INTERFACE DESIGN ASPECTS OF AN INTERACTIVE ATLAS

Robert SAUL
University of Vienna, Department of Geography and Regional Research
Universitaetsstrasse 7, A-1010 Vienna, Austria – email: saul@atlas.gis.univie.ac.at

Karel KRIZ
University of Vienna, Department of Geography and Regional Research
Universitaetsstrasse 7, A-1010 Vienna, Austria – email: kriz@atlas.gis.univie.ac.at

Andreas RIEDL
University of Vienna, Department of Geography and Regional Research
Universitaetsstrasse 7, A-1010 Vienna, Austria – email: riedl@atlas.gis.univie.ac.at

Peter JORDAN
Austrian Institute of East and Southeast European Studies
Josefsplatz 6, A-1010 Vienna, Austria – email: peter.jordan@osi.ac.at

Florian PARTL
Austrian Institute of East and Southeast European Studies
Josefsplatz 6, A-1010 Vienna, Austria – email: florian.partl@osi.ac.at

ABSTRACT

In the course of a project at the University of Vienna in co-operation with the Austrian Institute of East and Southeast European Studies, a prototype of a multinational interactive Internet-Atlas is being developed (project name: AtOS). Conceptual and graphical design of an interface as meeting point of man and computer plays an important role within this project. This report gives an overview of the general tasks and styling rules of a user interface and treats important conceptual aspects of interface design within an interactive atlas.

1. INTRODUCTION

The design of a user interface is of great importance to the process of the development of an interactive cartographic application. The role of an interface as a visual "communication centre" is to allow the user access to digital data; the most important point being, how spatial and thematic data are presented to the user. Various measures concerning design and concept can help to optimise the function of the interface and the provision of knowledge connected with it. It is important to realise that the user perceives the interface not only as far as its functions are concerned but also aesthetically [Sch98]. Satisfied users can only be guaranteed by optimising the fusion of contents and presentation acceptance of the product in the net.

The most important tasks of an interface include the distinct and transparent presentation of digital data, the intuitive design of tools and the possibility of interaction with the user. Various conceptual factors are indispensable for the implementation of these tasks; especially the planning of the overall structure of the contents and of the interactivity of the product has to be pointed out. Besides these conceptual thoughts, also the graphical design influences the handling of the interface. The design and use of colours, script and graphical signs are only some of the factors affecting the composition as a whole and the acceptance of the interface.

The concept of the interface for AtOS was developed in consideration of the general tasks and aspects of interface design and thus is another stepping stone on the way to an efficient user interface for an interactive atlas.

General tasks of a user interface
In this chapter the essential tasks of a user interface are treated. The visualisation of digital information as well as the provision and design of tools are the most important targets of an interface. Suitable measures and propositions for the implementation of these tasks will give an overview of the function of an interface within an interactive cartographic application. Together with a theoretical design model (mental model – conceptual model), these tasks are the basis for an efficient interface design.

Aspects of interface design
Within the broad spectrum of design possibilities, two distinct fields can be distinguished. The first field comprises conceptual factors concerning the systematic set-up of the interface. In three phases the planning of the overall structure, contents, and interactive behaviour have to be defined; the scheme of procedure developed in this process forms the theoretical basis of the interface. The second field includes design aspects, which have an important influence on the perception and the handling of the interface. Apart from the general design principles visual balance and image perception, the use of colour, script, and icons are of importance.

2. GENERAL TASKS OF A USER INTERFACE

As meeting point of user and computer, the interface's task is the visualisation of spatial information on the one hand, and the provision of functions and tools for user interaction with the digital data on the other hand. The user should be enabled to visualise the stored information in different ways, and to change it or filter it according to diverse criteria. Thus, the user has to be able to convert the elements of the interface into clear structures. It is the task of the interface designer to "translate" the meaning of contents and functions into distinct formal signs.

The development of an interface is an iterative process concentrating on those elements and objects the user consciously perceives and uses [Man97]. Thus, the design of the interface is closely connected to the definition of the user group. The interface does not stand on its own, but is designed for a special task and for a special target group. What follows is that the developer's ideas have to be adjusted to the user's demands. Ideally, the mental model of the user is identical with the conceptual model of the developer. Correspondence of these two models can be achieved by an intelligible description, expressive illustrations and consistent presentation [Sch98].

