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User Interfaces

Gateway or Bottleneck?

Thomas Bernold
Editor



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USER INTERFACES

Gateway or Bottleneck?

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PREFACE

The pathways to the future are the pathways of change. Above all, the growing dependence on complex information and communication technologies requires solutions that transcend the boundaries between different fields and functions. How a company organizes its approach to contemporary data processing will determine how successfully it can compete in the future.

This is also an expression of the corporate culture. Hardware is no longer the key to success: the quality of the software engineering and particularly of the user interfaces have become even more significant. Sophisticated and safe access to information and communications is no longer just for specialists.

The user interface is increasingly the window to an informational world. Its characteristics; its transparency and resolution, but also its distortion and filtering determines the quality of decision making. This goes beyond the question of mere ergonomics and user friendliness, interfaces are the crucial links between different sections within but also beyond individual companies in the worldwide net of communication.

In this context human resources gain a new meaning. Through the information network an increasing number of individuals interact directly. The range of each individual member grows far beyond his assigned task. The organization has to adapt to the new situation if it will not endanger its productivity and finally survival.

The basic theme of the proceedings is divided into two broad areas: 'Services and Administration' and 'Production and Manufacturing'. The aim of the different contributions is to build a bridge between technology, organization and users. This seems particularly important in a phase where knowledge based systems promise to open new modes of access and interaction.

The implications of today's decisions on investment in data processing and expert systems will continue to be felt long into the future.

Thomas Bernold
Zürich

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INTRODUCTION

THE USER INTERFACE: WINDOW TO AN INFORMATIONAL WORLD

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0. INTRODUCTION

The user interface with a computerized information system can be thought of as a window through which the user views the contents of the system. Only through this window does the user gain access to the information in the system. Just as an ordinary window can facilitate or obstruct the view of the world beyond, so can a user interface to a computer system. In extreme cases, the window or user interface can even totally block the desired view.

At the same time, the user interface is a window through which the system "sees" the user's world, i.e. through which the user enters commands, requests, data, etc. into the system.

This analogy with a window suggests a number of aspects or dimensions of a user interface which should be considered when planning, specifying and designing a user interface as well as when assessing the effectiveness of an existing one. Such characteristics include transparency, breadth of view, magnification, resolution, selectivity, distortion, filtering effects, etc. In this introductory talk, these and other features of a user interface will be examined. From these considerations, a list of criteria in the form of an evaluation sheet for assessing the suitability and effectiveness of the user interfaces presented later in the conference will be derived.

1. THE INFORMATIONAL WORLD BEING VIEWED

Through a window one views some world. In the case of a computerized information system, the world being viewed is a collection of data and information or even knowledge. This collection is a more or less realistic model – a sort of mirror image – of the "real" world, the true subject of ultimate interest.

The degree to which the collection of information satisfactorily represents the real world of interest depends not only upon the content and structure of the data base, but also importantly upon the needs of the user. While we will not consider the adequacy of the informational model of the real

world in this paper in detail, it is important to distinguish between shortcomings in the window (the user interface) and inadequacies in the informational model being viewed through that window. Apparent deficiencies in the interface may, in fact, be due to inadequacies of the information collection and vice versa. Both the information collection and the user interface must be of sufficient quality if the system's overall specifications are to be met; shortcomings in either will render the system unsatisfactory.

In this context, the most important characteristics of the information collection are probably scope, level of detail, structure, completeness and accuracy of the data stored in the system. In the following paragraphs, we will assume that these measures of the quality of the informational world being viewed are satisfactory and represent the real world adequately in terms of the needs and desires of the user.

2. PROPERTIES OF A WINDOW

Among the many properties of a window, the following are particularly relevant to our analogy with a user interface to a computerized information system:

- transparency
- angle of view
- resolution
- contrast
- magnification
- filtering and selectivity
- distortion
- permeability
- control

Each of these properties of a window to an informational world is discussed in some detail below.

2.0. Transparency

One of the most obvious properties of a window is its transparency — the fraction of incident light (available information) which it lets through. Often, a high transparency is desirable, but not always. In bright light which can dangerously overload the human eye (e.g. when arc welding, viewing the sun, etc.) a low transparency is essential. Similarly, information systems often have the potential for greatly overloading the user's capacity to assimilate information and the user must be protected from such an overload. An intentionally limited transparency of the user interface is indicated in such cases. In the context of a computerized information system, limiting the transparency corresponds to limiting the amount of information presented.

Closely related to the concept of transparency is the ability of a user interface to limit or adjust the rate at which information is presented to the human user. The ability of the

user to control the rate at which the interface delivers information to him can be of importance.

One extreme of transparency is illustrated by the data communications network which dashes our hopes with a message something like "network down" [1, p. 57]. An example of the other extreme is the information retrieval system which insists on pouring out several VDU screens full of information in response to our imprudent request for "help" before it will accept our next command.

2.1. Angle of view

Of considerable importance to the user is the angle of view his window offers. In physical terms, this property can be measured in terms of the width and height of the video display screen, printed report, etc. For some purposes other measures are more meaningful, e.g. number of points in a graphical display.

The importance of this property is frequently underestimated. The angle of view offered by computerized information systems is often too small, restrictive and unnatural. Many systems for processing and displaying text, for example, use a screen 80 characters wide and 25 lines high. The user of such a system is accustomed to working with a page of text as a basic quantity of information, and often he would like to be able to look at several pages at once. The dimensions of a typical page of text being about 80 characters wide by 50 to 60 lines high, an appropriate physical angle of view for the typical reader of textual information would be about 80 characters by some 150 lines or more, several times that of a typical video display screen.

In informational terms, the angle of view corresponds to the scope of the information provided to the user, i.e. to the answer to the question: Does the user interface provide the "whole picture" or only a rather limited range of specific details?

