A Semiotic Engineering Approach to HCI

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Abstract
Designing software involves good perception, good reasoning, and a talent to express oneself effectively through programming and interactive languages. Semiotic theories can help HCI designers increase their power to perceive, reason and communicate. In this paper we present the semiotic engineering approach to HCI and some of the results that have been reached at the Semiotic Engineering Research Group (SERG) at the Informatics Department at the Pontifical Catholic University of Rio de Janeiro (PUC-Rio).

Keywords
Semiotic Engineering, HCI Design, Interdisciplinary Studies.

Introduction
Mainstream theoretical approaches to HCI design have drawn on cognitive perspectives. They have the power to explain what users do when they interact with computers, and to predict a lot of what they will or will not do depending on the quality of the system's interface. Much of the research in this field aims at discovering, understanding, and supporting users in their attempt to make sense and make use of software applications. A multitude of target features have been found, and handy compilations of them are offered in the form of guidelines and heuristics for HCI design. *Know thy users!* Thanks to cognitive approaches we know a lot about them, though we cannot always hit the targets they set to us. Other disciplines such as ethnomethodology, anthropology and sociology have provided software designers with powerful insights and valuable knowledge that helped increase the adequacy of corporate systems and of CSCW as a whole. Nevertheless, here again, the theoretical contributions from these fields were more insights and new targets.

It is our belief that semiotic theories can be associated to cognitive and social theories in providing insights about HCI, since Semiotics can produce an account of the process of HCI design, using models of human interpretation and expression. It can also be used to analyze the product of HCI design being used by people in a variety of situated contexts. This homogeneous semiotic framework used for talking about both process and product allows us to contrast *design intentions* (that emerge in the process) with *perceived meanings* (that are derived from the product), at the very end of the line — the user interface. In this paper we briefly sketch our approach for Semiotic Engineering (de Souza'1993) and some of the results we've reached with it over the last few years.

A Semiotic Engineering Approach
In our Semiotic Engineering approach, software artifacts are viewed as *metacommunication artifacts*. They are one-shot messages from designers to users about the range of messages users can exchange with systems in order to achieve certain effects. Thus, Semiotic Engineering explicitly characterizes HCI as a two-tiered communicative process: one is the designer-to-user communication and the other is the user-system interaction. In our view, HCI can only be achieved if both levels of communication are successfully achieved. Becuase the designer-to-user message tells the user what range of messages she or he can send and receive during interaction, and what goals and effects can be associated to them, productive interaction is actually *dependent* on the success of the one-shot message. In other words, the success of an interface in our view results from a deliberate and successful communication of *arbitrary* design choices. It is not *inherent* to a particular choice of interface signs (widgets, images, words, layout, or dialog structure).

We have investigated how models, methods and techniques based on a theoretical semiotic approach can contribute to the various challenges involved in interface design. We have explored how to support the designer's expressive choices regarding multi-user interfaces, workflow systems, help systems, extensible applications, and we have also developed an interface evaluation method. Some of our conclusions are referred below.

In order to support the designers' choices and predictions about the communicative effects of selecting one or another means and mode of expression at a certain level of communication, we have structured the space of analysis, and identified useful classifications of signs and messages (Leite'1998).

Multiuser applications such as groupware present to HCI designers the challenge of designing three different systems of communication: (a) the user-system interaction; (b) the user-user interaction; and (c) the designer-to-user communication. In other words, first and foremost, the designers of such systems must have a conception of the domain of application, of the group structure(s) they want to support, of the mechanisms of coordination and communication needed for productive collaboration, and of the direct patterns of system activation and system response that best fit their design. This overall view should be conveyed directly and indirectly at all levels of communication and by all instances of interfaces a user is likely to encounter. We have developed a model to support designers of multi-user interfaces by providing them with qualitative indications on their description of the interface (Prates'1998, Prates and de Souza'1998).

Semiotic Engineering also provides a characterization of end user programming as an essentially linguistic design activity, where users become designers of extensions to existing applications (de Souza'1997, de Souza'2001). The role of designers is to communicate not only the messages we have already described for standard interactive applications, but also the messages relative to the *syntax and semantics* of another language, a meta-language, with which users can specify new conversations and achievements for the original application. A special means by which designers can achieve this effect is by designing systems that can interpret metaphors and metonymies with which users refer to new features they want to add to applications (Barbosa'1999, Barbosa and de Souza'2000).

Moereover, our Semiotic Engineering approach can support the software development cycle itself, with an evaluation method that can be applied at different stages of development. It carries different messages to designers, depending on whether the subjects performing the steps of the method are designers, users, or experts in Semiotics. The communicability evaluation method (Prates et al.'2000) fully embraces our view that interactive systems are metacommunication artifacts, by telling designers, in a number of ways, how well their message is getting across.

Final Remarks

We do not claim that our Semiotic Engineering approach accounts for *all* of the results and insights brought forth to HCI by cognitive and social theories. Rather, we expect it to *complement* them by providing designers with new perceptions on the process and product of HCI design and focusing on.By aligning a theoretical scaffolding with an evaluation method, Semiotic Engineering reunites both ends of the software development method under a homogeneous framework and unifies a considerable portion of HCI design knowledge.

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