Towards the Sixth Level in Interface Design: Understanding Culture

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ABSTRACT

Five levels have been recognized in the history of interface research and development. Each of the levels has had its own focus, which has followed the changes in technology and the user base. Consequently, the interface has been moving outwards, further from hardware.

We argue that the growing interest in cultural issues in interface design is a part of this general development and foreshadows a new level, which will provide a cultural perspective to interface design.

Keywords

Culture, interface design

INTRODUCTION

When Jonathan Grudin wrote his seminal paper on the history of interface design in 1990, the development of interface design was in the beginning of a new phase [5]. Today interface designers are witnessing an era that in many ways resembles the one that Grudin described fifteen years ago. Interface design is yet again reaching outward, learning more of the human world.

But this time the change may well be even more pronounced. The archetypical user today is no longer a middle-aged, Western office worker as was the case in the 1980s. The continuous expansion of the computer industry to new market areas is increasingly diversifying the user base: people of different ethnic groups, genders, strata, geographical locations, groups with special needs, generations, languages, and so forth [1]. The research and design approaches that responded to the challenges of the 1990s, are not well-suited for the new challenges of the

third millennium.

Grudin predicted that the interface would continue to move further outward. We argue that he was right and that cultural aspects will form the next level in interface design. By extending Grudin's historical framework, we present how the emerging research on culture and CHI can be seen as a part of the larger development in interface design. We believe that this will help the researchers to understand better the problems and the various options in studying culture and interface design in the future.

We begin by sketching Grudin's historical framework of interface design. Second, we contemplate the changes that have taken place in the user base and consider the possibilities and challenges that these changes bring. Third, we put forward our outlook on research on the new level, and finish with a discussion on future research.

GRUDIN'S FIVE LEVELS OF INTERFACE DESIGN

Grudin [5] introduced a framework of how interface design has historically developed (see Table 1). His framework consists of five levels, each of which expands on the previous level.

In Grudin's framework, the focus of interface design shifted from hardware to software to terminal etc. in about one-decade intervals. One of the main reasons for the transition between the levels has been the changes in user base – from technicians to programmers to end users in the 1970s, and from individuals to groups in the 1990s. Even though the levels are distinct, they are neither exclusive nor successive: research can and should be done at different levels at the same time.

The first level of Grudin's framework, which occured during the 1950s, was chararacterized by a focus on hardware: the principal users were engineers who knew computing equipment well. Computing performance was central to this level. In the 1960s, as software engineering gradually gained a foothold, the principal users became programmers. Usability enhancements such as high-level programming

	LEVEL 1: INTERFACE AS HARDWARE	LEVEL 2: INTERFACE AS SOFTWARE	LEVEL 3: INTERFACE AS TERMINAL	LEVEL 4: INTERFACE AS DIALOGUE	LEVEL 5: INTERFACE AS WORK SETTING
Principal users	Engineers / Programmers	Programmers	End users	End users	Groups of end users
Interface specialist disciplines	Electrical engineering	Computer science	Human factors, cogn. psychology, graphic design	Cognitive psychology, cognitive science	Social psychology, anthropology, organizational, ...
Research methods	Largely informal	Largely informal	Laboratory experiment	Wizard of Oz, thinking aloud, …	Ethnogr., contextual, participant observer
Duration of basic events studied	Microseconds to hours	Milliseconds to hours	Seconds	Minutes	Days
Cost	Lowest	Low	Moderate	High	Highest
Precision, generality	Highest	High	Moderate	Low	Lowest
Major focus	1950s	1960s-1970s	1970s-1990s	1980s –	1990s –

Table 1. Summary of the distinctions across levels of interface focus [5].

languages, environments and operating systems increased the productivity of programmers.

In the 1970s, several hobbyist groups brought the computer out of the laboratory, making computing available to the public [9]. As the computer spread to Western society, the development of computer systems that were better suited for "end users" began. At first the focus was on perception and motor skills, and later shifted to fields such as cognitive psychology and ergonomics. The 1980s witnessed a trend towards interface designers focusing on high-level cognitive aspects such as learning, modeling, and user-system dialog.

