7 ATLAS GUI AND LAYOUT DESIGN

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7.1 INTRODUCTION

The Graphical User Interface (GUI) of an atlas system is the exclusive link between the user and the atlas content. Maps, numerical data, multimedia information (e.g., text, graphics, photos, sound and videos), links, and interactions are only accessible by means of a single flat surface with limited screen space. Commands, data and actions of the computer are graphically represented and can be manipulated by means of tools.

Thus, it is of great importance to consider decisions for the atlas GUI from the very beginning of the project, and also to design the atlas GUI very carefully.

This chapter clarifies the terms, means and concepts, and describes the GUI design process and its elements. Finally, it should be possible for atlas authors to recognize the main design phases, and to extract relevant issues for their own atlas project. Since the general understanding of creating a GUI is based on User Centered Design (UCD; see Chapters 3 and 10), we will focus here more on functional GUI aspects, commonly termed as Interaction Design (IxD).

Why to use a GUI

A GUI is an essential part of every interactive atlas. In comparison to a Command Line Interface (CLI), a GUI offers several advantages for atlas designers and users. A GUI procures an intuitive approach and a high learning curve by using a well designed but limited number/set of options. Novice users get quickly acquainted with the content and the basic functionality of the atlas, while more experienced users can access dedicated, sophisticated functions. Atlas designers have full control over the application, meaning that they can steer and define the general degree of interactivity or even of different parts of it. Thereby, they intend to guide the users unconsciously in order to prevent them from nonsense maps, and additionally offer ways of exploring the atlas and its maps.

From a visual-graphical perspective, the GUI communicates not only the spirit of the brand, but also the look & feel of the application, inviting the user to explore the atlas content. Moreover, it serves as a unifying reference frame for the different spatial and thematic issues of an atlas, thus easing visualization, information retrieval and analysis tasks.

When using a GUI, also some disadvantages have to be taken into account. Normally, a GUI needs considerable system resources, and the speed of user operations is limited which might be suboptimal for very experienced users. But the advantages of a flexible, well-designed GUI override these technical limitations by far.

7.2 PLANNING AN ATLAS GUI: GENERAL PRINCIPLES AND CONCEPTS FOR GUI DESIGN

To realize an atlas GUI is a rather sophisticated and challenging task, involving not only atlas authors but also IT and Web specialists, and graphic designers. Therefore, it is highly recommended to follow a focused and well-structured approach. But first of all, you have to know some basic elements of user interaction.

Principles of Interaction Design:
- Knowing your user
- Matching between system and the real world
- Making explicit the system internal state
- Preserving consistencies
- Following standards
- Error prevention, detection and recovery
- Minimizing the cognitive load on users
- Balancing user control and freedom
- Ensuring overall flexibility and efficiency of use
- Optimizing the number of functions
- Minimizing mouse tracks and clicks
- Designing an aesthetic and minimalistic GUI

Principles of Interaction Design

When planning and designing an atlas GUI, some general principles of User Centered Design (UCD) and Interaction Design (IxD) should be kept in mind. While UCD is stressing the interaction process between the user and the product interface, IxD is mainly concentrated on the graphical design and implementation of the GUI into an application.

These principles, mentioned by almost every famous designer [Tufte 2001], [Nielsen 1993, 1995], [Shneiderman 1998], can be summarized as follows:

- *Knowing your user:* The best-known principle of UCD plays also an important role in IxD. In order to realize a tailor-made product for the target group, the user preferences and behaviors have to be known or assumed. This is an ongoing process; therefore, the atlas system should allow continuous contact to users before, during, and after the project.
- *Matching between system and the real world:* The system should speak the users' language (alerts, etc.). Technical expressions and procedures – except of common one's – should be avoided.
- *Making explicit the system internal state:* The system should always keep users informed about internal processes influencing the external user actions and the system performance.
- *Preserving consistencies:* Different wording, situations, or actions for the same thing should be avoided. Consistencies to be preserved in a GUI are related to: labeling, terminology, graphic conventions, GUI components, and layout.
- *Following standards:* The application should use standards and guidelines for interactions, abbreviations, and terminology. Standards are essential for cross-application consistency and effective implementation. They ensure professional quality and quick recognition while reducing the design effort.
- *Error prevention, detection and recovery:* The system should be tested under different conditions and with different user groups to prevent errors. However, if an error occurs, it should be able to precisely indicate the problem, and constructively suggest a solution.
- *Minimizing the cognitive load on users:* People are able to focus attention for a limited amount of time and information only. Thus, the GUI should provide informative feedback, memory aids, self-explaining icons and other cognitive supports. Recognition suits better than recall: important GUI objects, actions, and options should always be visible.
- *Balancing user control and freedom:* The GUI should give the user as much freedom as needed, and also some guidance. It is important that users can navigate at ease, but they shouldn't get lost in space. Concerning thematic issues, they should be e.g., able to combine different thematic in-

