Lexivisual Interfaces – The New Look

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Human-computer interaction is primarily based on communication with visuals, i.e text and pictures. On the display screen, both information from the system to the user and feedback in respond to the users actions, are presented. Thus, good visuals are important for effective communication. This fact has also been recognized in design of modern software, for instance operating systems, programming environments, tools and application programs, where increased use of visuals can be seen. In addition, graphical design and visual interfaces are increasingly important as marketing arguments.

In existing systems, a number of graphical techniques and visual effects are used, for instance windowing, icons, visualized metaphors, and typography to mention a few of them. However, when studied from the communications point of view it can be shown that many problems still exist. Compared to how professional communicators, like graphical designers, use visuals, only part of the full potential of visualisation is utilized. A particularly promising technique for communicating information is lexivisual presentation, which aims at creating visuals that are easy to read and understand.

This paper discusses and gives some exemples of how lexivisual presentation techniques can improve various aspects of human-computer interaction.

Keywords: Human-computer interaction, communication, lexivisual presentation, graphical interfaces.

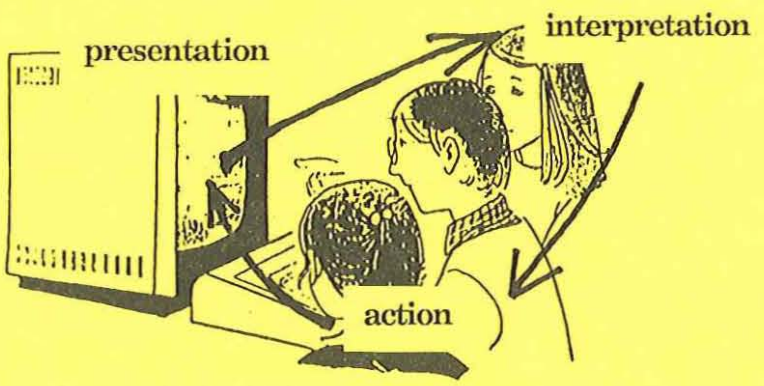
Visual communication and human-computer interaction

Human-computer interaction can be viewed from many different perspectives. In our work we stress a communication perspective where we view the interaction process as an exchange of messages between the user and the system. A good system should be communicative, which means that the user can interpret and use information in the system the intended way, that the user's intentions can be communicated to the system with ease, and that the user finds it stimulating and effective to work with the system.

A model of the human-computer communication process

Visual communication is essential, since both output from the system and input from the user are presented on the screen.

system's model ⟷ medium ⟷ user's model



Many problems in human computer interaction originates from bad communication between the system and its user. Communication problems can have several different causes. The most common are discrepancies between the model built into the system and the user's knowledge and experience, and bad communication of the model to the user due to poor visual design. Vague and confusing information, problems of orientation, misunderstandings, mistakes, and misinterpreted icons, are examples of problems related to visual design.

Much research effort is put into developing models of users in order to adapt the system's behavior to the user's actual level of knowledge and performance. A number of problems are being studied, such as how to model the user, and how to apply this knowledge to adapt the system's behavior. (Benyon et.al 1987, Morris 1987)

We have chosen an approach to improving human-computer interaction which focuses on the design of the system's model, and the communication of this model to the user. In order to avoid communication problems, different types of information need to be communicated to the user, among others

- the tasks that can be performed
- how to carry out various tasks
- how different tasks are related to each other
- the functions available at a certain stage
- the structure and content of data related to the application
- the status of the system - ongoing processes etc
- what help information is available

This paper is focused on the visual aspects of communication, i.e communication with text and pictures. Good visual design is essential, since both information from the system to the user and feedback in respond to the user's input, are presented on the display screen.

Although graphical interfaces are becoming increasingly popular, many systems still suffer from communication problems. One reason might be that a majority of existing systems, employ only a limited number of available communication techniques.

The communicative properties of interactive system can be improved by utilizing knowledge of professional communicators, like graphical designers, draughtsmen, publishers, authors, illusionists etc (Kindborg & Kollerbaur 1987). A particularly promising technique is called lexivisual presentation (Lidman & Lund 1972).

In the subsequent sections of this paper we will present the idea of lexivisual presentation and discuss its application to interface design. Furthermore, we will give examples of how systems might be improved using lexivisual techniques.

Lexivisual presentation

The importance of a close interplay between text and picture for effective presentation has been pointed out by Sven Lidman, who first described the idea of lexivisual presentation. Today, lexivisual presentation is widely applied for instance in newspapers, information material, school books, magazines, reference works, and at exhibitions (Bild och ord akademien et.al 1988).

A good lexivisual presentation should be a combination of text and pictures, balancing model and reality, suggestive and informative presentation. The presentation consists of various permutations of text graphics and pictures. In summary the most important principles for lexivisions are

- the presentation should have visual totality, each lexivision should be separate and self contained, giving the reader an overview
- the presentation should focus on the primary message, and it should give basic guidance for presentation of more detailed information
- the presentation should relate detailed information to its context
- the presentation should be based on text and picture interplay; the text is to bring forth the content of the picture, and the picture is to clarify the information presented in the text
- the presentation should be attractive and stimulating

A lexivisual presentation is supposed to be read as a picture. Opposite to the way we read a text, from the left to the right and from the top to the bottom, we start reading the picture as one entety. Then we focus details of interest in the picture. In a lexivision the main part of the information is often presented in the center, with references and explanations around it. Each detail in a lexivision carry a piece of information, a picture caption for instance, has to relate the picture to the whole, as well as introducing the picture itself. Alternative presentations of the same message, such as a photograph and a drawing, give a deeper understanding. Graphic symbols are used to relate the parts to the whole.