Grudin's fifth level arose from the realization that since most work occurs in a social context, computers will support work more successfully if they implicitly or explicitly incorporate social and organizational knowledge [5]. This level puts social context, organizational level, and groups in the foreground, and recognizes that individuals have a wide range of roles, skills, backgrounds, and preferences.

TRANSITIONS IN THE USER BASE

Grudin's framework documented one major shift in the user base of computers. This shift was the change from engineers and programmers to "end users" in general. Although there is plenty of intra-group variation within the category of engineers and programmers, the shift was still one from a relatively homogeneous group of people to a much more heterogeneous group of people. During the transition from the fourth to fifth level the principal users changed from "end users" to "groups of end users", but the category of "end users", remained roughly the same.

A lot has happened since the 1990s when the growth of computer networks led to workgroup computing, i.e., the fifth level of interface design. Computers, ICT in general, and the Internet are no more the exclusive privilege of rich countries. Currently, according to CIA World Factbook[1], there are 185M (million) Internet users in the U.S., followed by China (100M), Japan (78M), Germany (42M), India (37M), UK (33M) and South Korea (32M).

The growth potential does not lie in industrialized countries where the markets are becoming increasingly saturated. The population of China and India alone account for one third of the world's population, but the percentage of the population who use the Internet is 3.4% for India and 7.6% for China compared to roughly 60% for the United States. Only a minuscule portion of the almost 900 million people on the African continent is using the Internet, but lately the African ICT growth figures have been unparalleled. This growth is further sped up by numerous ICT development projects run by non-governmental and international organizations as well as ICT industry.

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[1] www.cia.gov/cia/publications/factbook/

We believe that a second major shift in the user base is happening as we speak. The ongoing diffusion of computing technology in developing countries is increasingly diversifying the user base. We note that there is controversy about the feasibility of national cultures [see, e.g., 14]. However, according to a number of studies, the differences between national cultures are considerable [6]. Hence, we argue that there is currently an ongoing shift from a (relatively) culturally homogeneous user base to a culturally heterogeneous user base.

CHALLENGES AND PROSPECTS

In the 1980s the market niche of major software products began a gradual broadening from large corporations, institutions, and organizations to include small and medium enterprises, homes, and now personal, portable devices. During the last fifteen years, miniaturization, integration, cheapening, and growing interoperability have taken information and communication technology from the desktops to pockets, from cable-bound to wireless, from proximal to ubiquitous, and from common to private. In addition, the amount of technology has increased, its forms have diversified, and information and communication technology has gradually become an integral and commonplace part of people's lives. Consequently, there is a clear motivation for designers to learn about the culture of the users beyond the workplace and to take more responsibility for the effects they may have on people's everyday life.

The heterogeneity of the international, multicultural and pluralistic user base of the 2000s sets new challenges to interface design. The design and research tools associated with Grudin's fifth level are a reaction to a need to support groupworking in organizations, at workplace. Grudin writes that on the fifth level, one needs to take into account social, motivational, economic, and political factors [5]. Yet, the tools associated with Grudin's fifth level may prove inadequate to meet the new, unforeseen challenges that the changes in user base and technology involve.

From a cultural point of view, there is an equally dramatic change due to the globalization, which has expanded the market area of software products to developing countries and brought along the global software production model. Software houses have already seen the challenges that the diversifying user base brings, and they attempt to rise to the challenge with internationalization-localization process.

Adaptation of software to different target cultures has raised many questions to which today's software engineering has no predetermined answers: Is it possible to design truly global software? If not, how to adapt software so that it would cater to the specific cultural conditions? What should be the priorities in software localization? How to find out what will work out and what will not? Finding answers to such questions requires broadening the current viewpoint of software engineering and acquiring new skills.

Following the development described above, culture has attracted greater interest also in interface design. During the past ten years the number of papers that address cultural matters has been increasing in CHI conferences and journals. Since the end of the 1990s, culture has been the theme of several special issues in journals and of new conferences (e.g., International Workshop on the Internationalization of Products and Systems (IWIPS) and Cultural Attitudes towards Technology and Communication (CATaC)).

We believe that in the following years this trend will continue and that culture will be established as a part of interface design. However, as the current studies addressing culture and interface design are still relatively scattered and few in number, it is important to consider the theoretical and methodological base for studying culture in interface design.