formation by selecting from a list of appropriate layers.

- *Ensuring overall flexibility and efficiency of use:* The interface should contain customizable elements. Customization in an atlas GUI can allow users to tailor frequent actions by means of shortcuts or preferences. For people with disabilities, barrier-free flexibility incorporates also to scale up the lettering/labels, or to change misleading color schemata. The application should also provide mechanisms to reverse performed actions. This allows users to freely explore the GUI, the functionality and the content, relieving them from the anxiety of being trapped in an unrecoverable mistake. Flexibility consists also in providing different usage modes for different classes of users. Novices could use wizards or other simplified means for an easy interaction, while experienced users can profit of some shortcuts.
- *Optimizing the number of functions:* Functional minimalism is a must for atlases; generally, users are overwhelmed and overcharged with too many functions. Since they use the application occasionally from time to time, they often apply only basic functionality. In every complex, sophisticated application like an atlas, only 20% of the functionality is used 80% of the time. Optimization can be achieved by functional layering. Thus, the functions most used should be placed on top of the GUI, while expert functionality can be put on a secondary level.
- *Minimizing mouse tracks and clicks:* It seems to be obvious that the mouse track length should be kept as short as possible. This corresponds to Fitts' law of proximity [Fitts 1954], where the time to click an object is proportional to the distance and inversely proportional to the object size. In addition, the number of clicks should also be kept small in order to provide a barrier-free information access.
- *Designing an aesthetic and minimalistic GUI:* Graphical GUI design is most important for a successful application. While from a developer's perspective, functionality and technical design are the two main domains to focus on. But from a user's view, a slim designed GUI avoiding distracting effects is the optimal solution. To reach this goal, a simple advice can be given: Consult and/or engage an (interaction) designer!

These principles address *information access strategies* as well as the technical and graphical design of an atlas GUI. Thus, both key strategies and the steps of GUI design are discussed in the following.