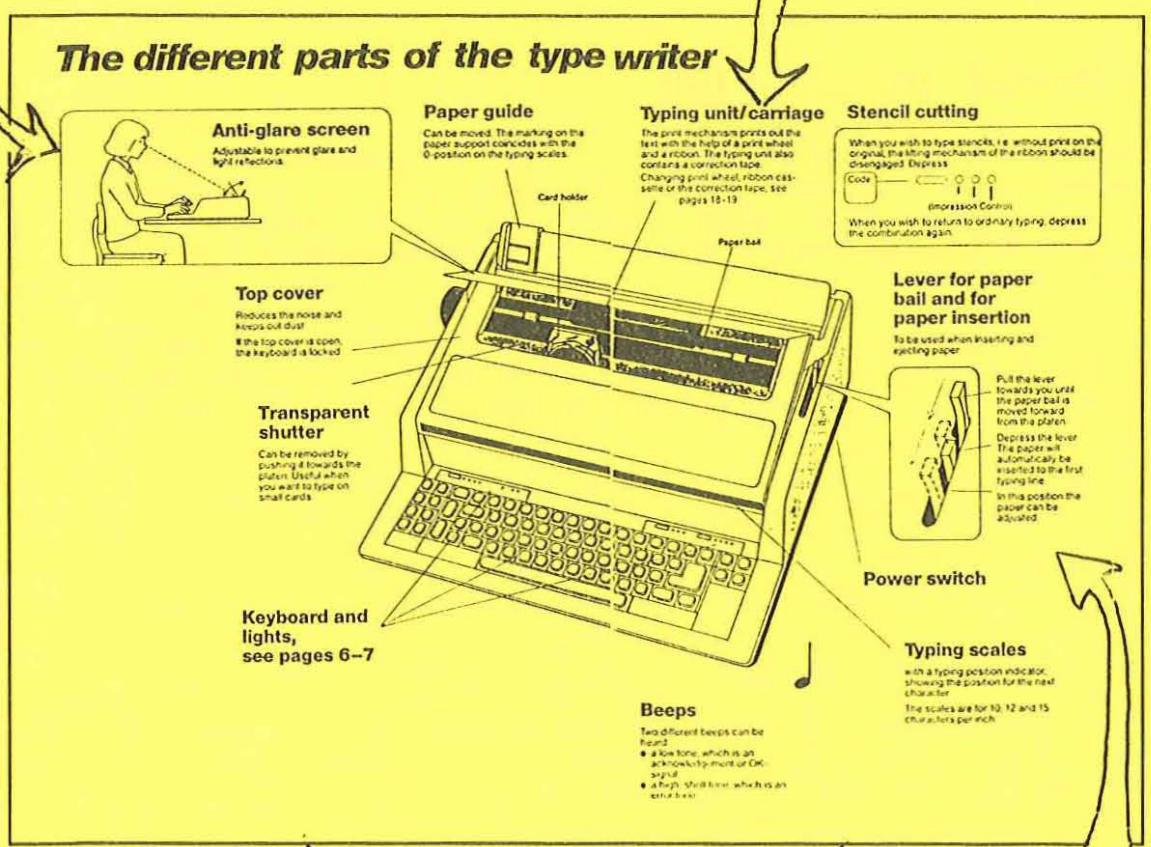
Lexivisiual presentations often cover a double page-spread. The space and format are important for clarity of the presentation. A double page-spread, is a natural unit when presenting information on paper, but lexivisions can be presented in other formats as well.

The tool box for presenting visuals consists of different types of pictures, text and graphic markers. Pictures can be of many different kinds – drawings, maps, diagrams, pictodiagrams, charts, strip cartoons, pictograms, photos etc. Captions, labels, headlines, introduction text and verbograms are the textual tools. Arrows, flags, bargraphs, tint boxes and panels, and color marking are the graphic markers.

Example of lexivisual presentation

Explanation in context. The text relates directly to a part in the picture.

The part that the reader needs information about is easily found



A blowup gives more detailed information

The lexivision is presented on a double spread page.

Implications of lexivisual presentation for human-computer interaction

We previously stated that the requirements for effective communicaton in printed media also apply to human-computer communication. Principles for how to select, structure, represent and layout information, can be employed in the design of interactive systems.

However, there are a number of differences between communication in printed material and computers, due to the characteristics of the computer based medium. The possibilities and the complexity are extended beyond the presentation of static information, since dynamic and reactive information also can be presented (Barker et.al 1987). In computer based systems we have two-way communication where the information can be changed, sent and received both by the user and the system. On the other hand certain restrictions on communicating information can be found. Limited screen format, limited graphics capacity, and restrictions in software are examples of limitations for presenting information.

