

# Using Usability Test Results to create Usability Patterns for Geoportals

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## Abstract

Today's geoportals still show various usability issues, which could result in inefficient usage or usage mistakes. This poster submission describes how to use usability tests to discover usability problems in geoportals and how to develop guidelines, so-called usability patterns, which offer best practice solutions to improve the usability of geoportals. We performed a usability test and used the results to develop two usability patterns for geoportals focussing on map usage as an initial subset of usability patterns for GI Web applications.

Keywords: *Geoportal, Usability, Usability Pattern*

## 1 Introduction

Geoportals serve as entry points for discovery of geoinformation resources [1], [2]. They often differ in their purposes for instance to share scientific data or to support public authorities. They offer various discovery functions, e.g. address searches or complex thematic searches and provide map visualizations and tools for the results. Further, geoportals differ in their structure, design and interaction concepts and the offered user assistance and thus, finally they differ in usage and user-friendliness. Usability describes how users utilize a software for specific tasks in order to achieve their objectives effectively, efficiently and satisfactorily [3]. Therefore, it influences the acceptance and up-take of web offerings such as geoportals.

This poster submission addresses the following research questions: (1) How can usability problems of geoportals be identified? (2) How can solutions be defined and be linked to the identified problems?

We elaborate on the idea of using usability patterns to structure major results from usability tests for geoportals ([4], [5]). Therefore, we performed a usability test to analyze the usability of the geoportals of the German states *Rhineland Palatinate* (Figure 1) and *Saxony* (Figure 2), first in general and second with special regards to the provided map tools. The test results were used to create two *Usability Patterns* for geoportals, which do not only describe the identified usability problems, but also enable the linking of identified problems and implemented solutions across geoportals.

## 2 Method

### 2.1 Hardware and Software Setup

The test was performed on a laptop with a 15.6'' screen (1920x1080 pixels) using the Web browser Mozilla Firefox. Users' behaviour, in particular mouse interactions and comments, were captured with the software *Techsmith - Camtasia*.

Figure 1: Map client of the Geoportal Saxony.

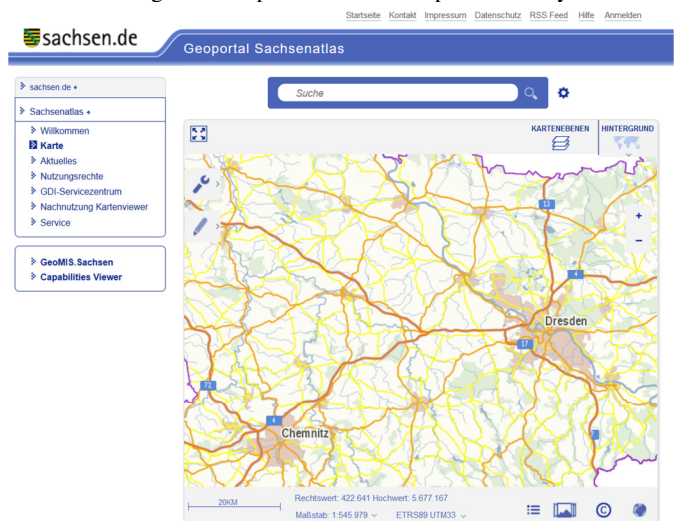
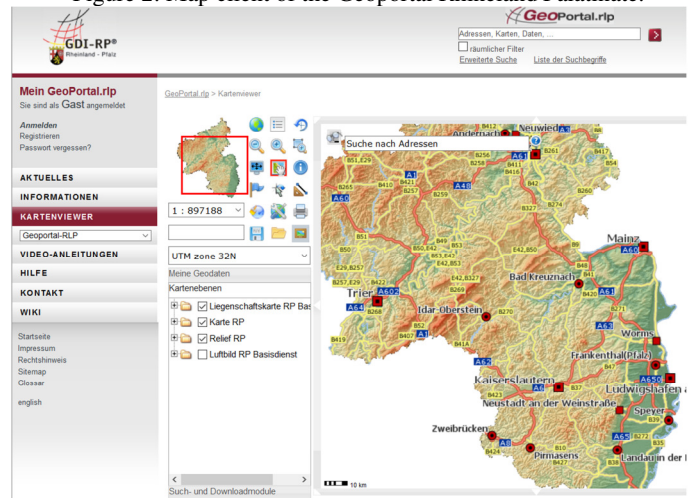


Figure 2: Map client of the Geoportal Rhineland Palatinate.