THE SIXTH LEVEL: INTERFACE AS CULTURE

In this section we discuss several matters that are central to the interface design at the sixth level. In addition, we present a preliminary description of the sixth level based on Grudin's framework of the historical development of interface design.

What is culture?

Culture is a phenomenon that has been generally described as difficult to grasp and define. Even so, we feel that the question of how culture should be defined in interface design is crucial, because the way the researchers see culture influences both the methods they use and the results they get. Instead of resorting to one of the numerous definitions of culture available, we discuss here briefly some of the different viewpoints from which culture can be considered.

Culture is often seen as principally a mental phenomenon, that is, a phenomenon consisting of values, ideas, mental models and so forth. However, culture also includes material and social phenomena, which we feel should be considered as equally important parts of culture.

Culture is also commonly used as a label for the group of individuals that share certain characteristics. In this meaning it makes sense to talk about "cultures" in plural form. This view of culture is typical of cross-cultural psychology (see, e.g., [10]). Other researchers argue that culture should not be seen as any collection of things but as a process, because the things that are often considered as culture are actually only a residue of this process [8].

There are various opinions about the level at which cultures exist. Many anthropologists are not comfortable with the wide variety of phenomena that are referred to as "cultures", whereas some anthropologists consider an individual as "a junction point for an infinite number of partially overlapping cultures" [13], claiming that culture is a fuzzy concept and that no strict boundaries can be drawn between individual and cultural. In the case of the sixth

level, we are especially interested in cultural phenomena that go beyond the level of organizations.

In addition to the previous points, we would like to emphasize that culture has many controversial characteristics. Thus, culture can be both coherent and diverse, extensive and restricted, durable and variable, and motivational and unmotivational [13]. In software localization, for instance, culture is often seen as fixed, as something into which software needs to be molded. This viewpoint underplays the dynamic aspect of culture and its role in helping humans to adapt to new conditions [7].

Theoretical background

So far most common sources of cultural theory in interface design have been cross-cultural psychology and cross-cultural communication (e.g., Geert Hofstede's cultural dimensions [6]). These studies are often interested in culture at the level of an individual. Although some post-cognitivist theories in CHI, such as activity theory, have emphasized the significance of context, they have been rarely used for studying culture at the level of societies or national cultures.

Thus, there is a need for theories that address the relationship between technology and, for example, society in interface design. Anthropology continues to be one of the reference disciplines on the sixth level, alongside more multi-disciplinary efforts such as Science and Technology Studies (STS). In addition to STS, other social sciences are needed to offer insights into the functioning of societies, national institutions, and global structures. In the field of psychology, the theories of cultural psychology may prove useful.

Also some strands of diffusion research can prove useful in charting the aspects of technological relevance. Everett Rogers' four decades of research on the diffusion of innovations has showed that in order to succeed in a community, technology needs to be relevant in a number of ways [11]. Of Rogers' different aspects of relevance, two are specifically significant from our point of view. First, new innovations have to be relevant to local users. Systems that are hard to use are adopted slower than those that links to the knowledge the user already has. Second, new innovations have to be relevant to the local culture and society [11]. The structure of a social system may facilitate or impede the diffusion of technologies.

Rogers' study shows that the adoption of an incompatible innovation often requires prior adoption of a new value system, which is a relatively slow process. The strands of diffusion research that concentrate on, for instance, the rate of innovation adoption in different social systems, the consequences of technology [11], or the models of innofusion [4], seem promising.

Research methods

Although culture at the national level is distinguishable from subcultural levels and should be studied with different methods than the methods used for subcultural levels, the levels are so functionally interdependent that they cannot be properly understood in isolation [12]. Consequently, national cultures should be seen in relation to lower cultural levels (and vice versa).

The methods on the fifth level are often based on observation in the work context. However, these methods may be insufficient on the sixth level. While observation in the work context may give some clues to the larger subcultures of users, it provides a very incomplete description of their total subcultures, of the larger functions of the organizations, or of the meaning of the organization in relation to larger systems [12]. In addition to that, people are often unaware of many aspects of their culture, making them difficult to discuss. Therefore designers should not expect that all the culture related issues would automatically surface during the observation or conversations with the users.