When discussing which rules and techniques can be of interest for human-computer communication, we first want to state that many of the lexivisual rules and techniques can be identified in existing systems. However, their application seems neither systematical nor conscious. In our view all lexivisual rules and techniques can be applied, and would improve human-computer interaction. Some of them are however more obvious than others, which will be further discussed in subsequent sections. It should be pointed out that though we present the lexivisual principles under separate headings, they should be applied together to achieve the best effect.

Although this paper primarily discusses presentation techniques, the perhaps most important question in all communication is *what* to present. It is essential to decide which infomation is necessary and sufficient for a certain task. The presentation should not be overloaded with irrelevant and distracting information. At the same time, the user should not have to remember information which is known to the system. Furthermore, information should be presented in a form that does not have to be "translated" to be understood. An example of this is the WYSIWYG-principle.

Visual totality - overview and context

An important principle in lexivisual design is to communicate information as a whole. The presentation should be based on an overview and successively present and explain information in more detail. This is easier to achive in traditional media than in computer based media.

Computer based information is abstract, and it is difficult to perceive the wholeness directly. Furthermore, information is often fragmented due to the restricted screen space. These properties lead to loss of overview and orientation problems.

Therefore it is vitally important to find ways to communicate how the system is structured, which different parts and levels the system consists of, where you are and how you orient yourself around these different parts. Besides the functions of the system, it is also important to communicate the content and the structure of data in the system. Current research in the hypermedia field refers to this as the orientation problem (Conklin 1986). The more advanced and rich a system is, the more difficult to navigate and to identify different parts of the system. As an example consider a computer based encyclopedia.

In order to maintain a ***visual totality*** the subject should be limited to what can be presented in a convient layout. In our case we are limited to the screen presentation, and our different ways of expanding this area by the use of dynamic presentation techniques, such as windowing, scrolling techniques, and dynamic menus.

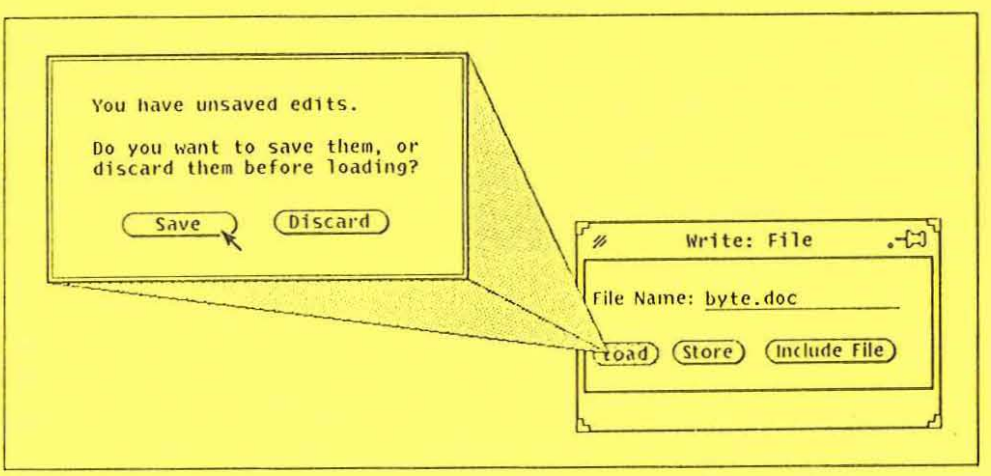
One form of visual entirety is the use of ***visualized metaphors*** such as the desktop in the Star system (Smith et.al 1982). Spreadsheet systems give another form of visual entirety based on a textual form called a verbogram – different forms of tables and lists for conveying information about metaphors.

Pull-down ***menus*** can be seen as a way of giving information about the available functions in the system. The user can browse through all the menus and get an overview of the tasks which can be performed. Graphic techniques, such as shading or reversed video gives further information to the user. One reason for not having menus on the screen continously is the limited presentation area. Pop-up menus solve the space problem since they do not crowd the screen with information, but they do not give a visual overview. On the other hand they are faster to use once they have been learned.

Lexivisual presentation rules say that ***relationships and comparisons*** should be immediately perceivable. Several techniques can be used to fulfill these requirements. Two of the most common are to show relationships with arrows, and to start with an overview and successively reveal additional detail, or vice versa (see the illustration below).

Visualization of detailed information

An arrow is used to show the context of the exploded dialog box, though in our view the arrow is a bit too dominant to be aesthetically pleasing. This example is taken from Open Look (Hoeber 1988), the recently announced visual interface for Unix.



Text and picture interplay

"In good lexivisual presentation reality should be seen through the picture and through the words it should be understood." (Lidman 1972, English abstract)

The text and picture should be presented in close connection to one another. The purpose of the text is to bring forth the informative content of the picture, while the picture clarifies the abstact information presented in the text. Text and picture should complement each other. A picture without text can be interpreted in a wide variety of ways (Petterson 1985, 1986). The text is needed to communicate the intended interpretation unambigously.

In interactive systems, pictures are widely used in the form of ***icons***. Icons for representing functions and objects were first introduced in the Dynabook system (Goldberg et.al 1977), and were further developed in the Star system (Smith et. al 1982).

