

Introducing Human-Computer Interaction: A Didactic Experience

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Abstract — Experts on human-computer interaction (HCI) are required to establish communication media for a broad variety of users in consequence of the expanding services offered to the market and the changing technology landscapes. Software developers need suitable criteria to handle computer interfaces because of the diversity within the ‘digital population’ and it seems natural that educators should answer the professional questions posed by software designers.

In this paper we report on the experience of a vocational course on object-oriented design, which – among other topics – provides professional criteria to students who are required to plan a large assortment of computer interfaces from panels to object lists, from animated images to social web pages.

In the first stage, lessons on HCI illustrate the psychological portraits of computer users. Second, the lessons deduce practical guidelines from those profiles. Finally the students learn the technical contents regarding HCI design.

The concise psychological and social criteria which guide the students to prepare the visual interfaces constitute the innovative contribution of the present work at the didactic level. The initial lessons on HCI go beyond mere technical training and it may be said that they improve the professional culture of students. The feedback from participants appeared very positive.

Keywords— *Human-computer interaction, typology of computer users, interfaces for working-users, interfaces for free time.*

I. INTRODUCTION

From the beginning a wealth of research has been conducted on human-computer interaction (HCI). Sector studies were conducted on distance learning [1] e-commerce [2], computer games [3] and many other application areas.

User interfaces for desktop, mobile, and web reach across culturally diverse user communities and sometimes across the globe [4] thus experts of HCI began to appreciate the assistance offered by social/psychological theories and cultural constructions [5]. On one hand, technicians started to learn the relationships between contemporary psychology and digital systems. On the other hand, the design of interfaces provided psychologists with a diverse and challenging empirical field in which to assess their theories and methodologies [6]. Researchers extensively analyzed the typology of computer users – such as [7] and [8] – and these

studies ultimately conform to the *user-centered design* (UCD) methodologies [9][10].

The multifaceted issues of HCI also affected the education sector. The explosion of interactive technologies such as web and mobile communication networks and the demand for software products with high usability contributed further to the didactic issues. The ACM arranged the Special Interest Group on Computer-Human Interaction to establish didactic guidelines [11].

Several courses on HCI are oriented to technologies and aim to improve the practical capabilities of students [12]. However technical training is not sufficient for software analysts who work in companies, banks, institutions and business and are called for designing interactive software applications for a broad variety of users: from managers to workers, from customers to generic web surfers. Practitioners who will be asked to plan alphabetic/numeric panels and attractive web pages should learn the criteria to determine the appropriate types of interface for each software application [13]. The principle “*practice first, concepts follow*” does not comply with the needs of educators who should resolve these kinds of issues:

- (a) How to orientate students within the wide spectrum of human-computer interfaces?
- (b) How students should manage the development of interfaces either at home or in outsourcing?

We faced these didactic questions when we were called to create a vocational course on ‘Object-Oriented (O-O) Analysis and Design’ for personnel employed in various organizations. Most students occupied the positions of junior and senior analysts, data managers, and project managers. The major topics covered in this course, which we personally developed in IBM, were as follows:

- The methodologies of O-O analysis and design,
- Human-computer interaction.

The lessons on HCI dealt with the technology say HTML and Java languages, the Model Visual Controller (MVC) paradigm etc. Firstly, the lessons provided concepts to answer questions (a) and (b) above. The following section sets out the initial subject contents that constitute the original contribution of this paper.

II. A LESSON ON HCI

The ACM Curricula in Human-Computer Interaction [11] plan lessons on psychology and sociology in order to make the student aware of the inclinations and behaviors of computer users. Those lessons should provide the initial orientation to answer question (a) but unfortunately educators do not find much support in the CS literature. Researchers furnish detailed illustrations of the agents who use digital appliances but they mostly focus on operational aspects [14], [15], [16]. Studies often overlook the more detailed traits of the user temperament.

We decided to prepare an introductory lesson on HCI with a deeper insight into computer users on the basis of psychologists' inquiries [17]. We aimed to provide insights into the mind of agents operating digital appliances in order to effectively prepare professionals following the IBM course on 'O-O Analysis and Design.'

