# Towards a Literature Overview for Intercultural User Interface Design

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## Abstract
In the moment, another literature study of the research in user interface design regarding cultural aspects since the upcoming of the topic 1990 is at work. Many papers do not reflect high effort in selecting proper references. The creation of the IUID bibliography in the articles should be improved in future to have sound and correct references. This can be done by ensuring literature aware supervisors of young scientific newcomers. The literature studies must be extended by analyzing the newest papers to be integrated in the references. Also, the literature study presented in this paper must still be extended to cover also the implications of changing topics and search terms in the area of IUID.

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## Author Keywords
IUID; user interfaces; user interface design; cross-cultural user interfaces; culture; intercultural user interface design; literature; overview; compilation; research; results.

## CSS Concepts
• **Human-centered computing~Human computer interaction (HCI)**; *empirical studies in HCI*.

## Introduction
With increasing interest in the topic of IUID since 2000, researchers come across an extensive range of literature in their search for new sources of information. The research field itself uses findings from many disciplines such as cognitive psychology, HCI, economics, cultural studies and technical development. In order to get an overview of IUID, a good idea is to collect literature sources. Since this topic can have a very broad scope, this study has examined cultural differences in a broad context. The interface between user interfaces and meaningful use depends on culture. User behavior in different cultures should be predictable in order to design a user-friendly interface. The solution of this research problem can be supported by literature review covering a wide range of research areas for IUID. Subsequently, a classification of the collected literature was carried out in order to systematically allocate the data. Each article has been evaluated according to certain criteria, thus creating a basis for

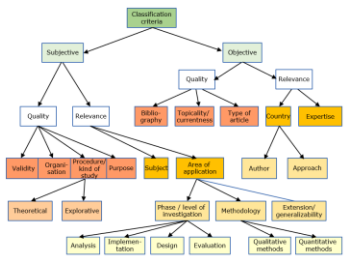


Figure 1: This is the classification tree containing categories and relationships used for the analysis in the literature study.

| Characteristic | Description |
|---|---|
| Topicality / Currentness | What sources does the author draw on? Are they predominantly current? (up-to-date, not up-to-date, timeless) |
| Bibliography | How many references does the article contain? Very little: <10; Little: <20; Medium: <50; Much: <80; Very much: >80. Do the references come mainly from papers (primary literature/their own work) or from book chapters (secondary literature/work on others)? |
| Validity | Are there any gross errors in the article such as small sample size? (none, in deficit, solid, solid+& reliable) For analyses with qualitative methods, the sample size is not critical to the same extent as for quantitative methods. |
| Organization / Structure | Structure of the article, how were the contents illustrated? (good, bad) |
| Purpose | What was the article written for? (description, discussion, exploration, information, modelling, workshop, hypothesis-testing) |
| Procedure / kind of study | Is the article theoretical or explorative? (descriptive statistics, experience report, essay, experimental, field study, case study, correlative, tests, theory, comparing, none) |
| Level | At what level can the findings be applied? (analysis, design, implementation, evaluation) |
| Methodology | Which methods were used? If there are several methods, the qualitative methods have a higher weighting. (algorithm, survey, document analysis, expert opinion, questionnaire, interview, meta-analysis, tests, observation, workshop, none) |
| Extension | To what extent can the findings be applied to other topics? (wide, narrow) |
| Country/Approach | Is it about a comparison between several countries (etic) or an analysis within a country (emic) or about globalization in general? (globalization, individualistic, individualistic-collectivistic, collectivistic, none) |
| Country/Author | In which country is the institution where the author is employed? (western, eastern-western, western) |
| Expertise | In which subject area is the author working? (anthropology, research, education, business, design, electronic, geography, health care, computer science, arts, mathematics, media science, medicine, neuroscience, philosophy, psychology, sociology, religion, none) |
| Subject | What is the problem the article is about? (anthropology, automobile, education, business, design, games, gender studies, health care, hardware, HCI, computer science, user interface, communication, arts, management, marketing, mobile devices, neuro-computing, online services, online learning, philosophy, psychology, religion, robotics, service, software, social networks, linguistics, usability) |
| Type | What is the type of document in the article? (original article, article, book chapter, review, research paper) |

Figure 2: Rating attributes.

statistical evaluations. Aims of this literature study were:

- to produce a summary and classification of the literature on IUID of at least the last decade,
- prepare the results from systematization in contingency tables,
- to interpret the results with reference to the research problem to create adequate cultural user interfaces.

## Procedure

Several steps were identified in which the literature was collected, classified and interpreted. First, articles related to IUID were collected. A meaningful classification of the articles was designed in order to systematically process the data. Then the articles were evaluated, and contingency tables were created. Phases 1 to 3 built up the whole procedure.

