

# Characterizing Intercultural Encounters in Human-Computer Interaction

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**Abstract.** This article presents a two-step study, which is part of a project that aims at investigating how cross-cultural systems, intentionally or not, express and promote *indirect intercultural encounters* in Human-Computer Interaction. Previous research have proposed five Cultural Viewpoint Metaphors, a Semiotic Engineering conceptual tool to support HCI designers to understand and organize communicative strategies in the interactive discourse to promote such encounters. At this stage of our research we investigated the design of cross-cultural systems using CVM and one of the best known among numerous classes of signs proposed by Peirce – icons, indices and symbols, aiming at supporting the semiotic engineering (specifically, the choice of signs, i.e. the interface elements) of these kind of applications. Our findings point at the power of an alignment of the semiotic characteristics of Cultural Viewpoint Metaphors with theoretical semiotic elements from Peirce’s typology of signs in the interaction design cycle of cross-cultural systems.

**Keywords:** Culture · HCI · Cultural viewpoint metaphors · Semiotic engineering · Intercultural encounters

## 1 Introduction

The ever-increasing World Wide Web (Web) and its wide variety of cross-cultural applications (i.e. systems that intentionally expose foreign material to their users [16]) and users from different cultures have established a growing interest and need in research about Culture and Human-Computer Interaction (HCI). Over the years HCI research has been conducted aiming at investigating methodological [1, 6, 14, 17] and practical challenges [2, 10, 12, 21] about international and cultural aspects of HCI, such as the effect of culture in interaction [4, 11], intercultural collaboration [21], solutions to HCI design and culture-sensitive interaction [15].

This work is part of a broader research about how cross-cultural systems may, intentionally or not, express and promote indirect intercultural encounters with signs and traces of foreign values, practices, heritage, and so on, in HCI. Intercultural encounters in HCI may direct or indirect [15]. Direct intercultural encounters may happen when users make contact by interacting with users from others cultures with CMC technology. Indirect intercultural encounters, in turn, take place when users are exposed and/or may explore cultural diversity (belief, law, customs, language, symbols and so on) by interacting with cross-cultural systems.

The two-step study presented in this paper investigated such indirect intercultural encounters with concepts of Cultural Viewpoint Metaphors (CVM) and Peirce's typology of signs (icons, indexes and symbols). CVM is a Semiotic Engineering [4, 5] conceptual tool to support designers in stimulating users to engage in different levels of intercultural contact (if it is desirable), which may increase their perception about cultural diversity in the particular domain where the system is placed. So, the intercultural contact potentially causes a level of perception of cultural diversity. The adoption of each metaphor invite designers to follow a specific combination of communication features and cultural variables to achieve effects on interactive discourse.

Previous studies with CVM focused on the communication of culture investigating HCI practitioners' [15], users' [8] perspectives and methodological issues [9]. Among others, the results show two main contributions: (i) CVM have strong epistemic power for guiding the choices of communicative strategies in the design of cross-cultural application; (ii) CVM may be used as a vocabulary to reach users' cultural perspectives at evaluation time. In this paper, we are focusing on the semiotic engineering of cross-cultural applications regarding to how designers may protocol cultural components in the interface to promote intercultural encounters in HCI.

In order to address the research question presented above, we conduct a two-step study to understand the different ways of promoting intercultural contact with cultural diversity by using CVM (and their respective effects) in the light of Peirce's typology of signs. We aim at discussing and contrasting different ways to promote intercultural encounters in HCI as well as investigating users' perceptions about them.

The paper is structured in four sections. After the introduction, we present our theoretical foundations, with a brief explanation of CVM and Peirce's typology of signs. Next, the two-step study to answer our research question. Finally, our conclusion and possibilities for future work.

## 2 Theoretical Foundations

This paper presents a theoretical characterization of possible indirect intercultural encounters that may take place in HCI.

### 2.1 Cultural Viewpoint Metaphors

CVM is a Semiotic Engineering conceptual tool to support the decisions on dimensions of intercultural encounters in HCI design cycle of cross-cultural systems. Semiotic

Engineering, a semiotic theory of HCI, which is rooted in Peirce’s [18, 19] and Eco’s view [8] of Semiotics, a comprehensive study of culturally-determined codes and signs production, at all levels of human experience. According to Eco culture is the basis of two fundamental process: signification and communication.

