloud study individually coded all statements using the coding categories *Metaphor*, *Mental Model*, *Navigation*, *Interaction*, *Presentation*, and *General Comment* to ensure inter-rater reliability (IRR). The coding categories were derived from the framework of Marcus & Gould [54] that had already been used for the development of the prototypes. Based on these categories, we were able to cluster and identify common statements through inductive category formation according to Mayring & Fenzl [56] to finally derive differences and similarities in the answers of the German and Vietnamese participants. Our IRR analysis resulted in a value for α = .8963, 95% in a CI of (0.8224, 0.9120). According to Krippendorff [46], values for α that are higher than .8 can be seen as satisfactory.

3.5.4 Results. The overall goal of our think-aloud study was to evaluate (1) whether participants from Germany preferred different UI aspects compared to the Vietnamese participants and (2) whether we were able to consider these differences already during the design of the UI through the analysis of cultural dimensions. We did not specifically ask our study participants how much they liked distinct design and interaction aspects but rather motivated them to think out loud while they performed our tasks. In addition, we were interested in both usability-focused pragmatic aspects and experience-focused hedonic aspects and inquired reasons for the participants' opinions and statements.

All participants naturally commented on the features of interest related to our design hypotheses due to the nature of the case study tasks (e.g., search for a specific answer or topic, login attempt that prompted an error message). In particular, when they were confronted with the respective second prototype (either version 1 or version 2, depending on order) the participants were able to easily verbalize differences and their preferred concepts. In general, all participants from Vietnam (PV) and Germany (PG) gave feedback about the visual presentation (e.g., the photos of the social start-up founders) the structure and navigation (e.g., the search bar, tags, and filters), as well as the perceived trustworthiness of the website designs. Both concepts were generally well perceived and we had only few comments related to the overall design concept, i.e., our

Table 4: Exemplary statements from the study participants per country for the derived insight and number of participants who preferred version 1 or 2 (*numbers do not add up to 28 as 3 participants did not state a clear preference).

	Vietnam		Germany	
	Version 1 (high PD)	Version 2 (low PD)	Version 1 (high PD)	Version 2 (low PD)
	Preferred emotional language style		**Preferred factual language style**	
Content, language, and communication	"I was surprised. A more friendly sentence would have been better, e.g., I am sorry, we did not find [...]" (PV11)	"It is friendly and the users understands the problem." (PV8) "I think this information is better." (PV12)	"I would have liked to see that the website helps me [...] and suggests additional links to other websites." (PG2)	"I think it is normal that [websites] say if the user name of password is wrong. This states actually the same." (PG6)
	Restricted information density		**Guided information density**	
Information retrieval	"I have no problem [with this design] as I have the same feeling as I have on Google or Wikipedia." (PV7)	"There are more search functions [...] and it is not easy to use." (PV9)	"I would have preferred to have a navigation menu, [the website] becomes easily confusing with more text." (PG7)	"I would tend to version 2 because I can add tags. [...] I have a better overview when I do not use the search bar." (PG6)
	Trust through emotions and visuals		**Trust through content and validity**	
Trust	"The photos of the founders make the website look more professional. I like the logos of the organizations." (PV1)	"Information about the founders of the website is necessary [...] to increase the level of trust." (PV6)	"I think it is good that there is the source [of the information]. It makes it trustworthy." (PG7)	"[The photos] can be interesting in general but when I go to such a website I don't think it is important." (PG6)
preferred version*	8	4	4	9

partner's corporate identity, or the fidelity of the prototype (e.g., *"the font is too small"* (PV13), *"I like the colors"* (PG3, PV3), or *"the wording 'urgent issues' sounds weird"* (PG3)).

