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# Human aspects of medical computer application

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**Abstract.** Most of the research activities in the field of medical informatics are directed toward technological-technical problems. Human factors of computer use are often a neglected topic. Even the application of the tiniest microcomputer embedded in a medical diagnostic equipment may pose user acceptance and motivation problems but to mention larger scale hospital information systems. In this paper the author presents some aspects of the human-computer interaction problems in a medicinal computer application setting.

## 1. Introduction

Users of medical informatics solutions form a very heterogenous population. In some cases even non-professionals use such systems, e.g. hospital/polyclinic-based in-house information systems for patients or community health care information networks. The professional user group may contain technicians, financial clerks, receptionists, nurses or doctors : people with different expectations, different comprehension, different task completion approach. These users are heterogenous also in psychological terms: overt or less evident personality factors are apparent in terms of introversion/extroversion inner/outer motivation sensing/acting personality types etc.

## 2. User acceptance

The user may ask such questions when confronted with a new software system:

- What can I accomplish with the software package ?
- May me or technical problems cause faults with data loss ?
- How can I recover from an error ?
- How easily is the software to comprehend ?
- Will this new environment make my work more efficient ?
- Can I customize the program and import data from my previous system ?

The software quality measures are based upon such questions - psychological observations, the well-known six-domain ISO 9126 standard features a way to express metrics about

- functionality
- reliability
- usability
- efficiency
- maintainability
- portability.

Moreover, specific expectations of medical systems are communicated via the forthcoming CEN-standards like the HIF (Healthcare Information Framework) or HISA (Healthcare Information Systems Architecture). While the ISO and CEN standards provide

an abstract way determining the criteria, the roots of these standards systems lie in complex user expectations. On the other hand it is questionable whether between user-initiated expectations and the features presented in these standards the distance would not increase with each technological revision.

## 3. User interface vs. functionality

The user acceptance of a sofware greatly depends on the user interface. Ease of handling may win over richness of functionality. It is a commonplace that 90% percent of users use regularly the 10% of functions of an application software. Almost invisible, abstract assets of a system - like security policies - are not the mostly appreciated parts for an average user. The neat visual appearance with simple, straightforward operation on the "good" side and sparky protuberations of the UI on the "bad" side are jousting in each new software development.

It is very difficult to specify what would be the users' real, *sui generis* expectations in a non-industrialized setting, without the "pushing" effect of the software industry.

What could be the requirements of an "ideal" UI ?

· functions are plausible and correspond well to real world terms

· cohesiveness

· graphical : the optical appearance of an interface element is uniform throughout the environment

· semantical : the same element / action does not have different meanings or effects in the same or different context

· syntactical : the syntax of the commnd should not change in the program environment

Perception of a good software may be attributed to both functionality and a well-designed interface. Users with different technical knowledge judge differently on software quality: a workspace cluttered with toolbars satisfies a power user but confuses a novice user with limited abilities; on the functions side limited system functionality , with inherent simplicity captivates the ordinary user while annoys an advanced one. Customization of the visible side of functionality i.e. hiding / revealing menu or toolbar fragments is essential for a software developed for a wider range of users. Judicious use of the *metaphor approach* in UI design (i.e. arrangement and behavior of graphical elements simulates the real world: ward or office-like items on the desktop etc.) definitively increases user confidence.

## 4. Computing environments

### *4.1. General computing tasks*

Everyday operating system-related activities like copying or moving files, new directory creation or folder navigation seem to be difficult to deal with. Deletion of unused files and archiving is not a problem - only a few of the medicinal users do like that, - the huge hard disk capacity covers the flaws. System security is the weakest part of user activities: logging on with a collegue's identification code, leaving the terminal logged-in while leaving the room even for longer time periods are daily events.

### *4.2. General office work*

The difference in office automation package skills comes whether the actual person is involved in scientific research activities or not. "Purely" patient managing doctors stick with a word processor and basic touch-typing knowledge without relevant text formatting or structuring abilities. On the next level the user applies predefined templates. Doctors with report-generating obligations (scientists, contractual workers for pharmaceutical

industries) go further : they work with efficient direct text formatting, sometimes use styles to automate the process. Document organization and outlining (e.g. index generation, figure numbering) are often beyond this level.

*4.3. Internet activities*

The confrontation with Web-browsing and e-mail is surprisingly positive. The browsers have an intuitive and simple user interface. The users mostly lack to exploit the convenience of bookmarking - they type the URL repeatedly again and again.