Following these foundations, Semiotic Engineering theory supports the study of a distinctive unit of investigation: HCI as a particular kind of computer-mediated communication. Besides the cultural aspects of users and systems (itself), the theory involves the designer in the communication and signification process in HCI. In Semiotic Engineering terms, interaction designers need to choose and use (codify in the interface) signs to say how, why and what for the users may use the interactive system to reach their purposes. The combination of signs (interface elements, communicative strategies and styles and so on) will compose the interactive language.

Designers need, therefore, to be mindful of how (un)powerfully the interactive language may be due the choices they made (at design time) to communicate specific messages to be differently understood and perceived by individuals from multiple cultures. The five conceptual metaphors lead HCI practitioners to think about interaction as a journey in which the users are the travelers. CVM are plotted in a continuum of cultural approximation that goes from the user culture to a visited foreign culture (see Fig. 1). Each metaphor represents a different intensity of intercultural contact (between users and cultural signs from foreign cultures).

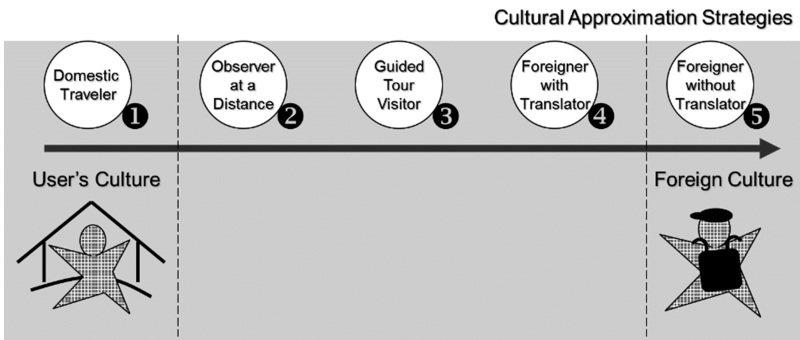


Fig. 1. Cultural Viewpoint Metaphors [15]

The domestic traveler metaphor keeps the user isolated in their own culture, the foreign culture is invisible to the user and communication is performed in users’ own native language, with no references to foreign practices and cultural values [16]. On the opposite site, with the foreign without translator metaphor the user may have contact with foreign culture as it is, with no mediation. There is an absence of cultural mediation in these two extremes.

In the three intermediary metaphors, different levels of cultural mediation influence the intercultural encounters. With the observer at a distance metaphor, cultural markers of another culture are communicated as “bits of information”: small facts about the foreign culture are presented for users interested in learning more about the subject (the native users’ culture and language dominate).

The guided tour visitor metaphor provides a contrast between the two cultures (the user and the foreign culture), so the foreign culture is illustrated and explained in the user's language through cultural markers that illustrate the foreign culture: there is a strong cultural mediation and approximation.


The foreigner with translator metaphor allows the foreign culture to be experienced directly, but with language translation of the verbal content, i.e., the cultural markers can be experienced directly, but in the user's language. Thus, the three metaphors situated between the two extremes (observer at a distance, guided tour visitor and foreigner with translator) indicate how does the intercultural encounters may take place according to the different levels of cultural mediation.

The adoption of each metaphor entails a different organization of the interactive discourse, including the design of communication features and the combinations of values assigned to two cultural variables: language (native or foreign) and cultural practices (with several domain-dependent values).

## 2.2 Peirce's Typology of Signs

Signs have been defined by Peirce [18] as "Something which stands to somebody for something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object. It stands for that object, not in all respects, but in reference to a sort of idea, which I have sometimes called the ground of the representamen".

Peirce defines a triadic model for a sign where: the representamen is the form which the sign takes (not necessarily material); the interpretant is not an interpreter but rather the sense that a human mind makes of the sign; and the object, to which the sign refers and thus provides *grounding* for it. In the following definition, Peirce clarifies the determination relationship among the elements of the semiotic triangle: "Sign is anything which is so determined by something else, called its Object, and so determines an effect upon a person, which effect I call its Interpretant, that the latter is thereby mediately determined by the former" [18].