A differentiated look at our results, however, revealed perceptible differences between the Vietnamese and German participants. In line with our design hypotheses and as indicated in Table 4, the majority of the Vietnamese participants preferred the design version 1 (focusing on high PD) and the majority of the German participants the design version 2 (focusing on low PD). An in-depth analysis of all coded think-aloud protocols allowed us to derive three main topics that summarize differing tendencies between the Vietnamese and the German study participants (Table 4 provides an overview of all three insights including exemplary comments from participants):

(1) Emotional vs. factual language style
(2) Restricted vs. guided information density
(3) Trust through emotions vs. trust through content

Emotional vs. factual language style: During the think-aloud study, all participants were faced with two planned error message, one as the result of an intentionally failed login attempt and another one after using the search bar on the home page. Based on our theoretical analysis we expected Vietnamese participants to prefer the short and direct error message in version 1 and German participants message with additional information about the error type in version 2. However, in contrast to our expectations, the error message in version 2 (low PD) was generally perceived familiar or even better (PV2, PV5-8, PV11-14, PG2-4,PG6-7, PG10-13), as *"it is friendly"* (PV8), *"the [additional] information is helpful to detect the error"* (PV10) and it *"makes it clear that [the participant] has to review his input"* (PG11).

Nevertheless, the study participants from Vietnam and Germany mentioned different reasons why they where shocked or disappointed (PV1, PV4, PV8, PV11, PG2, PG4, PG7) when they saw the error messages in version 1. German participants did primarily ask for factual information, e.g., *"links to other websites"* (PG2) as *"related content"* (PG4) and *"alternatives [are] missing"* (PG6) or even *"a prompt to add a new solution"* (PG11). Vietnamese participants, in contrast, rather noticed a lack of emotions and suggested to *"use different words"* (PV9) or more precisely a *"more friendly sentence"* (PV11). PV6 even suggested to use emoticons or stickers. However, the error messages did not strongly affect the overall evaluation of the Vietnamese study participants from which the majority still favoured version 1 (see Table 4).

Restricted vs. guided information density: The main tasks of our think-aloud study included the search process to find a specific question and related answers on the websites. Consequently, all participants had to familiarize with the platform and its navigation structure. We saw that the navigation had a stronger impact on the final evaluation of the designs. Vietnamese participants generally valued the *"clear, concrete, and direct"* (PV2) structure of version 1 that makes it *"comfortable [and] easy to use"* (PV6). They also highlighted to prefer using the search bar (PV1, , PV2, PV4, PV7, PV 9, PV12). PV7 even mentioned that the general concept reminds her of Google or Wikipedia. PV10, however, still concluded that it *"would be good to have more sub-categories"* as it would make the search process easier. In contrast, version 2 was perceived as *"too long and difficult"* (PV12) and *"not easy to use"* (PV9). PV9 suggests, among other things, that the read-on button of article should not link to another page but open as a flip-out menu instead, PV 13 highlights that the list of categories in version 2 is too long. In sum, our Vietnamese study group preferred a restricted information density.

German participants rarely used the search functions as, e.g., they *"prefer to click through the topics on the website and browse through the articles"* (PG1). In contrast, they generally preferred an independent yet guided step-by-step information search. Consequently, several German participants positively valued the tag and filter possibilities in version 2 (PG1-4, PG6) as it allows to *"get fast to the respective topic"* (PV8) and one does not have to scroll through unimportant information (PG7, PG14). In addition, PG14 highlights that it is important to have an overview about all the data. Also, PG2 appreciated the breadcrumbs in version 2, while PG12 suggests that an additional navigation bar would have made the search process even easier. PG 13 summarizes that he just *"like on Amazon [...] first looked for sub-categories"* and then fine-tuned his search.

Trust through emotions vs. trust through content: The main aspect of cultures with different perceptions of PD is a varying acceptance of hierarchy in society. According to Marcus & Gould [53] this is reflected in images of hierarchically higher people. In our case study, we received divergent feedback from Vietnamese and Germany participants yet in line with the theoretical hypotheses.

The majority of our Vietnamese participant group appreciated the photos of the platform founders in version 1 as they *"make the website look more professional"* (PV1). PV6 highlights that even more information about the founders should be provided to *"increase the level of trust"*. Additionally, the logos of organizations for each article increased the credibility of the platform (PV1, PV3). In contrast, the lack of the photos in version 2 was frequently stated as a negative aspect of the version that was based on low PD design aspects (PV6, PV9, PV10, PV13).

From the German participants, only a few stated that the photos increased the reliability of the website yet take up too much space on the home page (PG3). In fact, many participants claimed that they do not necessarily favour the photos of the founders on the home page (PG6-9, PG13) or even think they are too dominant (PG1). However, the sources of the articles (e.g., links or names of the organizations) increased trust and validity of the content on the platform (PG1, PG2, PG7).

