An interaction design approach for multilingual users

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Abstract. *Despite data demonstrating the existence of a large contingent of bilingual and multilingual individuals in the world, probably exceeding the number of monolinguals, this characteristic of software users went unnoticed for several decades. With the emergence of Web 2.0, users began to produce and make content available on their favorite websites, generating a series of intercultural interactions with other users. In this context, users are increasingly willing to interact with content from other cultures. Several companies began to adapt their systems to this new reality, preparing their applications and websites for multilingual users. In this paper, basic and initial studies of the doctoral project will be presented seeking to map, through the development of a pattern language, the existing adaptations in the current systems related to users' multilingualism. Through the evaluation and analysis of this pattern language, we expect to outline a new approach to interaction design towards the design of interfaces for multilingual users.*

Resumo. *Apesar de estudos demonstrarem a existência de um grande contingente de indivíduos bilíngues e multilíngues no mundo, provavelmente excedendo o número de monolíngues, esta característica dos usuários de software passou despercebida por várias décadas. Com o surgimento da Web 2.0, os usuários começam a produzir e disponibilizar conteúdo nos seus websites favoritos, gerando uma série de interações interculturais com outros usuários. Neste contexto, usuários estão cada vez mais propensos a interagir com conteúdos de outras culturas. Muitas companhias começaram a adaptar os seus sistemas a esta nova realidade, preparando suas aplicações e websites para usuários multilíngues. Neste trabalho, estudos básicos e iniciais do projeto de doutorado serão apresentados, buscando mapear, através do desenvolvimento de uma linguagem de padrões, as adaptações existentes nos sistemas atuais relacionadas ao multilinguismo dos usuários. Ao avaliar e analisar esta linguagem de padrões, espera-se delinear uma nova abordagem de design de interação voltada para o design de interfaces para usuários multilíngues.*

1. Introduction

The emergence of Web 2.0 in the early 2000s started a new phase for the Internet and computing in general [O'reilly 2009]. Also known as the *participatory web* [Blank and Reisdorf 2012], it refers to a gradual transition from the static websites of the beginning of the Web to more interactive websites that put emphasis on user-generated content and a participatory culture. This transition from static content only

to user-generated content was so significant for software systems by then, that the Time Magazine elected "You" as the Person of the Year in 2006 [Grossman 2006]. Among the new technologies that followed the advent of the Web 2.0, we may include social networks, crowdsourcing, user reviews, and the sharing economy. In all these applications, intercultural communication among internet users became ever more common.

It did not take long for software developers to realize that many of these Web 2.0 users were able to understand and produce content in more than one language. In 2007, Facebook announced its Translations application [Lenihan 2011], one of the first large scale crowdsourced translation projects and a key tool for the translation of the social network into more than 160 languages, including many vulnerable and endangered tongues [Scannell 2012]. The Facebook project was soon followed by similar projects from other companies, such as Second Life in 2008 [Van der Meer 2008], and Twitter in 2009 [Ostrow 2009, Kamdar 2011]. Besides actively participating on the translation of their favorite websites, users were also exchanging experiences in their social networks, contributing reviews for their recently purchased goods, and trading underutilized resources in sharing economy platforms. In all of these situations, multilingual and intercultural communication was frequent if not the norm. For the first time, software engineers were leveraging on a disregarded characteristic of technology users: their ability and willingness to communicate in multiple languages. As a matter of fact, available data indicate that there are more bilingual and multilingual individuals in the world than there are monolingual [Tucker 1998, Wei 2007].

Despite the high incidence of bilingualism among the world's population and perceived trends of a more intercultural Web, many bilingual cultures remain marginalized in several regions of the planet. According to Romaine, although monolinguals are a minority when considering the world as a whole, they are a very powerful minority, often imposing their language on others, who have no choice but to become bilingual [Romaine 1995]. Even today, more than fifteen years after the software industry started to turn its attention to bilingual users, highly popular applications such as the Google Play Store still maintain the monolingual rigidity of their interfaces, completely hiding user-generated content produced in different languages [Hale 2014a].

Unlike the Google Play Store, many other current systems already present design strategies that adapt them to a multilingual audience. The display of international user reviews in travel and tourism websites is one such example. Portals like Booking.com[1], Airbnb[2], and TripAdvisor[3], websites of great popularity in the area of accommodation, allow the visualization of comments from other users written in different languages. Fig. 1 shows a hotel page on the Booking.com website with two user reviews, one in Turkish and one in French (while the interface language is Brazilian Portuguese). In 2014, Hale wrote in his personal blog about this type of interface using for the first time the term "design for multilinguals" [Hale 2014a].