In the Star system icons are presented with text, which makes interpretation easier. If icons are presented without text, the user usually has to learn the correct interpretation (Lodding 1983).

Icons without text can be difficult to interpret

(We leave it to the reader to figure out the possible interpretations of these icons from Microsoft Word.)

Furthermore, the text should be easy to read. In graphical design there are a number of typographical rules, for instance

- on paper, some fonts are regarded as easier to read than others, for instance serif fonts are easier to read than sans-serif fonts
- lowercase letters are easier to read than uppercase letters
- the use of different fonts in the same lexivision can improve communication, but too many fonts can cause distraction

Layout

"The presentation should not be crowded. The layout should be visually striking but at the same time logical, both arrangement- and readingwise". (Lidman 1972, English abstract)

Layout is an important factor for creating presentations that are clear and pleasing to the eye. Attractive presentations will have a motivating and positive effect on the user. However, the presentation should not become obstructive and annoying. The presentation should stimulate, not distract.

Many systems can be criticized for poor layout. Traditional and historical reasons has often led to designs where information is meant to be read sequentially, as in traditionally designed printed material. In some modern systems however, the presentation uses a more lexivisual layout, with important information focused at the center of the screen.

The ***limited screen space*** enforces more or less "crowded" designs. This has partly been improved by the use of windows and different interaction techniques. However, the use of these techniques introduces new problems. Overlapping windows, dialog boxes and windows with help information, can result in crowded, messy screens. In many systems information is fragmented, giving a lack of overview. Techniques for relating information could improve design on small screens. One suggestion is to relate windows by using different shades of color (Reichmann 1986). Obviously, lexivisual techniques, such as arrows and layout, could also be employed.

Reactive and dynamic information

As stated above, the reactive and dynamic nature of computerized media distinguishes it from traditional static media. Even films and videos are static in a sense, since the sequence presented is unchangeable. One can not interact with a movie. Since lexivisual presentation is designed for static media, an additional set of communication techniques and principles are needed when designing interactive systems.

Information in an interactive system is changed as a result of the two-way communication between the user and the system. Like in a theatre play actors appear, communicate,

process messages, and vanish. This dynamic communication situation leads to special problems in presenting information, for instance when, where, and for how long a message should be presented, and by which actor. Some information should be presented by system, and some information should be sent by the user.

Feedback becomes particularly important when manipulating information interactively, in order to inform the user of what is happening. Arcade games are often mentioned as good examples of interface design (Shneiderman 1983). In most arcade games the players receive continuous visual feedback, informing the user of the state of the system. Objects in these games are sometimes animated using comic strip techniques such as speed lines, which further enhances the presentation.

An additionally important area concerns ***status information***, communicating changes in the system's state. Switching context or changing mode should be clearly communicated, for instance using different shades of color for window borders etc.

System processes can be particularly hard to understand, especially if they are invisible to the user. It is important to show, not only *what* the result of for instance a search operation is, but also *how* the process works and proceeds. If a process is time consuming, such as a search, a copy, or a save operation, it becomes even more important to show what is going on.

Thus, techniques for ***process visualization*** should be used. To visualize for instance a compile-link process, comic strip techniques could be employed. Each frame in the strip shows a state in the process. During execution, the frame which represents the current state can be illuminated to illustrate, what is happening. In this way the user can achive an overview of what the system is doing. A similar technique has been employed, animating graphs to show the dynamic behavior of programs (Böcker et.al 1986). Another commonly employed visualization technique is to shift the shape of the cursor during time consuming tasks. Typical symbols are an hour glass or a watch.

Examples of lexivisual interface design

In the following section we will present a couple of examples that show the practice of some of the techniques and principles inherent in lexivisual presentation.

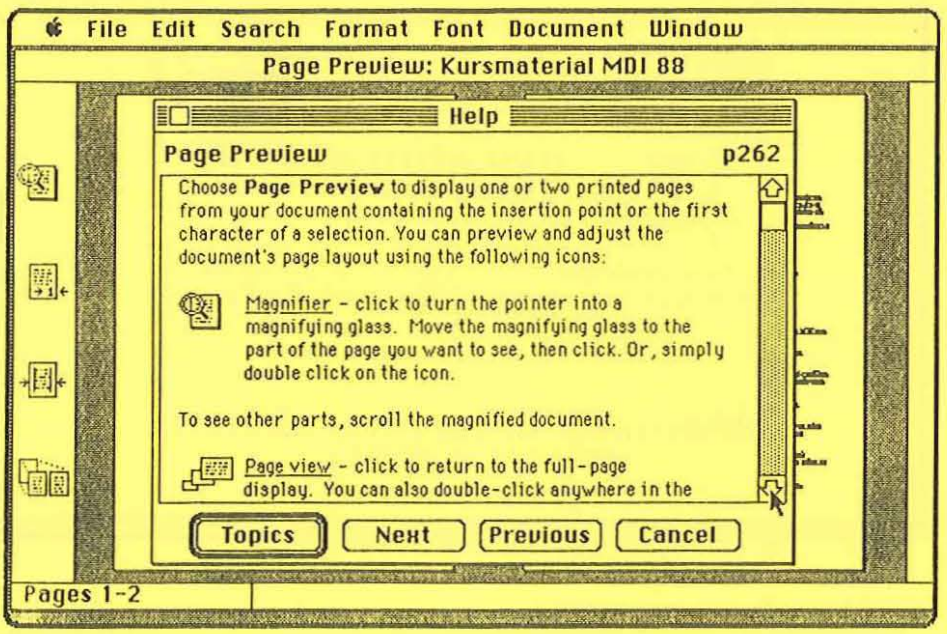
The examples are all from the word processing program Microsoft Word 3.01 (Microsoft 1987). In analyzing Word, we found that the lexivisual principles were often violated. By applying lexivisual rules and techniques we have designed some alternative solutions. These particular designs are not yet empirically verified, but previous research in this direction has been conducted (Kollerbaur et.al 1988). Our suggestions have to be further discussed, developed and evaluated. However, we believe it is important to give examples which shows how lexivisual thinking can be applied.