Information Access Strategies for Atlases

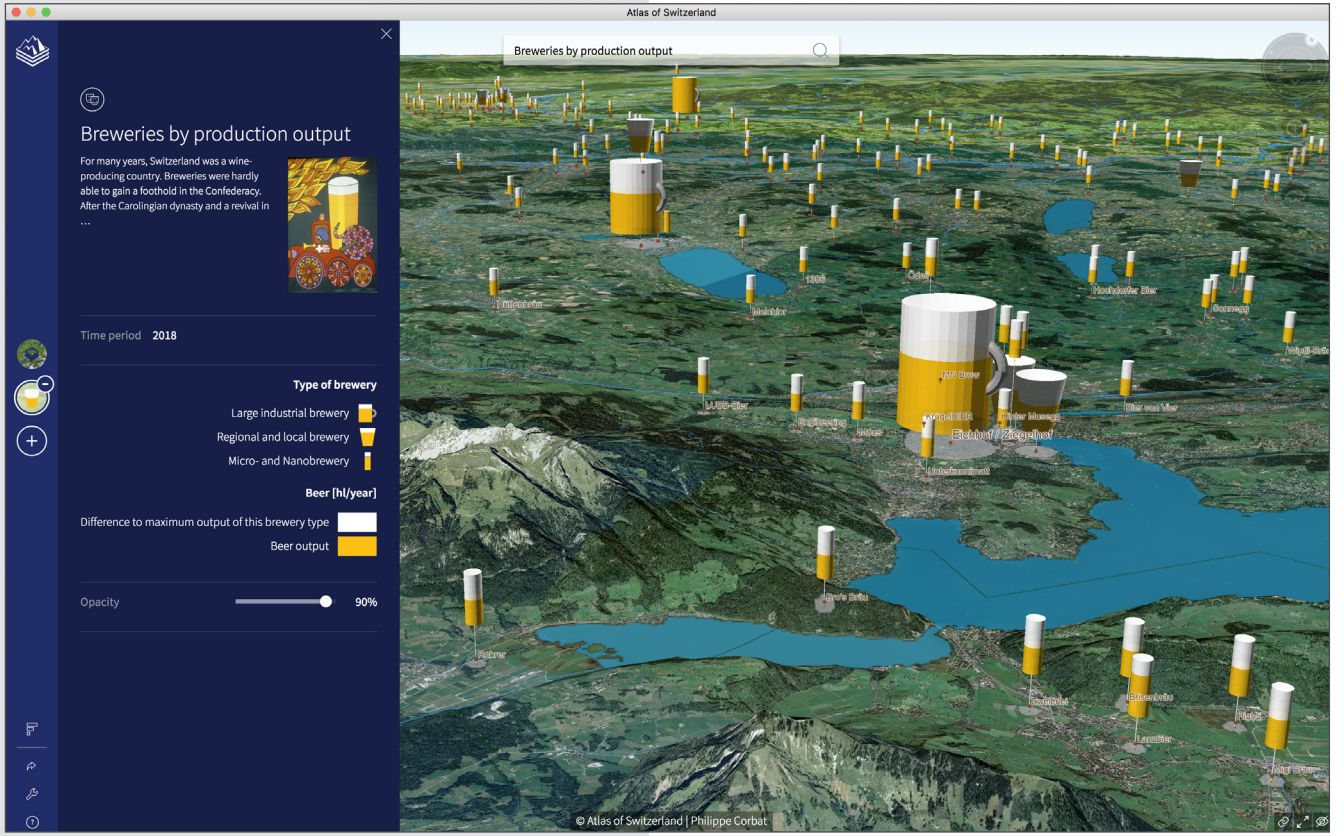
Before starting the design process, it is very important to reflect the way to get to the relevant and variegated information in the atlas. In fact, there are many ways; thus, the atlas authors should be aware of the different possibilities.

In terms of i*nformation accessibility*, the information is either a) directly presented to the user, or b) the user has to play an active role and search for the information. In our opinion, a mixture of passive and active information access is the best solution.

To start and get acquainted with an atlas, the user will mostly prefer a passive role, where maps are presented immediately. In this context, the incorporation of *Narratives or Storytelling* [Caquard & Cartwright 2014] are well suited concepts. We can also make use of Metaphors (book, story, globe, travel, time, toy, workplace), different kinds of *Thematic access* (menu, search, index), and *Spatio-temporal* access (spatial units, coordinates, index, map extent; time stamps or periods).

FIGURE 7-1:

INFORMATION ACCESSIBILITY: BEER BREWERY MAP AS A DOOR OPENER FOR ECONOMIC THEMES [ATLAS OF SWITZERLAND – ONLINE 2018].



We can also implement a *Contextual* access for map-related information as e.g. Multimedia elements (text, pictures, sound, videos).
To actively explore the contents of the atlas, the sociological *Serendipity* concept [Merton and Barber 2003] – discovering just by chance unexpected, yet positive facts or events – should be considered. In case of atlas cartography, this means to offer different levels of information for laymen and experts. A simple map, e.g. of beer breweries (Figure 7-1), can work as door opener for more sophisticated economic map themes. And randomly sorted maps can seduce the user to explore a totally unknown thematic field, only by means of an attractive presentation. Another possibility is the *Gaming* access, using e.g. quizzes, puzzles, or adventure environments, leading to new topographic or thematic discoveries.

In terms of GUI *Screen Layout design strategies,* atlas authors should take care of the arrangement of the GUI features and the segmentation of the screen, as well as the density of the layout. In addition, the type of application – desktop, tablet or mixed – and the corresponding screen sizes have to be considered.
The arrangement of the GUI features can be chosen between the two poles of a clearly structured and a freely arranged layout. The advantage of a structured layout is apparently the fact that users can find the same GUI elements always at the same place. It acts as a reliable atlas framework or even gets a characteristic recognition value. In contrary, a more unstructured layout may be more adapted to the map content, using only space for those elements that are really needed for the map