Schulz and Andleigh define the most important tasks of a user interface as follows [Sch98, And96]:

- The interface has to give access to digitally stored knowledge and represent it in an optically distinct way.
- The structure of a user interface has to be simple and logical, and the tools for the user have to be designed intuitively.
- The interface has to allow user interaction and processing, which are represented visually by the relevant functions.
- The user should be supported in his/her actions and guided in his/her attention.
- With its visual language, the interface should elucidate hierarchical structures and guarantee the user's orientation and general view.

The realisation of these tasks of a user interface requires different measures and considerations. Thus, every effort should be made to dissolve the complexity of an interface and give the tools a transparent design.

Reduction of complexity
On the man-computer interface single tools correlate with each other. Forms and colours influence each other and have an effect on the user's perception. The resulting complexity can be further increased by different functions of the single elements. Thus, a central concern of

interface design is the reduction of the complexity of interactions to create transparency for the user. The following measures can help to reduce the complexity of a user interface:

- taking the user's foreknowledge into account
- using familiar presentations
- presentation of information in segments

Transparent presentation

A transparent interface stands out for the reduction of necessity of interpretation, the facilitation of visual perception as well as simple handling and functioning of the application. To ensure clear differentiation, it is especially important that the design and position of the visual elements (tools, contents, decoration) support their function.

3. ASPECTS OF INTERFACE DESIGN

As far as the design of the interface is concerned, conceptual and design factors have to be kept in mind. The conceptual structure can be subdivided into the following planning steps that should help create the interface's general conceptual structure. The planning steps include considerations of the interface's overall structure, its contents and its interactive behaviour.

Apart from these conceptual aspects, design factors play an important role. The interface's usefulness and acceptance is not only determined by its technical and conceptual realisation, but even more so by the design of the single elements. The use of colours, typography, icons, and pictures is an important design aspect that has strong influence on the interface's usefulness and transparency.

3.1 Conceptual aspects

Planning the overall structure
The first step is the definition of the target and of the user group as well as the purpose of the application. The definition of the user group is especially important, because the design of the interface has to meet the user's needs and wishes. According to these fundamental considerations, the overall structure of the application can be planned. This means for an internet-based application that the number of layers needed and their hierarchical structure have to be perceived. A possible configuration could be therefore defined as follows: starting site (welcome) – selection site (selection of the theme) – main site (interface as such) – other sites.

Planning the contents
In the next step, the defined sites have to be allocated. The main elements of the application, which constitute the overall design, are derived from the structure of the contents. The major elements of a cartographic interface are: main map, overview map, legend as well as spatial and thematic navigation. In a first step it is important to decide which elements will be shown on the screen permanently and which can be activated or opened temporarily. In that context, the construction of a storyboard is a possibility of showing the elements' relations and their presence on the screen. Furthermore, variables like size and position can be defined.

Planning the interactive behaviour
The number of functions characterises the interactive behaviour of an application. The way that the functions are presented determines the way they are called. In the course of the development of graphical user interfaces, different styles of interaction, that allow the user to intervene in the application, have been developed. For cartographic applications, direct manipulation is the most important form of interaction; special features are single-stage mode, reversibility as well as fast practicability of the functions and actions. The interactions are visualised with the help of tools like buttons, icons, scrollbars, menus, and windows.

Especially as far as the design of icons is concerned, real-world objects that are recognisable for the user and thus simplify the handling of the application should be used. These elements interact with other elements and entities on the screen and thus influence the perception reciprocally [Sch98]. Functions with logical connections should therefore be presented in groups, so that their interrelation becomes clear from their presentation.

3.2 Design aspects

Visual balance
The visual balance of an interface refers to the overall layout, and especially the proportions of the elements' sizes and colours. In a cartographic interface, the main map – according to its importance - should occupy most of the space. Together with the other cartographic elements like title, legend, overview map, scale, and navigation tools, the elements have to be brought into well-balanced proportions by the designer.

Two different possibilities are available for the arrangement of a balanced design:
- Dark, expressive colours and shades have strong visual weight.
- The section of the main map should be as large as possible; at the same time the accumulation of other elements on the surface should be avoided.

Perception of pictures and text
The use of graphic representations has it pros and cons. Since pictures are perceived comprehensively, they can be recognised and interpreted more quickly than writing, which is perceived in a linear way. It has to be pointed out, however, that pictures can very well be ambiguous or even meaningless. Text can make pictures plain just as well as pictures can illustrate or describe text. Pictures with purely decorative function are superfluous and should thus be avoided.