4 DISCUSSION AND LIMITATIONS

In this work, we showcased the applicability of cultural dimensions in early stages of a UI design process. Our think-aloud study revealed that Vietnamese study participants tended to favour UI elements that we anticipated as suitable for high PD cultures, such as Vietnam, and German participants, vice versa, design elements for low PD cultures. Throughout the whole case study, we felt that the analysis of cultural dimensions represented a helpful framework to consider critical UI elements for a culturally sensitive design process. At the same time, we acknowledge that our decisions to limit the scope and complexity of our case study invariably brings other limitations and open questions.

4.1 Reflection about the Study Setting

Study setting and generalization of our insights? Due to our collaboration with a social start-up we defined our case study based on their Q&A-website. Different use cases or websites might require further analysis or even lead to difficulties in applying cultural dimensions. For future studies, we recommend and will continuously consider a validation of design insights, similar to our analysis of existing Q&A-websites. Likewise, as we focused our analysis on only one cultural dimension, further research is required to draw a conclusion on the applicability of other cultural dimensions. We decided to focus on only one dimensions to derive distinct design insights and to decrease and cope with the complexity of our cross-cultural case study. Also, we have chosen to focus our case study on the analysis of Vietnamese and German study participants. Although the feedback from participants from other countries might lead to more in-depth insights, the controlled setting with selected target countries allowed us to specifically interpret our results as well as the value of both cultural dimensions and our benchmark analysis. Furthermore, we do not want to argue that websites should be adjusted for every single country but rather for regions with comparable cultural backgrounds. Consequently, we see our comparison of Germany and Vietnam as an initial use case and will further investigate how cultural dimensions are applicable for different culturally similar regions. Similarly, a quantitative analysis (e.g., a log analysis as conducted by Lachner et al. [47]) will provide additional insights and help to validate our derived design insights. In our study, however, we decided to conduct a qualitative study with at least 12 participants per participant group for data saturation in interview studies (as suggested by Guest et al. [26]) to better understand why certain design elements are preferred. Finally, we needed to conduct the study with German participants remotely as no author was able to interview our German participants on-site at the time we had scheduled the interviews. Although a remote setting might affect the implementation of the study, we designed all study tasks and questions in a way that participants were able to focus merely on the design of the websites.

Implementation of cultural theory in design processes? Our overall research question was guided by the motivation of implementing cultural theory in the UI design process. On the one hand we were able to see that cultural dimensions represent a helpful tool to introduce cultural consideration in the design process, on the other hand we still need to investigate how such theoretical constructs can be best combined with further methods. According to Pettersson et al. [69], particularly questionnaires and observations represent commonly used methods that, from our perspective, should be evaluated in this context. In our case study, we saw that our qualitative think-aloud study benefited from the initial analysis of cultural dimensions.

The role of the user? In addition, we see potential for further research on the impact of culture on user studies in general. In our case study, we realized that Vietnamese participants were less talkative during the think-aloud study. German study participants, however, were more talkative. Lewis [51] describes an indication for this observation as Vietnam is listed as a reactive culture (i.e., cultures that prefer to focus on respect, listen quietly, and react carefully) and Germany a linear-active culture (i.e., cultures that plan, systematize, and follow correct procedures) in his model for cultural considerations. In addition, Hall [28] describes Vietnam as a higher-context culture, Germany as a lower-context culture indicating that communication in Vietnam includes more implicit information than in Germany. We suggest to investigate implications on design evaluations in the future.

4.2 Reflection about Cultural Dimensions

Implications for HCI in further contexts? In our analysis of related work in the context of culturally sensitive design, we realized that cross-cultural considerations based on theoretical frameworks (e.g., cultural dimensions) show a tendency to investigate differences in Asia, Europe, and America (see, e.g., Calabrese et al. [13] who focus on Brazil, Portugal, Angola, and Macau, Karacay-Aydin et al. [42] who study USA and Turkey, Singh et al. [86] who investigate USA and China, Singh, Zhao, and Hu [87] who compare China Japan USA, or Sachau & Hutchinson [81] with their study of USA and Mexico). Research in rural or developing regions, particularly in Africa, is rather based on ethnographic studies or remote analyses as previously discussed. However, we see high potential for culturally sensitive HCI research based on cultural theory in such settings. First, from our perspective, the analysis of cultural dimensions in the context of HCI can lead to a better understanding of good design in a globalized world, particularly as, e.g., in South Africa (see Pretorius et al. [73]), the field of UX and design still lacks appropriate knowledge and inadequate training. Second, a better understanding of cultural dimensions and cultural preferences will be beneficial for cross-collaboration as international and globally acting design teams will better understand potential biases and culturally diverse mental models.