Sending and receiving e-mail does not pose problems to medical computer users. Attaching files may be a more difficult task. Compressed transfer of attachment files are avoided (similar ideological and skill-"hiatus" like archiving). The author had not encountered with anyone using automated mail filtering : manual selection of mail messages is almost exclusive.

The average user does not even know about newsgroups, despite the integrated newsreader in the WWW-browser. File downloads occur within the browser. (Note: it is a shame for the leading browser developers that retry-resume features are no implemented although many freeware ftp-clients offer "disconnection-proof" file downloading feature).

*4.4. Document reading*

In the life of a medical doctor studying-reading has a continous role. Beyond printed , paper-based information electronic media - multimedia, hypermedia - fight their way to acceptance.

Hypermedia can be interpreted as structured, "entry level" information systems. Even simple computer-based books (e-books) offer certain advantages over printouts: easy reproduceability (within legal copyright frames), searchability and some customizability of the user interface (i.e. changing display fonts, draft/page WYSIWYG view, individual keyborad code bindings etc.) . The Internet has achieved a lot in this area: the standard World Wide Web representation of documents via HTML offers more flexibility than "serial" formatted or non-formatted text. HTML with recent extensions enables embedding of feature-rich multimedia into web pages: still pictures, sound, 2D movies or even 3D virtual world walkthroughs.

Hypermedia versus serial text - people's opinion is not equivocal. Although hypertext is more structured, navigating back and forth via hyperlinks e.g. between a Table of Contents page and section body text may be cumbersome when the reader wants to read the whole article. Multi-level hyperlinking in a hypertext document can be more disastrous because today's browsers offer only one-dimensional navigation: they feature only back-and-forth movements. Reliable tree-like representation of WWW sites would be beneficial.

*4.5. Professional (hospital, outpatient etc.) information systems*

Professional computer systems form the "compulsory" side of the medical human-computer interaction. Being used during most of the office hours the staff should be - by virtue - very familiar with them. Many users meet with computers only by the application of such information systems. Today's HISs are tailored for everyday use in the healthcare , in contrast with legacy systems of the past decades - in the latter case general (mostly business) applications with minor modifications were advertised as patient management systems.

The acceptance of HISs (or any professional information system) poses the question of motivation: is the right way to assimilate the new working environment with external psychosocial drive ? Will the user be satisfied with promises of enhanced productivity - and will fulfill the increase in performance from an internal psychological drive, being truly motivated ?

From a certain view HISs are dead end for learning general computer skills:

· These systems are not built for creativity: they are surely concise , but even customization for personal needs may be a neglected or unexploited feature.

· Many comprehensive HISs do not run on "PC" platform They represent a "closed world" offering no bridges to everyday personal computing.

## 5. Conclusion

The obvious paradoxon of the complex medical thinking and the generally apparent inability to communicate with computers seems overt.

Medical problem solving is a multithreaded, non-deterministic process involving the manipulation of huge , loosely-structured information. The key to understand this discrepancy may be the *fuzziness* of medical thinking. A decisive milestone of artificial intelligence would be the adequate modeling of the abstraction process (in fact this discovery would be an infinitesimal side-effect of the solution of the general thinking-puzzle).

The medical application of ergonomics - beside infrastructural (workplace organisational and hardware) issues relies on software design. The software industry should prepare more user friendly programs to eliminate the gap between customer electronics and computing.

Although the highly appreciated GUI conformance (X-Windows or Microsoft Windows or whatever windowing environment) in the business scenario is a premiere issue, medical systems may (and they do) have distinct, genuine interface philosophy.

The thoughts of years long in-house and external consultations, teaching among medical doctor collegues are presented below:

- Knowledge or skill is not necessarily age-related : young doctors may be "rookies" while senior researchers may be more knowledgeable in computer application.
- Doctors without research activities are less experienced computer users than scientists.
- Professional systems need more training time than just the usual few (4-6 hours) agreed in informatics development contracts.
- Nursing informatics is often a neglected area: nurses and paramedics are less susceptible to the advantages of computer systems (either professionnal systems or home office automation)

**Abbreviations**

| | |
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| UI | User interface |
| GUI | graphical user interface |
| OS | operating system |
| HCI | human-computer interaction |
| HIS | hospital information system |

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