For instance,  is a sign that represents 'warning' by virtue of a conventional contemporary Western culture interpretation (interpretant). It signifies some risk to a person. A sign exists whenever some interpreter takes a representation to mean something. Moreover, according to Peirce, the meaning of a representation (its interpretant), is also another sign. Then, each sign has another sign that corresponds to its meaning. The interaction between the representamen, the object and the interpretant is referred to by Peirce as 'semiosis'. Eco uses the term 'unlimited semiosis' to characterize this process as potentially infinite [8].

Peirce defined a fundamental typology of signs that can be manipulated to help communicators achieve their intent – symbols, indexes and icons. It is intrinsically related to Peirce's phenomenological categories of semiotic interest (firstness, secondness and thirdness), which are meant to provide the basis for explaining any phenomena of interest, i.e., of all possible experiences to acquire knowledge [20].

The following interpretation of Peirce's view by Santaella gives us the notion of what these phenomenological categories are: "Firstness is allied to the ideas of chance, indeterminacy, freshness, originality, spontaneity, quality, immediacy, monad... Secondness is associated to the ideas of brute-force, action-reaction, conflict, here and now, effort and endurance, dyad... Thirdness is linked to the ideas of generality, continuity, growth, advocacy, mediation, triad" [20].

### 3 Two-Step Study

Firstly (in Step One), we contrast the concepts and effects proposed by each metaphor with each Peirce's phenomenological categories and typology of signs. We aimed at understanding the relationship between them and the effects in the promotion of intercultural encounters. We, thus, arrived at three levels of effects in intercultural contact: cultural diversity unawareness, cultural awareness, and cultural diversity experience. Secondly (in Step Two), we studied what users perceived at interaction time at an intercultural encounter situation. We, thus, triangulated the results from Step Two with the three levels of intercultural contact (achieved in Step One).

#### 3.1 Understanding the Effects of Intercultural Encounters (Step One)

To begin, the domestic traveler metaphor stays out of question, since it does not intend to promote intercultural contact. The intended design effect is, thus, that of cultural unawareness, i.e., the condition of being uninformed or unaware about other culture (unconsciousness resulting from lack of knowledge or attention).

The definition of observer at a distance metaphor says that "the cultural markers of another culture are communicated as 'information' (not as an experience the user can 'feel')". It is achieved by a narrative about the foreign culture to provide factual information about what is different from one's own culture. So, design intent is to give the seed for cultural semiosis, but not the experience of cultural diversity itself. In Peirce's semiotic terms, the idea of this metaphor is to present an index for the presence of other culture, so the user will be contact with other culture in a secondness way. We are not saying that the whole interface is created with indexical signs, but that the general idea is that a design with this metaphor usually evokes the secondness of the referents of cultural diversity.

The Guided tour metaphor, in turn, usually evokes the thirdness, since designer's deputy mediates intercultural contact by giving meaning to foreign referents. The definition says that the cultural markers from another culture are 'illustrated' to the user (aspects of cultural issues are exemplified and explained in the user's language). It is achieved by an interpreted view and commentary on the foreign culture which mediates the user's approximation and contact with cultural diversity. The idea of this metaphor is to guide the user's interpretation by thirdness signs, thus reaching the maximum mediation.

In both cases (in the observer at a distance and guided tour visitor metaphors) the intended effect is that of cultural awareness. But the effects on cultural diversity

perception are potentially different, since the strict associations evoked by secondness representation in observer at a distance metaphor are not mediated by the designer’s deputy.

The idea of the foreign with and without translator metaphors is to represent cultural diversity by evoking the firstness of their referents, since according to their definitions the cultural markers of another culture can be directly ‘experienced’ by the user. With firstness signs there is no mediation, but we also see secondness elements with the foreign with translator metaphor, since the interface in the users’ language acts as a reference to their native culture when making relations to the foreign cultures. In both cases, the design intent provokes a cultural experience, since it represents the nearest point of contact with a foreign culture where the designer may try to offer to the user.

As a whole, in Peirces’ semiotic terms, design represents cultural diversity by signs to users. If we consider that the correspondence between CVM and the Peirce’s categories is plausible, with CVM designers may work thinking about different levels of knowledge in terms of firstness, secondness, and thirdness. So, designers may consider that users’ semioses may walk through the continuum of cultural approximation by reflecting how intercultural encounters may stem from rationality to sensorial experiences with different levels of cultural diversity perceptions (see Table 1).