2.2. Resolution

Some windows offer the user a sharp, detailed view while others provide an aggregated, overall image. Depending upon the needs of the user, either can be appropriate. The manager will usually want an overall view and will find too detailed information distracting. The clerk processing a specific transaction or handling a particular query, on the other hand, will need high resolution. He will want to see the trees and their leaves clearly; the overall view of the forest will be irrelevant and inadequate for his purposes.

2.3. Contrast

Low contrast (lack of distinction in the view presented to the user) is almost always undesirable. The different aspects of the information presented should be clear and evident to

the user, without his having to strain and ponder the meaning of the data displayed to him.

Examples of poor contrast in an informational sense are confusingly structured displays, inappropriately worded or incomplete prompts, questions and replies, etc.

There once existed a compiler which often output a message of rather low contrast: "Error in source program" [1, p. 32].

2.4. Magnification

Magnification is related to, but not the same as, resolution and angle of view. The detail in the information presented to the user should be presented sufficiently expanded that he can discern it easily. Especially the ability to vary the magnification, as the photographer does with a zoom lens, is useful. Data base interrogation systems particularly should permit the user to adjust the magnification: low for orienting himself, high for examining the selected information in detail.

2.5. Filtering and selectivity

Does the system flood the user with all of the information it contains or does it permit him to specify categories of information he requires and present only them to him? Most data bases contain more types of information than any one user will find of interest. The ability to select information according to the needs of the user - and not on the basis of the system's or the system's designers' convenience - is an important evaluation criterion.

2.6. Distortion

Some user interfaces, as windows, distort the information passing through them. Uneven transparency, resolution, contrast, magnification, etc. are common causes of distortion. The consequences of distortion are particularly serious when the user is unaware of and unable to control its underlying causes.

2.7. Permeability

To what extent does the user interface permit certain categories of information to pass through the window at all? To what extent does it allow the user to communicate his needs to the system? Most of us have experienced the frustration of a user interface which has forced us to answer an irrelevant question before we could proceed; the interface was impervious to our objections. Similarly, many of us have been frustrated by user interfaces through which we could not gain access to information which we knew was contained in the system's data base.

Only a few days ago, while using a new, "modern" and supposedly user friendly information system, I found that I had

stumbled into an irrelevant part of the dialog and decided to terminate the session. I entered "end", "stop", "abort", "help", "H", etc. and pressed several keys with labels which seemed to promise an "escape" route, but all to no avail. The system was impermeable to my demands to terminate the dialog. It forced me to enter two screens full of what it considered to be valid data (some 25 items) before asking me whether the data just entered should be saved or rejected before returning to the next higher level menu. I was relieved that it did give me that choice. There might have been some short cut to escape from the data entry dialog in which I was stuck, but nothing on the VDU or in the documentation on the section of the dialog in question betrayed that secret.

It is useful to distinguish between two aspects of permeability: accessibility and security. In the first case, permeability is normally desirable, while in the other, the goal is to limit the window's permeability in certain ways.

2.8. Control

When assessing a user interface, one should consider to what extent and how easily the user may adjust the above listed characteristics of the window through which he is viewing the informational world in the system. The user interface with fixed characteristics will be of use only to a specific class of users. Especially if the system is to cater for ~~the~~ needs of a wide range of users, e.g. at different ~~hierarchical~~ levels in the using organisation, is flexible control required.

2.9. Time delay

The window analogy, useful as it is, does not quite suffice. Unlike optical systems, computer systems do not respond at the speed of light, and the response time (delay) is an important consideration. Perhaps even more important than the average delay time itself is the variation of the response time with such factors as system load (number of active users), size of the data base, selection criteria, etc.

3. EVALUATING A WINDOW TO AN INFORMATIONAL WORLD

The above properties of a user interface form a basis for evaluating a specific user interface. For each property, one should specify the needs of the users and the actual characteristics of the interface in question. By comparing the desired and actual characteristics, one can then determine the interface's suitability. The better the match, the more suitable is the interface. Conversely, large discrepancies indicate that the interface is unsatisfactory for the users' purposes.

The property of controllability is not a separate, individual property but refers to each of the other properties.

These considerations lead to the following checklist for evaluating a user interface:

CHECKLIST FOR THE EVALUATION OF A USER INTERFACE

<u>Property</u>	Characteristics and controllability		<u>suitability</u>
	<u>desired</u>	<u>actual</u>	
Transparency			
Angle of view:			
physical			
informational			
scope			
Resolution			
Contrast			
Magnification			
Filtering and selectivity			
Distortion			
Permeability:			
accessibility			
(both directions)			
security			
Time delay			

4. CONCLUSIONS

Depending upon its particular characteristics, a window to a computerized information system can be either a gateway, facilitating access to the desired information, or a bottle-neck, hindering or even effectively preventing such access. The optimum characteristics of a window depend greatly upon

- the user (in particular, his prior knowledge, outlook, experience and familiarity with the information collection being accessed and with the real world it represents),
- the task being performed by the user and his consequent needs and desires and
- the specific nature of the informational world being viewed.

Only a few generalizations regarding the optimum properties of a window can be made and most of these are fairly obvious. Perhaps the most dangerous trap is the equivalent of the stained glass window: the user interface which is, itself, beautiful but only appears to provide a view of the world beyond. Used mostly as a marketing gimmick, it is a nearly opaque work of art, not an effective window.

The suitability of a user interface can be judged only by comparing its actual characteristics with the requirements following from the task at hand. The degree to which these match one another is the best measure of quality of the user interface in question.

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- [1] Baber, R. L., *Software Reflected: The Socially Responsible Programming of Our Computers* (North-Holland, Amsterdam, 1982)