ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

IKG
Institut für Kartografie und Geoinformation
Institute of Cartography and Geoinformation

"A useful workflow to compare different 2D and 3D visualizations of alpine regions."

Master Project Work, D-BAUG, Spring Term 2014
Institute of Cartography and Geoinformation, ETH Zurich

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Aline Brüngger

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3D visualization
Poll
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Conduction of map-user-tests
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Motivation

- ***Shortness of user testing*** methods for cartographic visualizations (map-user-tests), either on 2D or 3D visualizations
- ***Need to find new easy methods*** to handle them

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Main goal

- To develop and provide a useful and easy-to-handle ***workflow*** for a comparative user evaluation of two different visualizations, especially of a 2D map and a 3D perspective view of an alpine region

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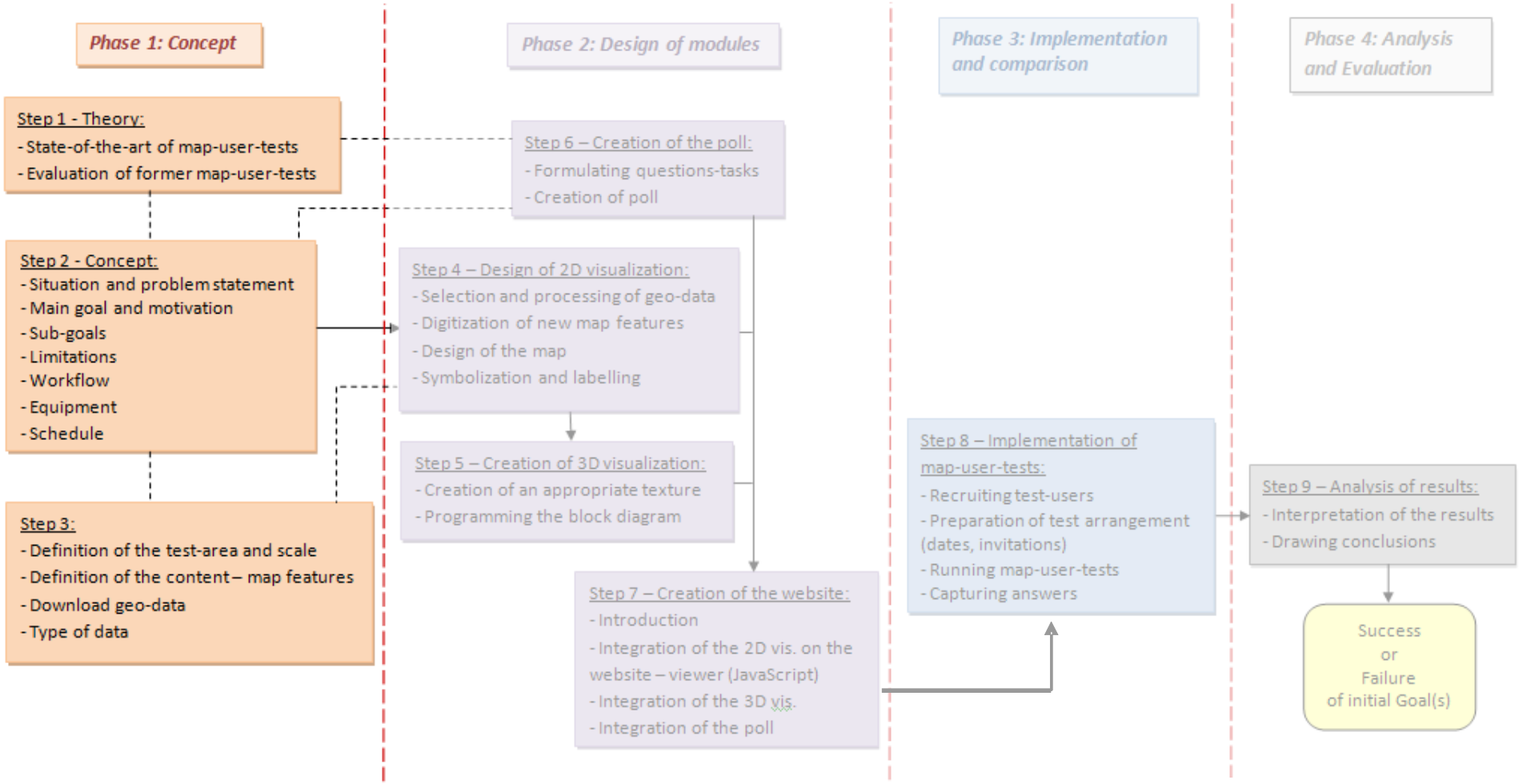
Sub-goals