*Phase 1*

A literature search was carried out to collect relevant articles on the subject. A total of 650 articles published between 1983 and 2013 were looked at. 339 articles of them provided an abstract and, hence, could be analyzed at all. The analysis of the second and third criteria was done by looking at the content of this corresponding abstract. Scientific journal articles (39%), book chapters (59%), conference papers and university theses (a total of 2%) from different databases were collected. The journal articles come from a total of 126 journal titles, the book chapters are taken from 202 book collections and there are conference contributions from 9 conference proceedings and 2 theses. Access to the articles was provided via the electronic Periodicals Library of the University of Regensburg. The titles were created using keywords. Furthermore, for a first move to longitudinal research, in 2020, additional 50 articles from 2020 (just from ACM digital library using the keywords „cultural & difference & interface") have been evaluated in detail. The criteria for the inclusion of an article in the analysis were in line with the following questions:

- If this article is about a cultural comparison or an investigation within a cultural group?
- Is there a reference point in this article on the topic of usability, user interface, HCI or UI design?

Articles that met these criteria were entered into the analysis library. The selection was done by looking at the contents of the corresponding abstract.

*Phase 2*

In the second phase, generic categories and characteristics were designed to classify the article, shown in Figure 1. 117 articles from 2012 (84), 2013 (33) and 2020 (50) have been evaluated in detail applying all classification criteria according to Figure 1. 33 articles (2013) and 23 articles (2020) have been evaluated according to all rating attributes in addition (cf. Figure 2). The characteristics according to which a scientific article can be evaluated are first level in the hierarchical structure. The used classification system contains categories and relationships embracing objective and subjective superordinate categories, which are based on the information content of the article. The objective criteria are directly derived from the articles on and require no further interpretation. The subjective criteria are defined in an article are not explicitly included and should be interpreted as follows:

- Quality criteria (criteria for assessing the quality of an article) including:
  - Bibliography: It is of importance what kind of literature sources the author uses has. Scientific articles belong to the primary literature and have a higher content new finding as book chapters (secondary literature).
  - Type of contribution: Research papers are rated higher than other document types.
  - Topicality: The problem should relate to the current state of research.
  - Validity: In psychological procedures, validity is to be understood as validity and contains two facets: internal and external validity. In the evaluation of the articles the validity refers only to the generalizability of the findings or whether the findings are generally valid. This could be violated if, for example, a low sample size is tested.
  - Organization: Here the complete content of the article is evaluated. It is about the comprehensibility and the overall presentation of the information.
  - Procedure: It is determined whether the topic is treated theoretically or exploratively. Whereby the explorative approach provides new insights into the topic and is therefore rated higher.
  - Purpose: Here attention is paid to the goal of the author. Hypothesis testing and model development have a higher priority than discussion and description.
- Relevance (criteria for assessing the reference to IUID)
  - Subject: Here it is determined to what extent the subject under discussion is related to IUID.
  - Field of application
    - Examination level: It plays a role on which level the findings are applicable.
  - Methodology: It is interesting to know which methods are applicable in which context.
  - Extension: Statement about whether the problem has a wide range of application.
- Country: Is it about a comparison between several countries (etic) or an analysis within a country (emic) or about globalization in general?
- Expertise: In which subject area is the author working?

*Phase 3*

In the last phase 3, characteristics for the analysis of the references were defined focusing on the search in the ACM digital library and with the search terms "culture & difference & interface" (cf. Table 1).

| Databases | Keywords |
|---|---|
| Springer Link | usability & cultural; cultural & differences; aesthetic & cultural; cultural & HCI; interface & design & cultural; cultural & cognition; **cultural & difference & interface**; self-construal & culture; cultural & preference; cultural & psychology & consumer; human computer interaction & culture & design; software & design & culture; global & usability; HCI & international; cultural & psychology; international & aesthetic |
| Wiley Online Library | |
| Taylor & Francis Online | |
| **ACM Digital Library** | |
| Science Direct | |
| SAGE Journals | |
| OvidSP | |
| EBSCO | |
| Jstore | |

**Table 1**: Used databases and keywords during the analysis.

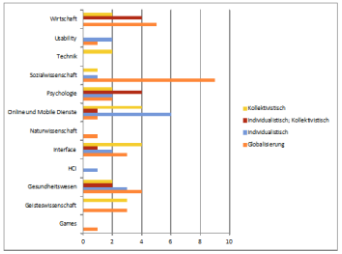


Figure 3: Overview of topics related to the values of cultural dimensions.

Based on the characteristics described above, some of the articles were evaluated. At the beginning, a detailed table was created, with the characteristic's procedure, methodology, subject, country study, author, and several additional characteristic values, which were used for the later analysis. With the help of pivot diagrams, the relevant characteristics were evaluated as cross tables. Some of the interesting results were presented and interpreted in the following.