**Table 1.** Potential effect on cultural diversity perception

| Metaphor                     | Cultural Diversity is represented by | Description  | Effect                         |
|------------------------------|--------------------------------------|--|--------------------------------|
| Domestic traveler            | Not applicable                       | Not applicable   | Cultural diversity unawareness |
| Observer at a distance       | Secondness signs                     | the strict associations evoked by secondness representation <b>are not mediated</b> by the designer’s deputy | Cultural diversity awareness   |
| Guided Tour Visitor          | Thirdness signs                      | designer’s deputy mediates intercultural contact by <b>giving meaning</b> to foreign referents               | Cultural diversity awareness   |
| Foreigner with translator    | Firstness and Secondness signs       | The language is the unique cultural mediator   | Cultural Diversity Experience  |
| Foreigner without translator | Firstness signs                      | There is no mediator   | Cultural Diversity Experience  |

The next section presents how users perceived the promotion of cultural diversity in intercultural encounters at interaction time.

### 3.2 Exploring User's Perception (Step Two)

We ran two empirical studies, the Study One (S1) with Englishtown<sup>1</sup> (ET website), an online English school, and the Study Two (S2) with Wikipedia<sup>2</sup>, a collaborative on-line free encyclopedia. Our research question was: How users perceive the promotion of cultural diversity (with intercultural encounters) in HCI?

ET website has not been designed with CVM, but it is clearly a cross-cultural application that exposes and exploits opportunities to intercultural encounters. The ET mission, as clearly stated in the website “is to use technology to create a fundamentally better way of learning English”. Wikipedia website is also a cross-cultural application: a multilingual, web-based, free-content encyclopedia project with more than 31,000,000 articles in 285 languages.

Each study (S1 and S2) was divided in two steps. In Step One, a Brazilian HCI evaluator inspected the selected website using CVM to identify portions where different levels of cultural approximation were explored and interactive resources used to promote indirect intercultural encounters. Seven scenarios of inspection were then created for user sessions in the next step of the study.

In Step Two, five potential users were recruited to evaluate (in individual sessions) the selected portions of the website (in each study). The participants belong to different areas of expertise: Statistics, Informatics, Education or Law. All of them were Brazilian, with college or university graduation. They all had at least a basic knowledge of English and are interested in learning more about this language (in S1) and had an interest in Encyclopedia information (in S2).

Step Two had, therefore, 3 (three) phases: recruitment, empirical study and empirical data analysis. In the empirical study (of each study), five different participants (P1, P2, P3, P4 and P5) were briefly introduced to the specific website and to the concept of intercultural contact (with examples and illustrations). Then, participants listened to an explanation of the evaluation activity they should perform. There were seven scenarios for inspection, each involving one or more tasks. At the end, participants described and classify detected intercultural encounters enabled by the interaction, with their own words. After completing the evaluation activity, during the post-test interview, participants reported verbally on what they had just done and experienced. This stage aimed at collecting evidence of their perceptions about how the interaction scenarios promoted intercultural encounters (or not).

Empirical data analysis was carried out in two stages using discourse analysis techniques [13], a systematic exploration aiming to find out major meaning categories in discourse with intra-participant and inter-participant analysis. Firstly, we looked for evidence of each participant's usage and signification of intercultural encounters during the evaluation activity and post-test interviews. In this stage, we investigated how participants perceived intercultural encounters according to Peirce typology of signs and what perceptions they expressed with regard to such encounters.

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<sup>1</sup> <http://www.englishtown.com.br>.

<sup>2</sup> <http://www.wikipedia.com>.

We conduct a research to see, thus, which category of sign (firstness, secondness, thirdness) the representations (interface signs to promote intercultural encounter) have evoked to users. For that to happen we drawn on the process of signification in an interaction context scenario.

**Synthesis of Results From Study One (with Englishtown).** Results from the empirical data in Study One pointed at a main category of meanings: specific interactive resources promoted particular contacts with foreign culture. For lack of space, we selected only some pieces of evidence to illustrate the kind of qualitative data we used.