Over the last decade, the influence of users' multilingualism on the various forms of human-computer interaction has been the subject of a few scientific works. Most of these publications are focused on the study of content generated by multilingual

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

[2]https://www.airbnb.com

[3]https://www.tripadvisor.com/

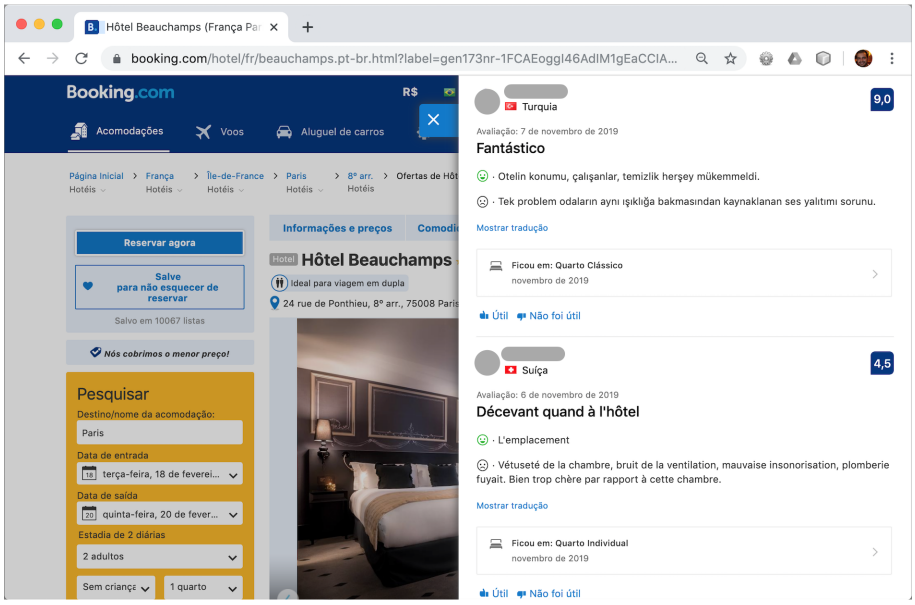

Figure 1. User reviews written in Turkish and Swiss French displayed to a Brazilian user of Booking.com. (Accessed in Jun 2022.)

users in social systems such as Wikipedia[4] [Hale 2014b, Hecht and Gergle 2010], Twitter[5] [Eleta and Golbeck 2012, Kim et al. 2014], and TripAdvisor[6] [Hale 2016]. Hale further explored multilingual user reviews conducting an online experiment with a prototype [Hale and Eleta 2017]. Other authors focused on studying the behavior of multilingual users in different situations, such as interacting with each other in the virtual world [Karusala et al. 2018, Papalexakis and Doğruöz 2015, Wei and Kolko 2005] or using news access systems [Ling et al. 2020]. Of all the analyzed studies, none is focused on the interface design strategies adopted for multilingual users, the main subject of this proposal.

One approach that is frequently adopted to identify and document design strategies in Human-Computer Interaction (HCI) is that of *patterns* and *pattern languages*. Initially proposed by Alexander for the area of Architecture [Alexander 1977], patterns quickly spread among researchers from other areas, including Software Engineering [Gamma et al. 1994] and HCI [Borchers 2000]. Patterns, also referred to as *design patterns* in HCI, are successful solutions to commonly recurring problems. According to Schmidt, not only do patterns teach useful techniques, they can help people to communicate better, reason about what they do and why, and learn new design paradigms or architectural styles [Schmidt et al. 1996].

Considering the aforementioned context, there are indications of a new form of interaction design being applied in current multilingual aware software systems, but it is also evident the lack of a set of best practices, such as a pattern language for the design of this solutions. This leads us to the research questions (RQs) that shall be analyzed along this research:

[4] https://www.wikipedia.org/
[5] https://twitter.com/
[6] https://www.tripadvisor.com/

- **RQ1:** What are the characteristics of an interaction design approach that embraces users' multilingualism?
- **RQ2:** How can a structured design approach assist designers in developing interfaces adapted for multilinguals?

The main objective of this PhD research is to propose an interaction design approach to HCI based on the observation of current software solutions and adapted for multilingual users. This approach shall be structured in such a way that it can assist designers in developing interfaces that leverage the experience of multilinguals without harming the experience of monolinguals. To register the discoveries about the current solutions, a methodology based on design patterns will be applied.