- Design of a ***2D visualization*** of a selected alpine region
- Creation of a ***3D visualization*** of the same alpine region
- The ***comparison*** between the derived 2D and 3D visualization presented on a ***website*** carried out by a ***poll*** with questions and tasks
- The procedure of the ***pilot study*** with test-users
- The evaluation of the ***workflow***

The proposed new schematic workflow



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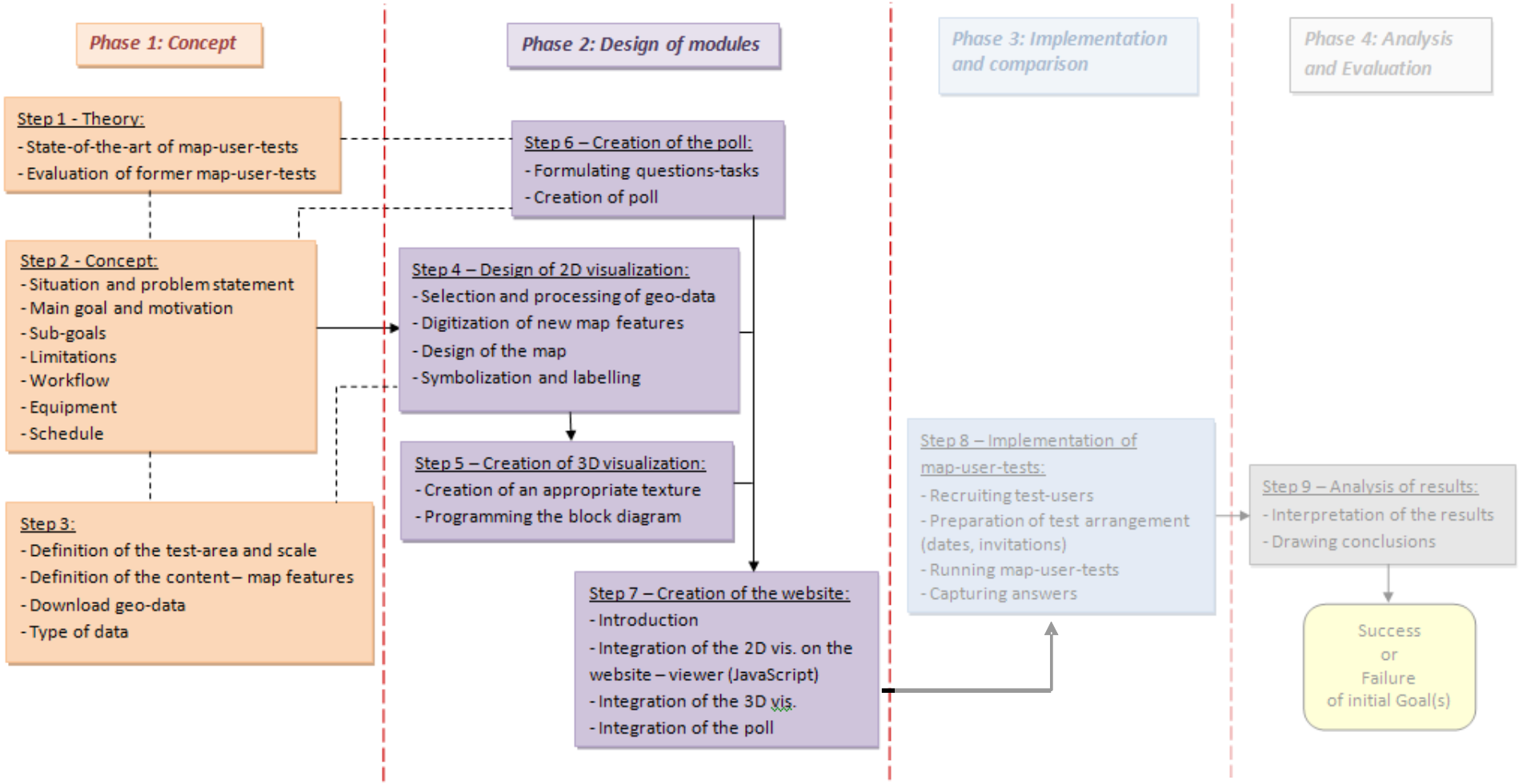