We have not made any *major* redesigns, neither of the basic Macintosh interface, nor of the Word-system. Obviously, in some cases the screen becomes crowded with information. Since large screens are not common yet, we have chosen to show the examples on a smaller screen.

Lexivisual principles applied to a full extent, using spacious layout and other techniques, would probably lead to designs different than the ones presented here, specially if using a large two-page sized screen.

Presenting information in context

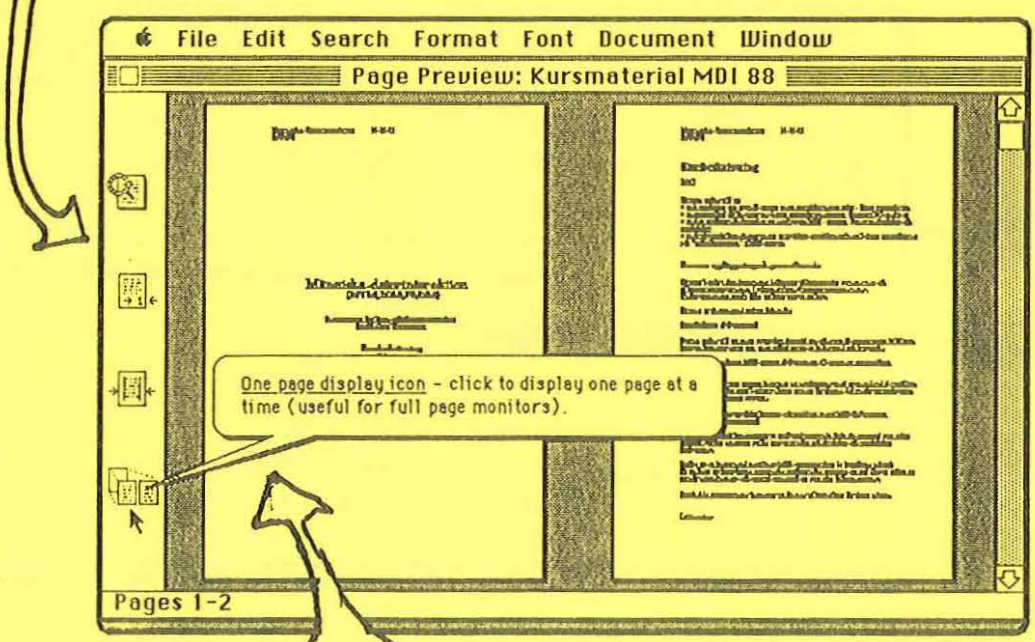
Old Look



This is the original design of context sensitive help in Microsoft Word. The help text is presented in isolation, which makes it difficult to relate the help information to the part of the system which it describes. Furthermore, when invoking the help, one is restricted to reading the help text. The user has to remember the text when switching back to edit mode.

New Look

The user can choose relevant information directly, by pointing at the icon of interest.



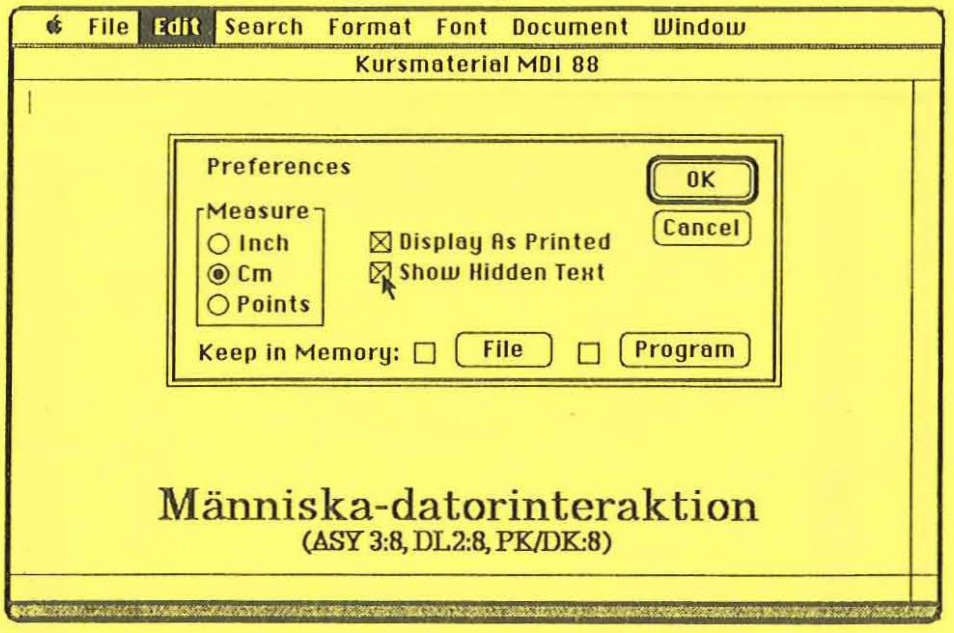
It is possible to read the text and work with the system simultaneously.