The next sections give a concise account of the lessons which include five principal stages in sequence as follows.

A. A principle to start

All forms of communication share a very intuitive and common rule in that it's not the speaker but the listener who determines the meaning of an utterance. As a consequence of this *principle of intelligibility*, the 'transmitter' has to conform to the psychology of the 'receiver.' A private conversation, a public lecture, commercial advertising, and also computer interfaces are to act in accordance with the culture and behavior of the listeners. The more the talker is acquainted with the inclinations, tastes and mindsets of his/her listeners, the more the communication is effective [18], [19]. To make computer interfaces more 'readable' an analyst has to be able to grasp the users' perspective, that is to say the analyst has to understand the psychological profile of the computer operators, their motivations, their preferences, their behaviors, and so forth. This is the prerequisite for preparing messages that will attract users' attention, and achieve communication in an efficient manner.

Computer users are made up of an extraordinarily wide-ranging and varied population, and the application of the previous principle seems to be rather demanding for software designers who have a technical extraction:

- (c) How to identify the audience of a company or an institution?

B. User involvement

Answering question (c) the teacher reviews the users' psychology in the following way. He classifies computer users according to their engagement with digital appliances. On one hand, there are *people who work with digital equipment*; that is to say they are engaged with a precise job, and they earn through the regular use of software programs. Employees, managers, workers, sellers, and all those who pursue specific purposes when they use a digital system belong to the first group which we label as *working-users*. On the other hand, there are *people who do not use the computer for work*. It may be said that the time spent on electronic equipment is a time of

entertainment for them. To give an example, they are web surfers peaked by generic curiosity for a subject; they are clients who have not yet made a decision; and they are young people who mean to play with a software application. Those who do not use the digital appliances for work make up the second group labeled as *leisure-users*.

We have established this pair of groups in order to facilitate the description of the psychological and behavioral traits of computer users.

C. From involvement to psychological profiles

In fact, working-users bear responsibilities to achieve objectives. They operate many hours every day and frequently follow precise procedures; as a consequence working-users like rather regular interaction and dislike unnecessary changes. Working-users fulfill duties that somebody checks and controls. If one makes a mistake on a computer system – e.g. a manual error – he/she suffers consequences to a certain respect.

The leisure-user – by contrast – has the opposite behavior. He/she does not have responsibilities, and does not have any formal rules to obey and nobody will control the results obtained using the computer system. He/she can make mistakes without any problem since he/she is playing with the electronic device. The leisure-user is attracted by novelties, colors, vivid images, etc. The working-user focuses on the subject contents that the screen displays, the leisure-user lacks profundity of thought.

TABLE I. OPPOSITE TRAITS OF COMPUTER USERS

Working-users (Employees, Managers, Sellers)	Leisure-users (Clients, Web surfers, Players)
Are working.	Are not working.
Are paid to reach precise targets.	Have generic targets.
Operate during working hours.	Operate when they like.
If they make a mistake, are called to account.	If they make a mistake, are not called to account.
Have precise economic and professional motivations.	Have generic motivations.
Obeys precise rules.	Do not have rules to follow.
Often handle repetitive tasks.	Are creative.
Dislike changes or varieties in computer operations.	Like variety in computer operations.

The present lesson summarizes the opposite psychological and behavioral traits for didactic reasons in Table 1. Working and leisure users have *two portraits that exhibit somewhat extreme attributes* and could be referred to as two *stereotypes* that have the virtue of aiding students' retention. Table 1 aids the

understanding of participants who may be familiar with technical matters but rather unfamiliar with psychological and social topics.

D. Consequences in Design and Management

At this stage the students are able to address question (a) by themselves. They can draw some inferences from the users’ profiles and inclinations – introduced in Sections B and C – with the help of the teacher. The participants easily infer that interfaces – designed for working-users – should have rather regular and standard shapes. In fact HCI is not required to be stimulating in a bank, an office or a company. Lively interfaces risk distracting the operators’ attention from the job, and programmers in Java or C++ inherit standard visual classes such as buttons and windows and do not invent new ones. Visual classes have regular forms that aim at optimizing the efficiency of user operations; colors are greyish. A software programmer or an analyst can design an interface with the help of the involved working-users without great effort (question (b)).