Several studies have pointed out that current methods of interface design, such as thinking-aloud-method, have been developed in Western countries and may not be suitable for all cultures. Indian users, for example, may find it difficult to give negative or individual opinions [2]. In such cases, designers should consider carefully how they could adapt their methods so that cultural factors would not affect the results too much.

Designer-as-bricoleur

One of the central problems in interface design has been the gap between designers and users. This problem is accentuated in the field of cross-cultural interface design, where the gap between designers and users is potentially even larger. Consequently, the probability of misunderstandings, surprises, and lost opportunities in software projects increases.

As a result of the wide variety of required methods and reference disciplines, the role of the interface designer is changing from an engineer to a "bricoleur", with which Norman Denzin and Yvonna Lincoln [3] associate, inter alia, the following characteristics:

- *Flexible and responsive*: willing to deploy whatever research strategies, methods, or empirical materials are at hand, to get the job done; "If new tools have to be invented, or pieced together, the researcher will do this."

- *Technically curious and multi-competent*: skilled at using different methods (interviews, observation, personal documents, *etc.*)

- *Intellectually informed*: reads widely and is knowledgeable about different interpretive paradigms.

It is neither necessary nor practicable that in cultural interface design all the interface designers would rely solely on their personal knowledge and experience. In addition, not everybody needs to have interdisciplinary skills – blending sciences is sometimes useful, but disciplines are also often

needed as pure. However, the designers should be able to question their own values and expectations during the design process, and they should also be able to see cultural differences as possibilities and valuable clues to the life of the users, rather than as mere nuisances to design. This sort of an open attitude would help interface designers to work efficiently as a part of an interdisciplinary design team.

Draft of the sixth level

We have described the presently forming sixth level in interface design in Grudin's terms (see Table 2). Principal users, reference disciplines, research methods, and major focus have been discussed above, and the variables of cost, generality, and duration of basic events are briefly explained here.

	LEVEL 6: INTERFACE AS CULTURE
Principal users	Multicultural
Interface specialist disciplines	Anthropology, social sciences (esp. STS), cultural psychology...
Research methods	Combined
Duration of basic events	From days to several generations
Cost	High
Precision, generality	Low
Major focus	2000s-

Table 2: Preliminary description of the sixth level in interface design.

According to Grudin, the duration of events studied can be measured in days on the fifth level, though he mentions that "many social processes unfold over weeks or months" in the work setting [5]. On the sixth level, designers are interested in events with even greater time spans. When they begin to consider things such as the diffusion of technologies to societies, they are dealing with processes that may take anything from months to several generations.

On the sixth level, generalizing becomes increasingly difficult. The higher level processes are not well understood and the number of potential problems to be solved increases. Although one may find some kinds of generalizations that apply to many if not all cultures, such generalizations have to be applied with great care.

The costs of cross-cultural studies are high, which will cause problems in software engineering and limit the range of methods that can be put to use in software design. The

costs can be cut down by the reuse of information in later projects.

DISCUSSION

The sixth level, interface as culture, is similar to the five earlier levels in that it is an addition to the continuum rather than a distinct level. As such, it does not question the value of the earlier levels, nor is it a sufficient approach on its own. As Grudin notes, work needs to be done at all levels, because it is not realistic to expect that we could solve all the problems at one level before moving on to the next level.

Research on the sixth level is still in its infancy, but judging by the number of studies published during the past few years, interest in cultural matters in interface design is clearly growing. Most of the current studies in the area of culture and interface design have concentrated on the viewpoints that the sixth level offers to the previous levels. Researchers have studied the effect of culture on, for example, perception (level 3), learning (level 4), and groupware (level 5).

All these are relevant research topics, but the sixth level is also valuable research area in itself, as a wider context than organization, such as ethnic culture, society or country. At this level, there are many interesting questions that are currently left unanswered in interface design. In our research, we address some of those questions by studying the following topics:

- Meaning of culture in interface design – defining and understanding culture as a phenomenon in the context of interface design.

- Interplay of culture and technology - how culture shapes and is shaped by technology.

- Methods for cross-cultural software design - evaluation of current design approaches from a cultural point of view and the introduction of new ones.

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