The pointer of the balloon relates the help information to the icon it describes. The balloon discriminates the help text from other types of messages.

Giving overview of functions

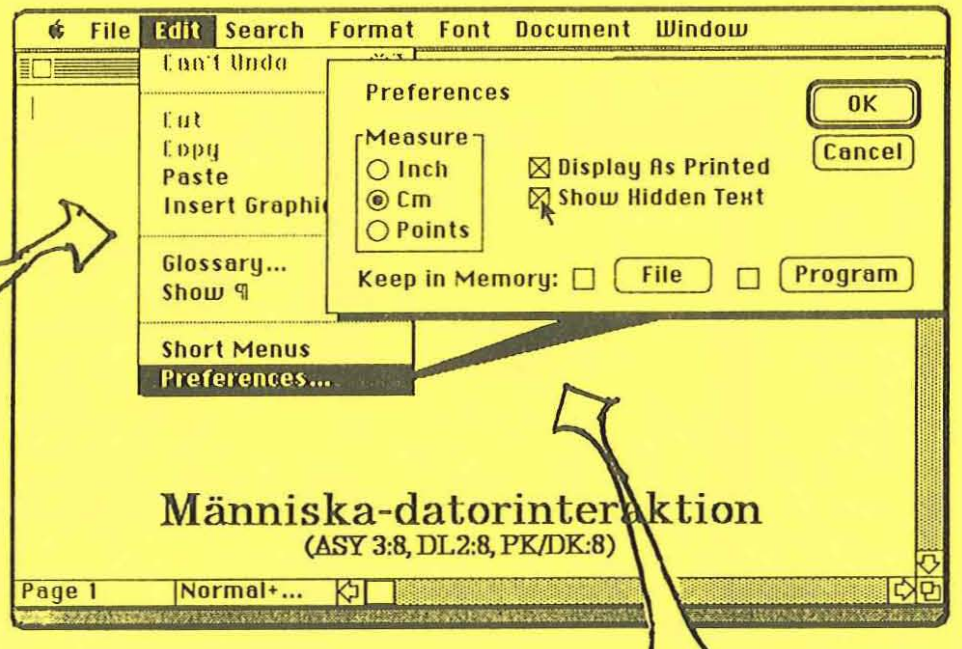
Old Look

It is vaguely indicated only, in which funcitional context the dialog box appear.



New Look

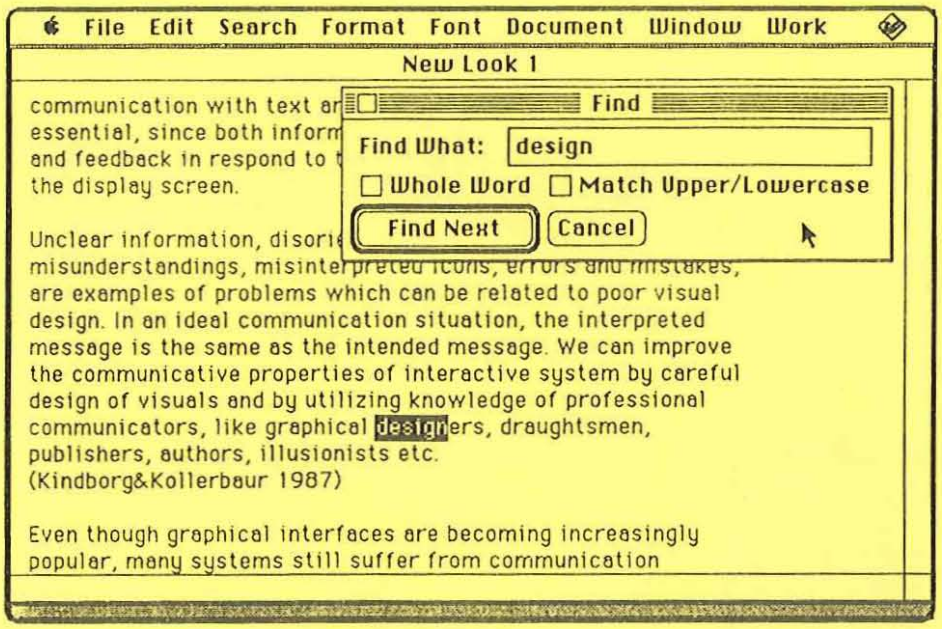
It is easy to see which menu item was selected, and it is easy to see which other menu alternatives are available.



The zoom-arrow visualizes the context in which the dialog box appear.