2. Methodology

To meet the objective described previously, we defined three sets of studies, namely: Baseline Studies, Initial Studies, and Future Studies (see Fig. 2). The Baseline Studies helped us to map previous research and the state of the art related to the topic of interest. The Initial Studies comprise ongoing studies that helped us to set the base of our proposal statement. Finally, Future Studies encompass studies that will lead us to answer our research questions and complete the research. Next, we discuss each of the studies in more detail.

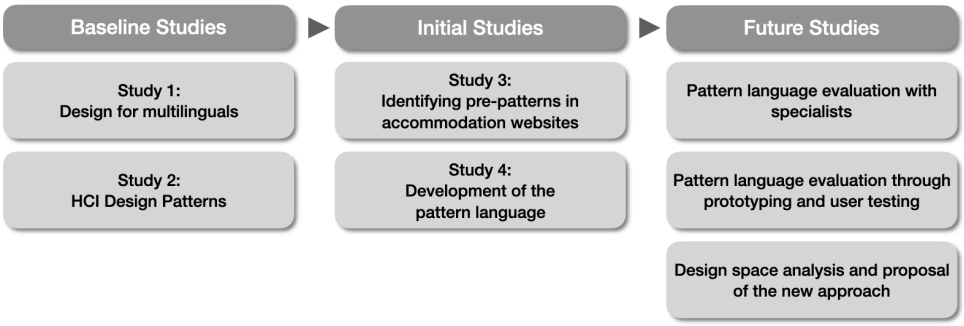

Figure 2. Basic structure of the research methodology.

- **Baseline Studies**
  - *Study 1 - Design for Multilinguals*: a literature review was conducted to understand the fundamentals of multilingualism and its intersections with interaction design that led to the practice of designing for multilinguals.
  - *Study 2 - HCI design patterns*: a systematic literature mapping was conducted to understand the process of developing pattern languages in the area of HCI. This mapping yielded a framework for HCI patterns development that grounded the subsequent research.
- **Initial Studies**
  - *Study 3 - Identifying pre-patterns in accommodation websites*: popular accommodation websites were inspected in order to evaluate the communicability of their user reviews sections. By analyzing the presentation of multilingual comments, a set of incipient patterns was identified.
  - *Study 4 - Development of the pattern language*: after an extended exploratory research, the selected systems were analyzed and a pattern language was developed with patterns that embrace users' multilingualism.

- **Future Studies**
  - *Pattern language evaluation by specialists*: this study will validate the proposed pattern language with the participation of HCI specialists. The exact methods are still to be defined, but might include: focus groups, and design workshops.
  - *Pattern language evaluation through prototyping and user testing*: we plan to build prototypes based on the language, allowing us to further evaluate the process.
  - *Design space analysis and proposal of the new approach*: this future study will analyze all the previous stages of the research, mapping the design space and searching for design opportunities not yet explored. Additional studies may be required at this point. This study will produce, as a final result, a proposal for a design approach for multilinguals.

3. Ethical Aspects

The project is being prepared to be submitted to the ethics committee of the Pontifical Catholic University of Rio Grande do Sul (PUCRS). The PUCRS' Research Ethics Committee[7] was constituted in 1990 and is considered one of the first committees adapted to Brazilian guidelines and norms. As of July 2022, the project is in its final phase of preparation to be assessed by the committee.

All the studies involving human beings are going to be included in the project description for evaluation. This includes the focus groups and design workshops foreseen for the assessment of the pattern language by specialists. Additionally, usability tests planned for the evaluation of prototypes will also be included.

4. Preliminary Results and Expected Contribution

This doctoral project is in its third year of development and is expected to be concluded on February 2024. In this section we describe some preliminary results (as of July 2022) and the expected contribution of the research.

The systematic literature mapping on HCI design patterns (Study 2) was compiled in an article and submitted to the Interaction Design & Architecture(s) journal (IxD&A)[8]. The paper was conditionally accepted for publication and a revision was sent for further assessment. The revised text is currently under evaluation.

Study 3, consisting of a semiotic inspection of the content in user reviews sections of accommodation websites, was also concluded and was published in the proceedings of the XXI Brazilian Symposium on Human Factors in Computational Systems (IHC 2021) [da Rosa et al. 2021]. The paper was presented as part of the Innovative Ideas and Emerging Results track of the conference.