Evidence from participants show how they could be closer from the other culture. P1, for instance, observed that they can see how natives from other culture (American) really speak from videos. P4, also commented about the opportunity to have contact with native's accent.

*P4: "The video is better because you see the situation, I mean, it gives tips about how you can behave. One's gets nervous like me (laughs), shy and became confused there. It shows the one's tension, which is something that one can not reveal in an interview. [...] In this video, it is simulating an interview situation. [...] Then you get the accent."*

By using pictures, in a learning situation, the ET website shows interesting places to take an English course abroad. Excerpts from P1, P2 e P3, for instance, showed us that this type of interface element attracted attention and sparked the curiosity of them.

*P1: "It [the website] wants to sharpen your curiosity in cultural life of the city and not in the English itself. It calls your attention to their culture to create curiosity."*

*P2: "So, this is a dynamic way. He puts a text, a very short content about what is better and the advantages of studying in that city. So, it is a very dynamic to give you that information and to motivate you. And it repeats [the cities]. So, if you move quickly, you can come back and see again. I found it interesting..."*

Participants also highlighted the potential of some interface elements. P2, for instance, said that the quiz give the opportunity to going deeper into other culture. P3 identified in lessons (using video) many possibilities to be in touch with foreign issues (subtitled texts, accent, and figures). P5, in turn, said that the articles are good for students that do not speak English well.

*P2: "[About the quiz 'Your English is good enough to get around in London'] It put very specific things there, slangs. So you can go deeper into their culture."*

Additional evidences, showed that the interface kept participants not so close to others cultures, but mediated the contact.

*P1: "So funny! [...] It [the website] is explaining the meaning of each situation. '-' The meaning of this expression. Is going to be different if you translate literally. You have to use the expression from that place."*

*P3: "It explains exactly what is the meaning (which is an expression when you get surprised by something), he explains what it is (without translating)."*

In conclusion, Study One showed that firstness signs helped users to get closer to the other culture and thirdness signs mediated the approximation. The quizzes and



videos, for instance, promoted an intercultural experience. Participants verbalized that they could be closer with other culture by having contact with translations, accent and other specificities. The articles and tips, in turn, improved their cultural awareness, because they perceived the opportunities to learn more by having contact with foreign material with cultural mediation.

**Synthesis of Results From Study Two (with Wikipedia).** Results from Study Two also showed us how participants perceived traces of others cultures, semiotically. For the lack of space, we selected excerpts from participant's discourse which compose the following category of meaning: different signs evoked different reactions and perceptions.

The P1 and P3 perceived the other culture when they saw a table with countries, which the official language is Portuguese. The website also shows a map that reinforces this contrast.

P1: *"The table gives you the opportunity to make a comparison between Brazil, which is my country, and the other countries that speak the same language. [...] This contrast is always very interesting. [...] Even here, for example, on the map you can see the contrast regarding the size. You see the size of Brazil and the size of the other countries [who speak Portuguese as the official language]"*.

In other situation, P1, P2, P4 and P5 realized that some links were indexes to learn more about the other culture.

P1: *"You became interested in Poland cooking? Great! You have also other different cuisines in the same continent [Europe]. If you want to check them, you have a link here that allows you take a look at there. So he's always encouraging you to take a look, experience the culture of another country or another region"*.

P5: *"He [the site] expands the possibilities of knowledge from this small cultural issue (that is the food). So, if you want to know how is the food in Northern Ireland, Romania, the links enables you..[to the cuisine of these countries]"*.

The sounds also called attention of participants to some details from other culture. P1 and P2 said that the sound allow them to go deep into other culture. P3, P4 and P5 realized that it is a good strategy to put them closer to foreign cultures.

P3: *"I think that when you listen the sound you are you coming closer to this cultural aspect. One thing is to describe something, but there is no way to describe the sound of the berimbau"*.

Some participants S2.P4 and P5 revealed their sensation when in touch with an article from a very different culture.

P4: *"He put me in a specific language, which I do not know which one is. Yeah, I 'm a little lost, but I would guess that here [in the top left], for example, was the amount of articles that it has [in that language]"*.