## 2.2 Participants and Procedure

Five participants took part, two of them were female. Two participants were aged 22-24; three were 25-27 and all were university students or already holding a university degree. None of them could be considered an expert geoportal or map user. The participants have used map applications before, but only one participant has used one of the tested geoportals before.

The test consisted of three phases: 1) answering a questionnaire, 2) performing a task-based usability test and 3) answering a final survey.

The first questionnaire asked for personal details and experiences in geoportals and map client usage. In the subsequent usability test the participants had to perform two trials, one for each geoportal. Each trial consisted of a fictitious scenario with four tasks. The following scenario and tasks, being slightly adapted to meet the geoportals content, were used to evaluate both geoportals:

*You are invited for a job interview in an unfamiliar city and want to find information about the firm's location and potential residences by using a geoportals, in particular its map functions.*

- 1) Enter the geoportal and familiarize with it, e.g. by testing provided functionality.
- 2) Enter the map and search for the company.
- 3) A friend lives nearby. Find out the distance from his flat to the firm.
- 4) You'll visit the city tomorrow. Use a thematic map to learn about tomorrow's weather.

The tasks' difficulty was increased with each task. For example, to solve final tasks, participants had to perform complex searches and use various map tools. Participants were asked to comment all their actions and thoughts. Applying the *thinking aloud* method [6] allowed to log the expectations, thoughts, suggestions for potential improvements and, combined with the analysis of recorded user interactions, to conclude recurring usability problems.

The final questionnaire was used to ask for personal feedback and to evaluate some geoportals' features, e. g. the quality of assistance received throughout the test in the geoportals.

## 3 Results: Usability Patterns for Geoportals

The usability test identified several problems in the selected geoportals. Simple tasks, such as using a map tool or performing an address search were of no difficulty to the participants. Performing a complex task, e.g. to search for two addresses and measure their distance, caused various usage problems. We use two of the discovered problems to show how to create usability patterns for geoportals based on the test results.

A *usability pattern* provides a structured template to link a recurring usability problem to a best practice solution [7]. It is described by the following attributes:

- **Name** is used for pattern identification
- **Problem** briefly describes the usability problem.
- **Solution** provides a functional solution or feature to prevent or solve the problem
- **Example** shows a best practice implementation.
- **Rationale** explains how the pattern improves the usability of the software
- **Context describes** conditions when the pattern should be applied
- **Illustration describes an** implementation in a fictional system. It can be used, if existing systems do not demonstrate the benefits of the pattern clearly.
- **Cost** describes potential risks, disadvantages and costs, which can result from the usability pattern.

### 3.1 Usability Pattern Provide a Measuring Tool

A measuring tool requires users to define start and end point of a distance on the map. This can be implemented in several ways, e.g. by drag-and-drop interactions or by using buttons. The usability pattern *Provide a measuring tool* addresses two problems: the lack of explanations on how to use the tool and the positioning of the tool on the map (overlapping displayed geodata) (Table 1).

### 3.2 Usability Pattern Provide Results of Address Searches on the Map

When users search for addresses, results should be displayed on the map. This functionality is typically implemented in today's geoportals, e.g. by providing links from address results to the map or by opening a map client and showing the address automatically.

The usability pattern *Provide results of address searches on the map* focuses on a suitable visualization for a chosen address result. Such visualization includes 1) positioning the address in the centre of the map and 2) provide it on a suitable zoom level (Table 2).

## 4 Conclusion and Outlook

The usability test identified specific usability problems in both geoportals, which were used to develop two usability patterns. Usability patterns offer a suitable concept to link best practice solutions to usability problems discovered in geoportals.

Future work includes the implementation of developed usability pattern solutions in geoportals and the comparison of the geoportals' usability before and after the pattern usage. Results of this comparison can be used to improve the usability patterns or create new ones.

Discovered usability problems do not only occur in the selected geoportals, but in several available GI Web applications. Thus, the usability pattern concept will be extended to the requirements of GI Web applications.