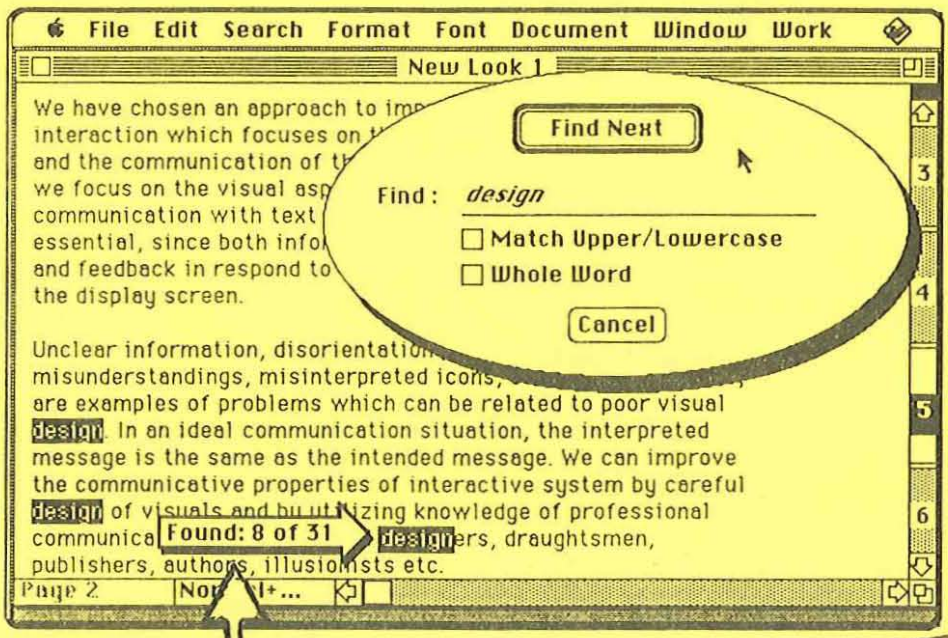
Giving overview of data

Old Look



It is not shown where in the document the search currently is. You do not know how much is already searched, nor how much of the document is left to search through.

New Look



By giving the entire dialog box a specific look, it can be easily distinguished from other types of boxes and windows.

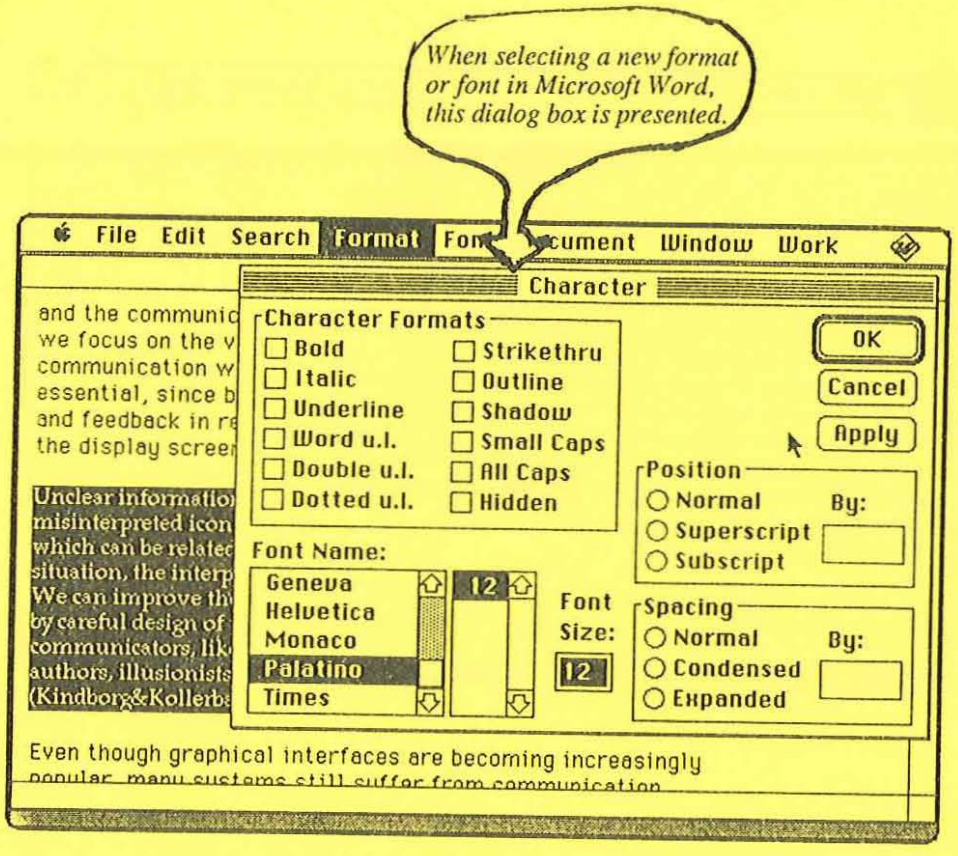
Information is given about total number of instances of the search string in the document.

Note how the scroll bar is redesigned to communicate which page and which part of the page, one currently is viewing. We have applied the lexivisual principles of relating detailed information to its context, and giving an overview.