From Sections B and C the students are able to conclude that display screens for leisure should exhibit vivid representations, they should be appealing and attractive. Visual films, animations, simulations and cartoons produced for free time evoke lifelike images, they have intensely bright colors, and they have the freshness of immediate experience. Shapes, sounds, scenes and other sensational features are to be inviting.

Interfaces for leisure are characterized by originality and expressiveness to the extent that implementation is entrusted to artists and creatives (question (b)).

The teacher uses a didactic visual example (Figure 1) to underline the distant manners of communicating recapitulated above. A software application used in an office visualizes – for instance – the student Paul Hinn through a window. Paul Hinn appears in a nice life-like form as in a computer game.



Fig 1. - Standard visual classes and cartoon-like classes with O-O programming

In short, Sections B and C yield precise answers to questions (a) and (b).

E. The changing roles of users

The teacher pinpoints how the working-user and the leisure-user are *stereotypes* that is to say they are two *characters* or *roles*. This notion is fundamental to prepare multi-form platforms.

Actually a software application offers various services and a single user can play different roles. He/she may even operate alternatively as a working-user and leisure-user with a sole application. The teacher illustrates this concept with the aid of the following case example.

Take a multi-form platform that offers products to clients. An appealing portal invites Internet surfers to enter the site and to see the extraordinary qualities of the merchandise. Web surfers behave like leisure-users in this initial phase and the company’s e-commerce application draws the attention of occasional visitors by means of vivid images. As soon as the visitor resolves to purchase a product, he/she has to fill in the commercial order and his/her behavior suddenly switches. The customer leaves aside casual behavior, because he/she has to pay for the acquired product; he/she switches from the leisure-user role to the working-user role. In consequence of this second part played by the user, the interfaces become severe and drab; colors and lures do not distract the user who enters his credit card number, the expiry date, the amount to pay and other important details. In consequence of the two roles of the visitor, the platform presents interfaces which have opposite features.

The multiple roles played by the generic computer agent provide further details to answer questions (a) and (b).

III. CONCLUSION

HCI is a complex topic pertaining to computer science (CS). Researchers have conducted extensive inquiries on this subject but the profound and psychological aspects of human-computer interactions rarely emerge in professional lessons. Teachers are often inclined to explain ‘how’ to implement a computer interface and overlook ‘why’ and ‘what’ interfaces are to be drawn. The present paper gives an account of an experience of a vocational course where the guidelines for designing an interface precede the technical contents. In particular the lessons on HCI introduce some notions about the psychology and behavior of computer users and derive the criteria necessary to structure the interfaces from these premises. The aim of the lessons is twofold; they are intended to enhance the professional skills of students and provide an in-depth understanding of user-centered design methods in HCI.

All the lessons of the course on ‘O-O Analysis and Design’ were traditional front-end lessons and the students used a text book that was written for the purpose. The course duration was one working-week; about twenty editions of this course were realized and were globally attended by over two hundred and fifty professionals.

The course was formally evaluated by means of the *satisfaction factor* (SF) whose mean lies over 90 points in all the editions. A student could express his satisfaction using five values: 100 (very satisfied), 75, 50, 25 and 0 (absolutely unsatisfied). Hence the feedback of the students appeared very positive. In addition many participants verbally expressed their positive appreciation about the present original approach which goes beyond purely technical learning.

Finally, this initiative is part of an educational project that has the purpose of enriching CS courses with subject contents handled by researchers so far, and in this way the teachers improve the knowledge and culture of the students. For instance the lessons illustrated in this paper deal with psychological aspects which are not common in CS education. We have also developed:

- i) An introductory course on CS on the basis of innovative theoretical frames [20].
- ii) A course that provides the exhaustive illustration of data bases indices [21].

We guess this didactic approach will further expand in the near future.

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