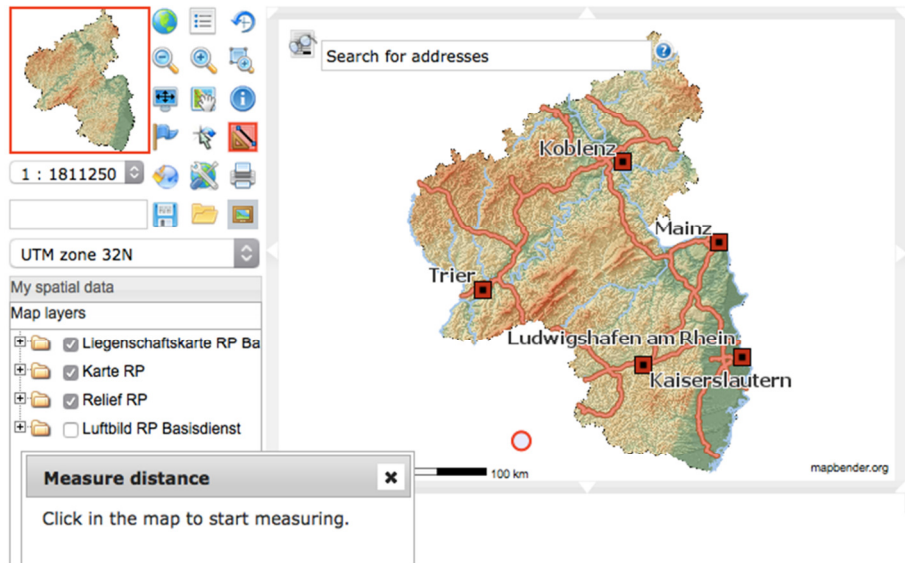
Table 1: Usability Pattern Provide a measuring tool.

Name	Provide a measuring tool
Problem	Users often want to measure the distance on a map. This function can be implemented in different ways, e.g. by drawing a line on the map or by combine the use of buttons and pointing on the map. Typically, the user does not get any feedback how to use such measuring tool (resp. how to start or end a measurement) or if the measurement is already started (Figure 3). When implemented as toolbar, the measuring tool often overlaps the map, hindering users to find suitable map information.
Solution	Provide a measuring tool, explain the tools and put toolboxes next to the map. Implement a measure tool and inform the user how to start and end the measuring, e.g. by tooltips or information boxes with a short description, and how to start a new measure. Describe the measuring tool in such way that an expert and an inexperienced user can use it easily. Put both, toolbar and tool description next to the map, to enable users to see all map information. If this is not possible, e.g. due to style guides, provide toolbars that can be moved by the users.
Example	Geoportal Rhineland Palatinatne: The portal explains the measurement tool in an info box.

Figure 3: Measuring tool in the Geoportal Saxony – different measuring modes are explained, but not how to use the tool

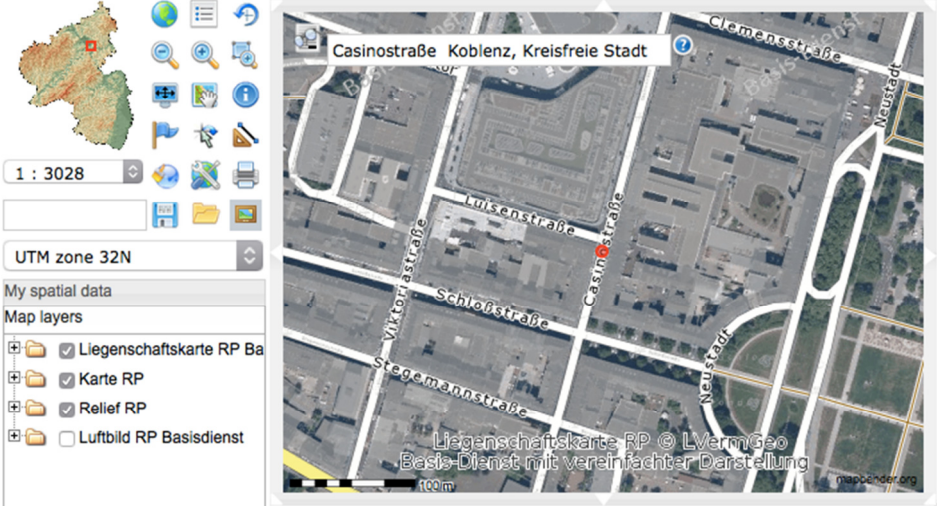
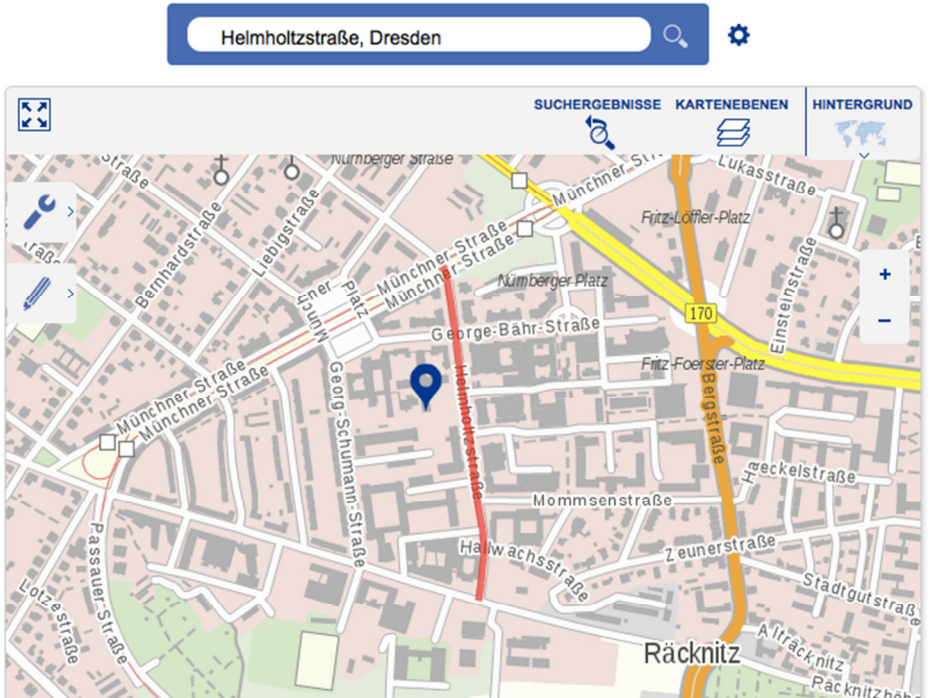