Presenting detailed information

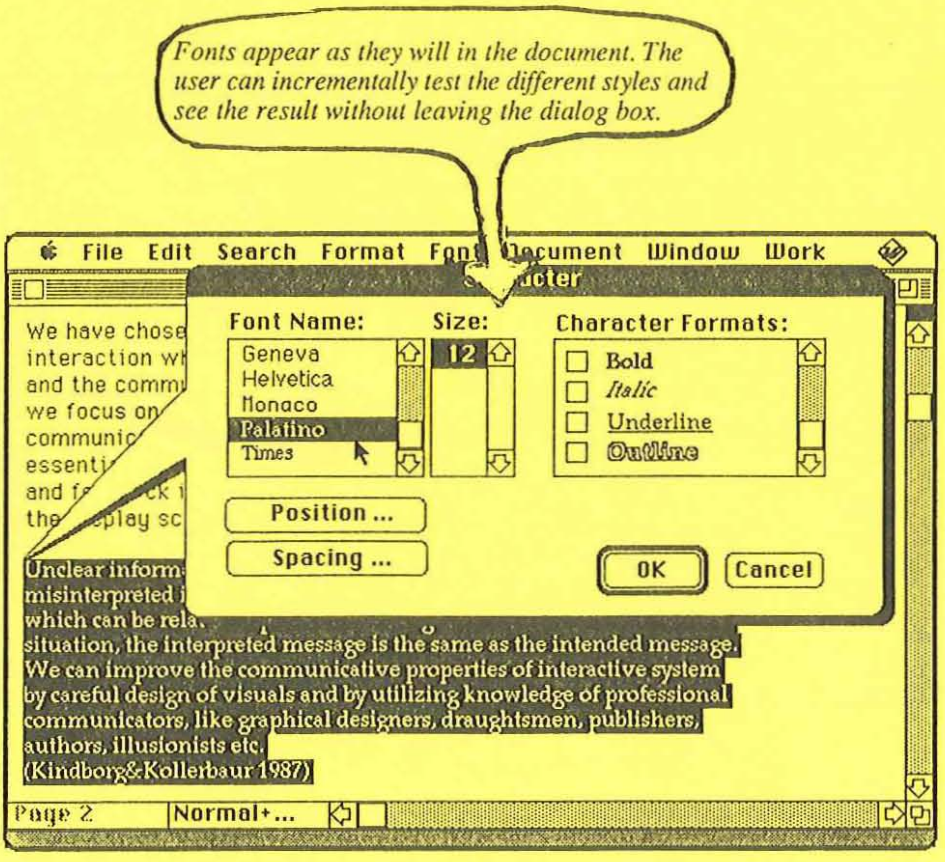
Old Look

When filling out the formula the editing of the document is disabled. The user has to remember or try out what the different types of formats and fonts would look like.



New Look

This presentation would be more communicative and follows the WYSIWYG-principle.



Towards a general application of lexivision to human-computer interface design

There are many similarities between the development and the use of text and pictures in computer systems and in other information communication areas. From being regarded as something other than totally serious, the use of visuals is now regarded as a necessity for effective communication.

A continued and increased development of knowledge and application of visuals can also be foreseen. Up to now most applications are related to personal computers and personal tools of different kinds. The investigation of the use of visuals in more traditional application areas is in its very early stages. One reason might be the limited availibity of graphics terminals. However, many lexivisual rules and techniques can be used on semigraphics terminals.

But even if we can see many prospects in the use of visuals, there are of course a number of pitfalls. Consider what happened when desktop publishing gave us tools for production of printed materials. A kind of "Las Vegas" effect occurred when people untrained in graphic design used as many of the available functions as possible in a document; fonts, graphics etc. Increased availibility of interface design tools can lead to a similar development in the design of visual interfaces. This can be seen in the use of icons, and in some systems developed with HyperCard.

One way of improving the design of visuals could be to create hand books, or even better - computer based tools. The problem, as we have tried to illustrate it, is that there are no standard rules for designing good visuals. In some cases more concrete guidelines can be developed, but mostly design is a more "open" task. Many solutions could be satisfactory, and it can difficult to find the ulitmate visual for a certain communication task. The conclusion has to be that design of visuals is both an art and a more formal process. This view of design of human-computer interfaces has also been expressed by Heckel (1984).

Good visuals implies certain requirements on the production process. Production of lexivisions in printed material is a creative, iterative work and a result of a team work between experts in their specialized fields, visualizers and editors. Examples of successfull lexivisions, fantasy, the tossing of ideas between members in the team, are important characteristics of the process. The process starts with sketches of the visual totality and the pictures, and ends with writing the texts.

We claim that a similiar process is needed in order to produce good visuals for computer systems. The design has to be be iterative with successive refinements of prototypes. Revisions of prototypes are based on results from evaluations. The ideal design team should include users, computer and systems experts, human factors people, domain experts, computer graphics people and experts on communication and media. Of course the role of a team member will vary at different stages of the design.

Finally, we have to stress the need for further research about usability and the effects of the use of visual presentation in computer systems. A number of continued studies of the lexivisual approach will be performed in CLEA as part of our investigations of how to improve the communicative aspects in human-computer interaction (Kollerbaur et.al 1988). An important part of that research is to develop methods for evaluation of human-computer interfaces.

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