Limitations of cultural dimensions? The application of cultural dimensions comes along with inherent limitations of Hofstede's work [91]. McSweeney [57] highlights that cultural dimensions are based on a concept of national culture, but Hofstede's data was gathered through a survey that was only sent to IBM employees. In addition, researchers argue that culture is a dynamic construct, whereas cultural dimensions describe a static taxnomoy [12, 57, 85]. To cope with the dynamics of the term culture, Irani et al. [38] introduce the term "postcolonial computing", referring to an approach that is based on engagement, articulation, and translation. The concept is mainly driven by the fact that further aspects, such as, e.g., gender, ethnicity, race, or subculture may influence the overall construct of culture [39]. Chandra et al. [14], Jack & Jackson [40], and Wyche et al. [99], for instance, apply the concept of postcolonial computing and derive an in-depth ethnographic research approach for their studies. However, we do not see the concept of postcolonial computing as a contradicting approach but rather as an overall "tactic" [71]. Based on our results, wee see cultural dimensions as a suitable starting point rather than a standardized framework for culturally sensitive considerations that are followed by further in-depth investigations, e.g., ethnographic research (similar to the approach of Schneider et al. [82]).

5 CONCLUSION AND FUTURE WORK

In this paper, we have presented a case study to investigate a culturally sensitive UI design process based on the analysis of cultural theory. In collaboration with a social start-up we developed two distinct UI prototypes for a Q&A-website and conducted a think-aloud study with 14 German and 14 Vietnamese study participants. The differing design elements in our prototypes were derived from the analysis of cultural dimensions. We found out that our study participants differed in their evaluation of information density, trust, and error handling. Our overall goal was to investigate how cultural theory can be applied during the UI design process.

In sum, we learned that the analysis of cultural dimensions helped us to anticipate differing feedback and, in particular, foresee critical design elements for a culturally sensitive design process in general. Consequently, we feel encouraged about the general value of cultural dimensions for a culturally sensitive design process. However, in accordance with previous study results, such as the work of Winschiers [98], we would like to raise concern if cultural dimensions are applied blindly for the development of a new design. Although we were able to identify and foresee crucial design elements that were assessed differently by our culturally diverse study participants, we also found slightly different yet culturally sensitive design insights. In this context, our additional benchmark of existing websites helped us to calibrate our mental model and shape our design hypotheses. In general, we suggest to use cultural dimensions to develop a common language in interdisciplinary design teams, calibrate the mental models, and to inspire culturally sensitive design solutions. However, due to the dynamic nature of culture and values (see Irani et al. [38]), we want to motivate researchers, designers, and developers to conduct additional research in cross-cultural projects to fully understand the needs of culturally diverse user groups.

In the future, we see the potential to derive more insights from further studies in other culturally diverse countries as well as the investigation of more cultural dimensions or varying study settings. In addition, a research questions that we did not raise yet but that needs to be addressed is how technologies, such as machine learning that is more and more discussed in relation to UX and UI Design (see, e.g., Dove et al. [16] or Yang et al. [101]), can support a culturally sensitive design process, e.g., through the automated detection of personal and cultural traits based on behavioral data (comparable to the work of Epp et al. [17] in the field of emotion detection). Further topics that will be relevant for culturally sensitive design are a suitable balance of globally implemented hence corporate identity conform design elements and locally adapted aspects.

Reflecting on our approach, we feel confident that cultural dimensions allowed us to anticipate crucial UI elements with minimum costs and expenditure of time compared to more in-depth ethnographic approaches. Similar to the case studies presented by Yaaqoubi & Reinecke [100] we argue that the analysis of cultural dimensions is helpful in early design stages, particularly if additionally validated during the design process. Overall, we see our current work as complementary to previous results in the complex landscape of culturally sensitive design and as a fruitful starting point for future work in different contexts, continents, and based on more cultural theories to ultimately define the role of culture in HCI.

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