Figure 4: Measuring tool in the Geoportal Rhineland Palatinatne – after selecting the tool, a popup describes how to start the measurement



Rationale	Explanations on how to use the measuring tool help (especially inexperienced) users to measure distances more efficiently and effectively. Users avoid making mistakes and get less frustrated.
Context	Geoportals are Web based user interface that provide functionality to various users. Complex tools such as the measuring tool need a proper position in the user interface and a suitable explanation on how to use them.
Illustration	A user is interested in the distance between her new flat and office. She uses a geoportal for the first time. After choosing the measuring tool on the geoportal's map, she is informed about how to start and end measuring step-wise.
Cost	A measuring tool can offer various functions, e.g. measure the distance between two or more points, or measure an area defined as polygon. Provided measuring functions should be chosen dependent on the geoportal's purpose.

Table 2: Usability Pattern Provide a measuring tool.

Name	Provide results of address searches on the map
Problem	<p>The user searches an address and likes to view the address and nearby area on the map. The presentation is intended to contribute to a better understanding of the selected data. The zoom level often does not fit to the searched address type (Figure 3).</p>
Figure 3: Address search in Geoportall Rheinland Palatinate – searching for a street results in a map visualization with a highlighted point coordinate	
Solution	<p>Provide map visualizations for address results on a suitable zoom level. Address results should be visualized on a map. The map should provide a suitable zoom level, e.g. showing the whole country, when searched for a federal state or showing a street and the neighbourhood when searching for an address. The map should enable the users to orient themselves.</p>
Example	<p>A geoportall offers the ability to search addresses. The resulting address is shown in the centre of a map. The selected zoom level facilitates orientation on the map by showing the neighbourhood of the address (Figure 4).</p>
Figure 4: Address search in the Geoportall Saxony – searching for a street results in a map visualization with the highlighted street and a suitable zoom level	
Rationale	<p>Providing map visualizations for address search results helps users to inform about them and their neighbourhood. By offering a suitable zoom level this task can be fulfilled more efficiently and effectively.</p>
Context	<p>This feature is only useful for geoportalls, which provide access to addresses and offer map visualizations.</p>
Illustration	<p>A user is interested in the address of her new office and the neighbourhood. She wants to inform herself whether there is a station nearby or not.</p>
Cost	<p>Providing map visualization for an address on a suitable zoom level helps her to find the proper information quickly. Typical use cases need to be identified to provide suitable map visualizations on a proper zoom level, because it is not possible to provide a suitable visualization for every possible use case automatically.</p>

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