P5: *"I suppose, strongly, that it is Poland [this Wikipedia page] and then it makes me feel illiterate, that is the feeling I have. I look and this is not telling me anything. I imagine they have relevant information of Polish culture here, historic landmarks, people who were important to that country or events that were important."*

The Study Two showed us that different signs (tables, links, images, sounds, links, and language) promoted different intercultural contacts to users. Moreover, the

participants discourse showed how they promoted different levels of intercultural contact.

### 3.3 Triangulation

The triangulation stage aims at validating our qualitative analysis [3, 7], by looking for consistencies and inconsistencies among our findings From Step Two (Empirical Studies) and Step One (Exploration of CVM and Peirce's Typology of Signs). After comparing and contrasting both results, we found evidence that interactive discourse promoted different levels of intercultural encounters due to the type of sign used by designer.

Discourse excerpts from participants showed us that iconic representations (which evokes the firstness of their referents) such as sounds, images and so on promoted an intercultural experience to participants. When P5 told us that he was lost when interacting with Polish material, is an example of *Foreigner without translator metaphor*.

Indexes representations (which evokes the secondness of their referents) such as links lead participants to anticipate possibilities to learn more about a foreign culture. Finally, symbolic representations (which evokes the thirdness of their referents) strongly mediated the contact with foreign elements by giving explanations, comparisons to the users.

In conclusion, our findings point at congruencies among the user's perceptions at interaction time and our categorization of cultural diversity perception (see Table 1).

## 4 Conclusions

Given the multifaceted nature (beliefs, values, ethnicity, regional and so on) of HCI, this paper presents a characterization of possible *indirect intercultural encounters* that may take place in HCI by using two related approaches: Peirce's type of signs and CVM, a conceptual tool of Semiotic Engineering [4, 15].

This research worked on the effects the elaboration and protocol of cultural components (signs, in Semiotic terms) in the interactive discourse may promote on users' perception. This research demonstrated the causal relation between the semiotic engineering with icons, indexes and symbols and the potential consequences of them to the users' levels of perception and knowledge about cultural diversity.

Others HCI researches have used Peirce's Semiotic approach. Mihai Nadin, for instance, applied that paradigm to interface design in the late 1980s with a fundamental conclusion for interface design as such: 'since the technology upon and for which we build interface changes very rapidly, pan-logical semiotic principles, in their breadth and depth, provide a foundation for improved interface design [22]. Joost and Hemmert, in Design, also investigated Tangible User Interfaces in light iconic, indexical and symbolic representations [23].

In conclusion, this work shows that semiotic engineering of cross-cultural systems, i.e., the elaboration of an interactive discourse that communicates opportunities for intercultural encounters, may be viewed as a matter of promoting cultural unawareness,

awareness or experience. The current Semiotic Engineering ontology considers (so far) three classes of signs in the designer's deputy's interaction discourse: static, dynamic, metalinguistic [18]. With this view we are opening a theoretical implication of thinking in classes of cultural signs in terms of the promotion of cultural unawareness, awareness or experience. This allow us to characterize HCI more precisely and deeply, illuminating subtle issues in cross-cultural HCI design research.

In the near future, we will be working on the improvement of CVM scaffolds in order to improve this epistemic tool usability and explore the categories proposed in this work in design studies.