Contrast (figure-ground problem)
The visual distinction of objects in the foreground and those in the background is an important aspect of graphical design. A textured, coloured background can have bad influence on the perception of the figures depicted. A patterned background also conveys restlessness and prevents shaping. Since the user tries to interpret every sign on the screen (i.e. also the pattern of the background), decorative backgrounds should be avoided.

Presentation of tools
The degree of the visual presence of tools can be changed with their colour, size and consistent location. In general, visibility simplifies the handling of an application. In some cases, tools are blended out and disappear under the surface of the application. This is only the case when the visual place of presentation (overall layout) is used for the display of contents in an optimised way. To avoid making the user a “seeker”, invisible elements have to be located carefully. Using buttons and icons is one possibility of activating and incorporating invisible elements.

Influence of colours
The use of colours allows the interface designer to animate presentations and to influence information in a qualitative and quantitative way. It is important to assign the colours to the elements according to their context – the perception of the general view can only be improved with a balanced interplay of colours.

Use of colours in interface design:
- as guideline for orientation
- to highlight information

- to direct the attention
- complex information can be structured and visualised vividly
- accentuate differences and facilitate readability

Typography and readability
The typographic design influences the readability of text. Mixing different types and sizes of script can lead to a reduction of the user's attention and a slowing down of the uptake of information. To avoid optical restlessness, it is advisable to use different types and styles of script sparingly. In front of patterned backgrounds, scripts without serifs can be favourable; otherwise scripts with serifs support good readability.

Icons
Icons are not a priori understandable better than textual signs; most importantly, the function of icons is that of reminding. The use of icons in an interface does not automatically include easier handling – the icon's design is therefore a crucial factor. Icons can appear "right" in articulation and are interpretable by the user only when there is a reference object in the real world that can be depicted graphically. The user interprets the significance of an icon according to its direct and indirect factual context. Icons with text-labels are either redundant (they depict the function pictorially) or decorative (the user can not connect the contents to the function). The use of decorative icons should be avoided.

Aesthetics and style
From an artistic point of view, a new component in interface design – one that influences the user considerably – is exposed: aesthetics. More often than not, visual elements impart more information than through their pragmatic function only. The aesthetic quality of an interface is always – consciously or unconsciously – perceived by the user.

Elements belonging together thematically and their behaviour have to be used consistently throughout the whole application. It could be said that several elements of expression, organised homogeneously, make up a total that is perceived by the user as style. This is achieved by a homogeneous layout, distinct terminology, and the use of script and colour. Each style in combination with the functions influences the user in a positive or negative way.

Style fulfils two criteria:
- homogeneous and general design principles
- adequacy of the design for the task and target group

Finally it has to be mentioned that an interface can reveal different patterns of social, cultural or personal origin the user can identify with.

4. CONCLUSION

The user interface, a "meeting point" of man and computer is an essential part of an interactive cartographic application. The nature and characteristics of interface design can help impart knowledge, support the user's understanding, and facilitate handling. Keeping conceptual and design solutions in mind can help develop efficient user interfaces for cartographic applications.

5. REFERENCES

[And96] ANDLEIGH, Prabhat K., THAKRAR K. (1996). Multimedia Systems Design. Prentice Hall PTR, New Jersey.

[Man97] MANDEL, Theo (1997). The elements of user interface design. John Wiley & Sons, USA.

[Sch98] SCHULZ, Angelika (1998). Interfacedesign: die visuelle Gestaltung interaktiver Computeranwendungen. Röhrig Universitätsverlag, St. Ingbert.

[Shn93] SHNEIDERMAN, Ben. (1993). Designing the User Interface: strategies for effective human-computer interaction. Addison-Wesley, USA.

[Ste99] STEINMETZ, Ralf (1999). Multimedia-Technologie: Grundlagen, Komponenten und Systeme. Springer-Verlag Berlin, Heidelberg, New York.

[Naj92] NAJJAR, L.J. (1992). Multimedia user interface design guidelines (IBM TR52.0046). Atlanta, GA: IBM Corporation. http://mime1.marc.gatech.edu/mime/papers/multiTR.html

WWW

http://www.cs.concordia.ca/certificate/index.shtml.

http://cassini.geog.fu-berlin.de/~ameissner/diplom/text/gui.html

http://www.fes.uwaterloo.ca/crs/geog165/mapdesign.htm