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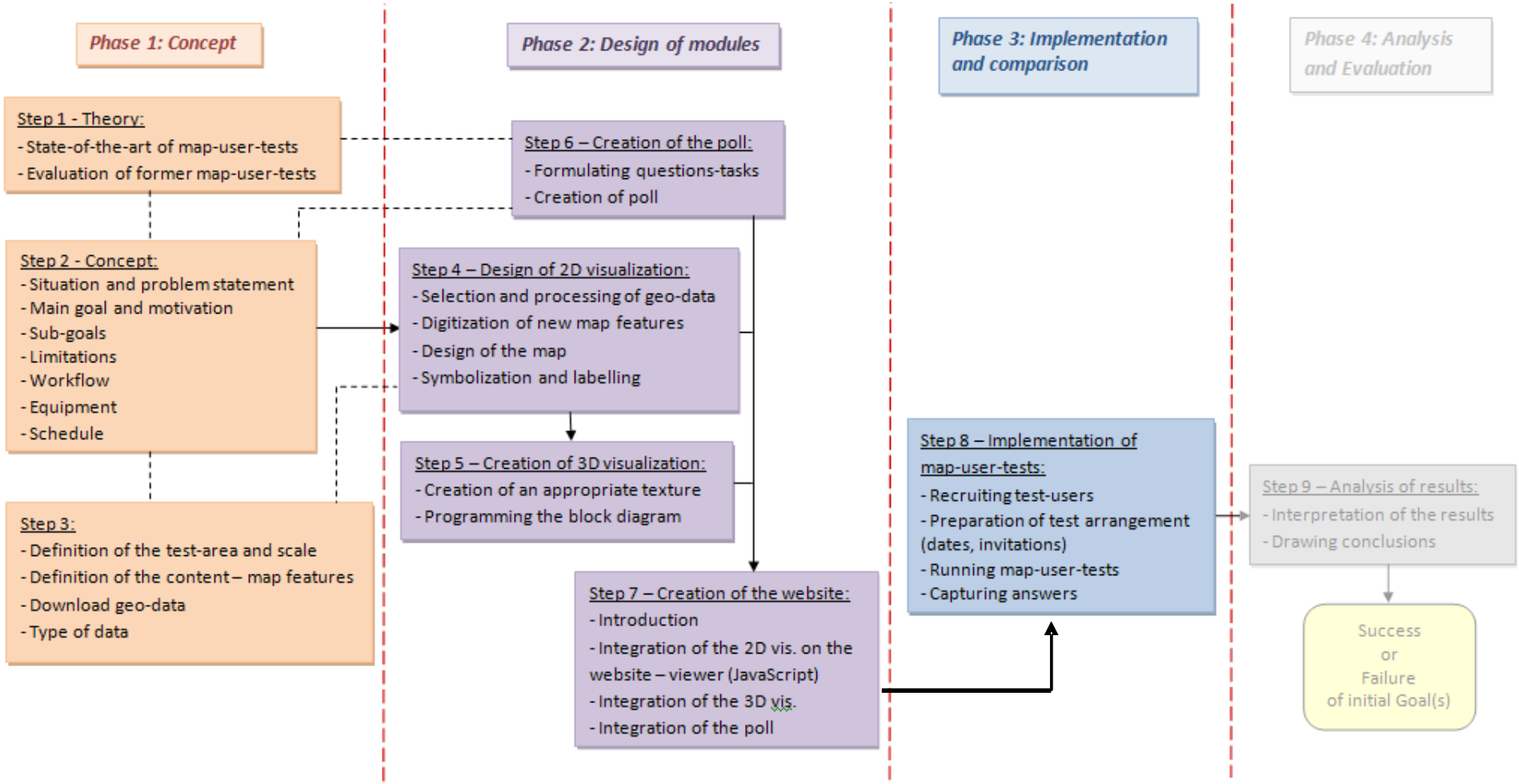