## First Results

Globalization is a major issue for all disciplines, with the greatest interest in social sciences. A comparison between individualist and collectivist countries shows that in individualistic countries studies are more likely to be made in the subject's psychology and economics. In individualistic countries individuals are expected to take care of only themselves and their immediate families, whereas in collectivistic countries, the relatives, or members of a particular ingroup look after them for unquestioning loyalty. Studies within collectivist countries are more concerned with online and mobile services and interfaces (cf. Figure 3). In almost all subject areas, hypotheses tend to be tested. There is less exploratory approach. There is a tendency towards model development in the areas of online and mobile services, interfaces, HCI and technology. This indicates that enough data is available for these topics to be able to develop a theoretical model. In the case of health care, the approach is more explorative, which suggests that the topic is not very well researched. Online and mobile services, health care and interface, besides quantitative methods also qualitative methods are used more often. Regarding the research question, it can be stated that the topics usability, technology, online and mobile services, interfaces and partly HCI have a focus on explorative studies. This is an indication for a little explored topic or for the necessity to gain new insights into these topics. Quantitative methods are used much more often to investigate intercultural differences. This is a consequence of the economic orientation of the studies, as qualitative methods are costly to carry out. There is a disproportionate distribution of the theoretical approach to globalization and a lack of theoretical work for the comparison between individualistic and collectivistic countries, as well as for the investigation within individualistic countries. This also supports the fact that between 2010 and 2019 are only few theoretical models to explain intercultural differences and the comparison between individualistic and collectivist countries pursues have been developed. At the level of investigation "design", data on comparison of individualistic and collectivist countries is almost not available. Eastern authors tend to concentrate on studies that pursue the purposes of exploration, hypothesis testing and model development. In contrast to Western authors, there have been few scientific papers that have focused on the discussion of a problem. In addition, there are very few studies that were the result of cooperation between Eastern and Western authors. Hence, there are almost no explorative studies and only a few studies that pursue model development as a goal within such a cooperation. Here it is important to mention that for some subject areas examination level "analysis" is missing. For interfaces there are more studies that deal with implementation. For mobile and online services, the focus is on evaluation. The number of contributions from "WEIRD"-countries ("western, educated, industrialized, rich, democratic) still predominates till today.

## Discussion

Some of the characteristic values on which the result diagrams are based contain redundant information. Enough data for the development of a theory would be available, but just very few theories on usability have been developed within the period from 2010 to 2019. It would be interesting to analyze the articles on the level "design" and "implementation" on the topic of interface to get deeper insights in this respect. [1-111] are demonstrating the results and the discussed aspects in this paper. For example, in [3], the methods of interaction and definitions of culture are outdated. Furthermore, identified aspects from different HCI framework sources, which are of cultural relevance to the IUID, are presented. However, the citated approaches regarding HCI and culture and intercultural approaches are outdated (from 2013) or even mistyped (e.g. "ionization" in the title of [112] in the references). The terminology is used similarly. Human-machine interaction (HMI) or human-computer interaction (HCI) is the name of the process in which information is exchanged between a user and a computer or system through a user interface [112]. Furthermore, in scientific text, the concepts, "intercultural", "cross-cultural", "cultural-centered" and "cultural-oriented" are employed interweave with more associated concepts like globalization, localization, internationalization, and culturalization.

## Conclusion

The total number of 700 articles collected for this research corresponds to a rough overview of cultural differences and their use for IUID. The articles represent only a potential selection of literature with reference to IUID. Often literature references are out of date. Therefore, many papers are not a real source for new and relevant facts which blows up the IUID literature. The content of the presented work in several articles, therefore, is questionable. Only a stringing together of existing old and the study of new articles referencing to the old are representative and the results therefore are usable. In several publications in the recent years, it seems that the author was new to the IUID issue and without any current literature research experience that lead to randomly compile old research results in order to complete a thesis in the IUID field as quickly as possible. In future, magistrates doing topics in IUID should be supervised by experts in the field of IUID also being aware of the current state of research in IUID thereby carefully regarding the current state of research of IUID by analyzing the IUID literature thoroughly.

## Next Steps

Since the hits regarding the search terms have changed over time, the further analysis will examine to what extent the search terms need to be adjusted to continue to obtain relevant hits. Furthermore, the fact that the number of relevant articles is constantly increasing will have to be considered by considerably increasing the size of the sample. It is planned to record and analyze the last 30 years since the publication of the topics "intercultural user interface design" and "cross-cultural user interfaces" around the year 1990 in order to be able to interpret the current state of research also from its history.

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