The pattern language proposed for this research (Study 4) currently contains 30 design patterns identified so far. Fig. 3 displays an overview of the language and an initial proposal for the classification of the patterns according to their level of abstraction and functionality. A website has been created and contains full descriptions for all

[7]https://www.pucrs.br/pesquisa/comites/cep/

[8]http://interfacce.mifav.uniroma2.it/

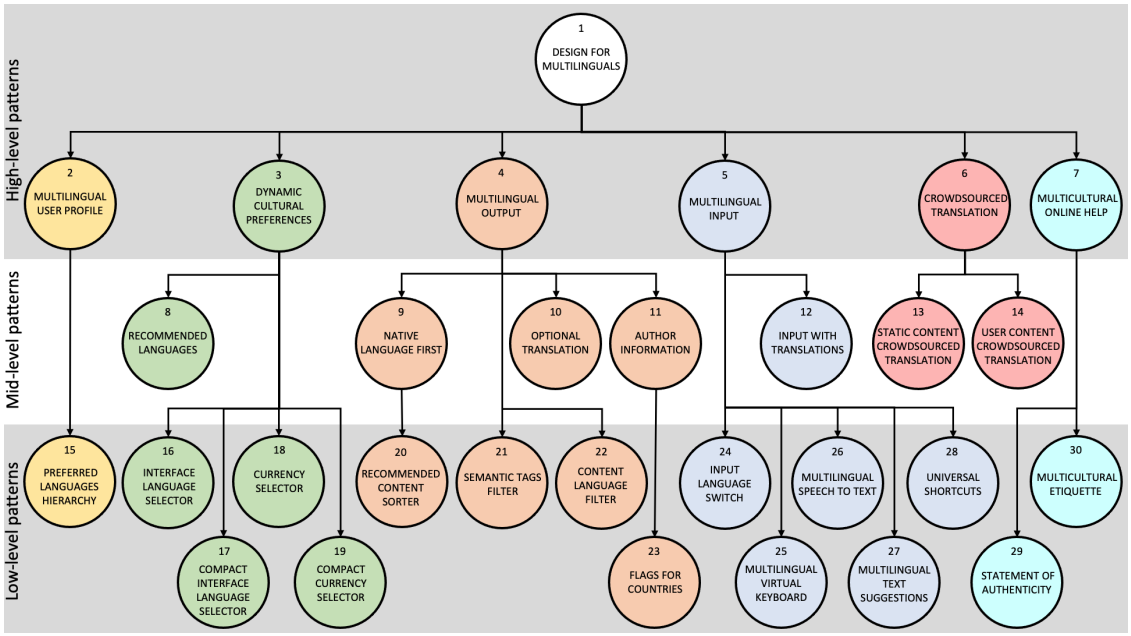

Figure 3. The proposed pattern language for the design for multilinguals.

the patterns[9]. A paper containing this language proposal has been accepted for publication in the 25th European Conference on Pattern Languages of Programs (EuroPLoP 2022) [da Rosa et al. 2022]. The paper and the pattern language have undergone the traditional shepherding process[10] between March and June 2022. In July 2022, the pattern language was discussed in a writers' workshop[11] during the conference in Irsee, Germany, with the presence of the first author and seven other pattern specialists.

Our language aims to document the characteristics of systems adapted to multilingual users. Still under construction, our proposal still lacks validation and a deeper analysis. We foresee two main contributions from this fully developed language. On the one hand, it records current design solutions, assisting designers in the task of developing modern interfaces adapted to an increasing multilingual user base. On the other hand, a further analysis of the language may give rise to improvement opportunities and a framework of rules and methods for an interaction design approach for multilinguals.

5. Final Considerations

In this paper we presented the background, methodology, preliminary results, and expected contributions of a PhD research project aimed at describing an interaction design approach towards the design for multilinguals. Besides that, a pattern language aimed at designing interfaces for bilingual and multilingual users was developed and presented.

A submission for the doctorate qualification exam was submitted and approved in September 2021, based on the early publications related to the research. This thesis

[9]https://design4multilinguals.wixsite.com/

[10]Process typical to the patterns research community in which the patterns are submitted to an experienced colleague for feedback prior to a writers' workshop or other type of review.

[11]Structured activity in which a group of discussants examine the strengths and weaknesses of a paper, accentuating positive aspects and suggesting improvements in content and style.

proposal was presented and approved in March 2022 by an examination board composed by one external and one internal examiner. Future developments within the research include the evaluation of the pattern language and further analysis to elicit innovative design strategies.

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