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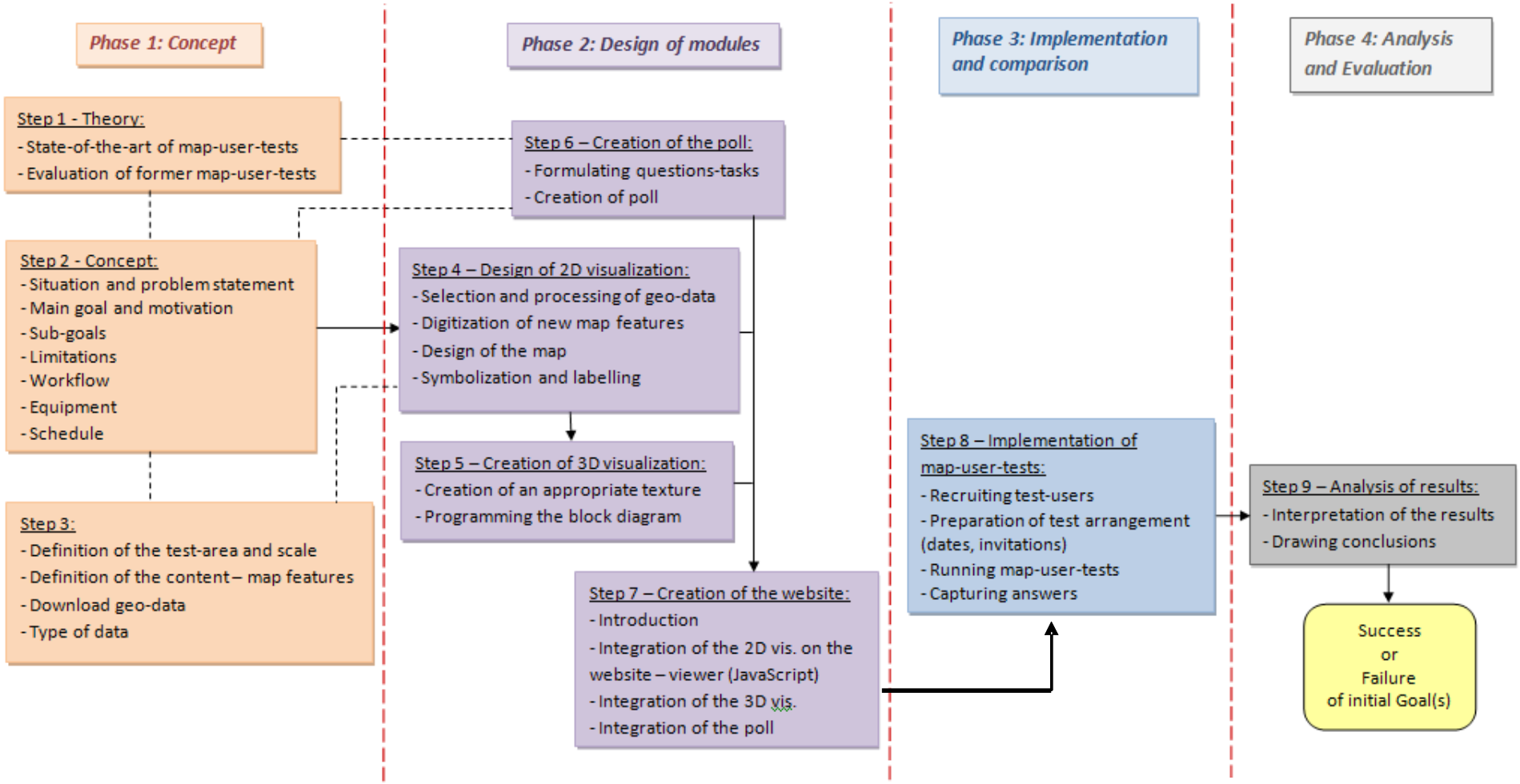

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State-of-the-art of map-user-tests

Step 1

Until now different methods were used for the evaluation of map visualizations.

- Questionnaires, interviews: time-consuming, easy to handle?
- Controlled indoor or outdoor settings
- Sample of test-users: experts or not, small or big sample
- Combination of methods

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Limitations

Step 2

- The simplicity of the workflow may lead to ***general conclusions***.
- Specific process steps of the workflow may not be considered simple by the ***map-designers.***
- Areas with ambiguous three-dimensionality, ***flat areas***, are not ideal for the creation of 3D visualizations.
- The ***parallel comparative evaluation*** of two visualizations on a website is ***not advisable*** because of limited space of the computer screen.