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## References

1. Barber, W., Badre, A.: Culturability: the merging of culture and usability. In: Proceedings of the 4th Conference on Human Factors and the Web, pp. 1–14 (1998)
2. Clemmensen, T., Roese, K.: An overview of a decade of journal publications about Culture and Human - Computer Interaction (HCI)- Department of Informatics Howitzvej DK. Working Paper nr. 03-2009. (2009). [http://openarchive.cbs.dk/bitstream/handle/10398/7948/WP\\_2009\\_003.pdf](http://openarchive.cbs.dk/bitstream/handle/10398/7948/WP_2009_003.pdf)
3. Creswell, J.W.: Qualitative Inquiry and Research Method: Choosing Among Five Approaches. Sage, Thousand Oaks (2007)
4. de Souza, C.S.: The Semiotic Engineering of Human-Computer Interaction. The MIT Press, Cambridge (2005)
5. de Souza, C.S., Leitão, C.F.: Semiotic engineering methods for scientific research in HCI. In: Synthesis Lectures on Human-Centered Informatics, vol. 2, no. 1, pp. 1–122. Morgan & Claypool, Princeton (2009)
6. del Gado, E.M., Nielsen, J. (eds.): International User Interfaces. Wiley, New York (1996)
7. Denzin, N.K., Lincoln, Y.S.: The landscape of qualitative research. Sage, Thousand Oaks (2008)
8. Eco, U.: A Theory of Semiotics. Indiana University Press, Bloomington (1976)
9. Ferreira, C.M.D., de Castro Salgado, L.C., de Souza, C.S.: A vocabulary to access users' cultural perspectives in human-computer interaction. In: Kotzé, P., Marsden, G., Lindgaard, G., Wesson, J., Winckler, M. (eds.) INTERACT 2013, Part IV. LNCS, vol. 8120, pp. 314–322. Springer, Heidelberg (2013)
10. Gasparini, I., Pimenta, M.S., De Oliveira, J.P.M.: Vive la difference!: a survey of cultural-aware issues in HCI. In: Proceedings of the 10th Brazilian Symposium on on Human Factors in Computing Systems and the 5th Latin American Conference on Human-Computer Interaction. Brazilian Computer Society, pp. 13–22 (2011)
11. Lindgaard, G., Dudek, C., Chan, G.: Cultural congruence and rating scale biases in homepages. In: Kotzé, P., Marsden, G., Lindgaard, G., Wesson, J., Winckler, M. (eds.) INTERACT 2013, Part IV. LNCS, vol. 8120, pp. 531–538. Springer, Heidelberg (2013)
12. Marcus, A.: Global and intercultural user-interface design. In: Jacko, J., Sears, A. (eds.) The Human-Computer Interaction Handbook, pp. 441–463. Lawrence Erlbaum Associates, Mahwah (2002)

13. Nicolaci-da-Costa, A.M., Leitão, C.F., Romão-Dias, D.: Gerando conhecimento sobre homens, mulheres e crianças que usam computadores: algumas contribuições da psicologia clínica. In: IV Workshop sobre Fatores Humanos em Sistemas Computacionais, IHC 2001, pp. 120–131. Anais SBC, Florianópolis (2001)
14. Oyugi, C., Dunckley, L., Smith, A.: Evaluation methods and cultural differences: studies across three continents. In: Proceedings of the 5th Nordic Conference on Human-Computer Interaction: Building Bridges, pp. 318–325. ACM (2008)
15. Salgado, L.C.C., de Souza, C.S., Leitão, C.F.: A Journey Through Cultures: Metaphors for Guiding the Design of Cross-Cultural Interactive Systems. Springer, London (2012)
16. Salgado, L.C.C., de Souza, C.S., Leitão, C.F.: On the epistemic nature of cultural viewpoint metaphors. In: Proceedings of the 10th Brazilian Symposium on Human Factors in Computing Systems and the 5th Latin American Conference on Human-Computer Interaction, pp. 23–32. Brazilian Computer Society, Porto Alegre (2011)
17. Winschiers, H.: The challenges of participatory design in an intercultural context: designing for usability in namibia. In: PDC, pp. 73–76 (2006)
18. Peirce, C.S.: The Collected Papers of C.S. Peirce, vol. 1–6, Hartshorne, C., Weiss, P. (eds.) vol. 7–8, Burks, A.W. (ed.). Harvard, Cambridge, 1931–1958
19. Peirce, C.S.: The essential peirce: selected philosophical writings. In: Houser, N., Kloesel, C.J.W. (eds.) vols. I, II. Indiana University Press, Bloomington, 1992–1998
20. Santaella, L.: Teoria Geral dos Signos – Semiose e Autogeração. São Paulo, Ática (2000)
21. Vatrapu, R.: Explaining culture: an outline of a theory of socio-technical interactions. In: Proceedings of the 3rd ACM International Conference on Intercultural Collaboration, Copenhagen, Denmark (2010)
22. Nadin, M.: Interfaces design and evaluation\*semiotic implications. In: Hartson, H.R., Hix, D. (eds.) Advances in Human-Computer Interaction, vol. 2, pp. 45–100. Ablex Publishing, Norwood (1988)
23. Joost, G., Hemmert, F.: In touch with representation: iconic, indexical and symbolic signification in tangible user interfaces. In: Design Research Society Conference 2010, 7 July 2010 (2010)