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Definition of the test-area

Step 3

Three-dimensionality: unambiguous !

source: http://www.mappuls.ch

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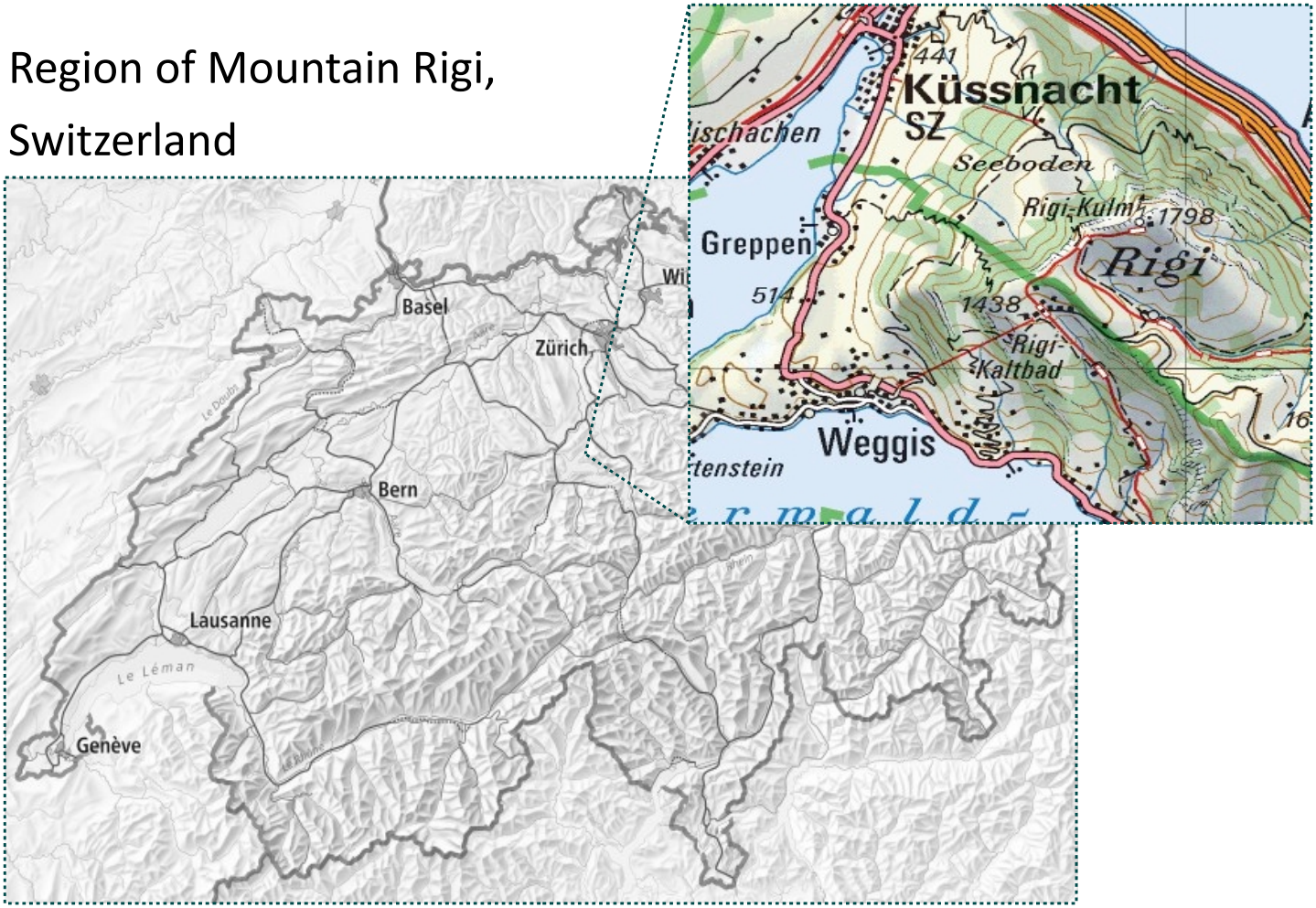
Definition of the test-area

Step 3

Region of Mountain Rigi, Switzerland



Source: geo.admin.ch

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Design of 2D visualization

Step 4

- Aim of the map: depiction of hiking paths of Mt. Rigi
- Target group: hikers/tourists of Rigi region
- Realistic impression of the tourist facilities of Mt. Rigi
- Pseudo-natural design: summer-season design (forest/pastures)
  bright settlement areas and roads
  shaded relief
- Data VECTOR25 from swisstopo
- Technology used: ArcGIS, QGIS, Adobe Illustrator

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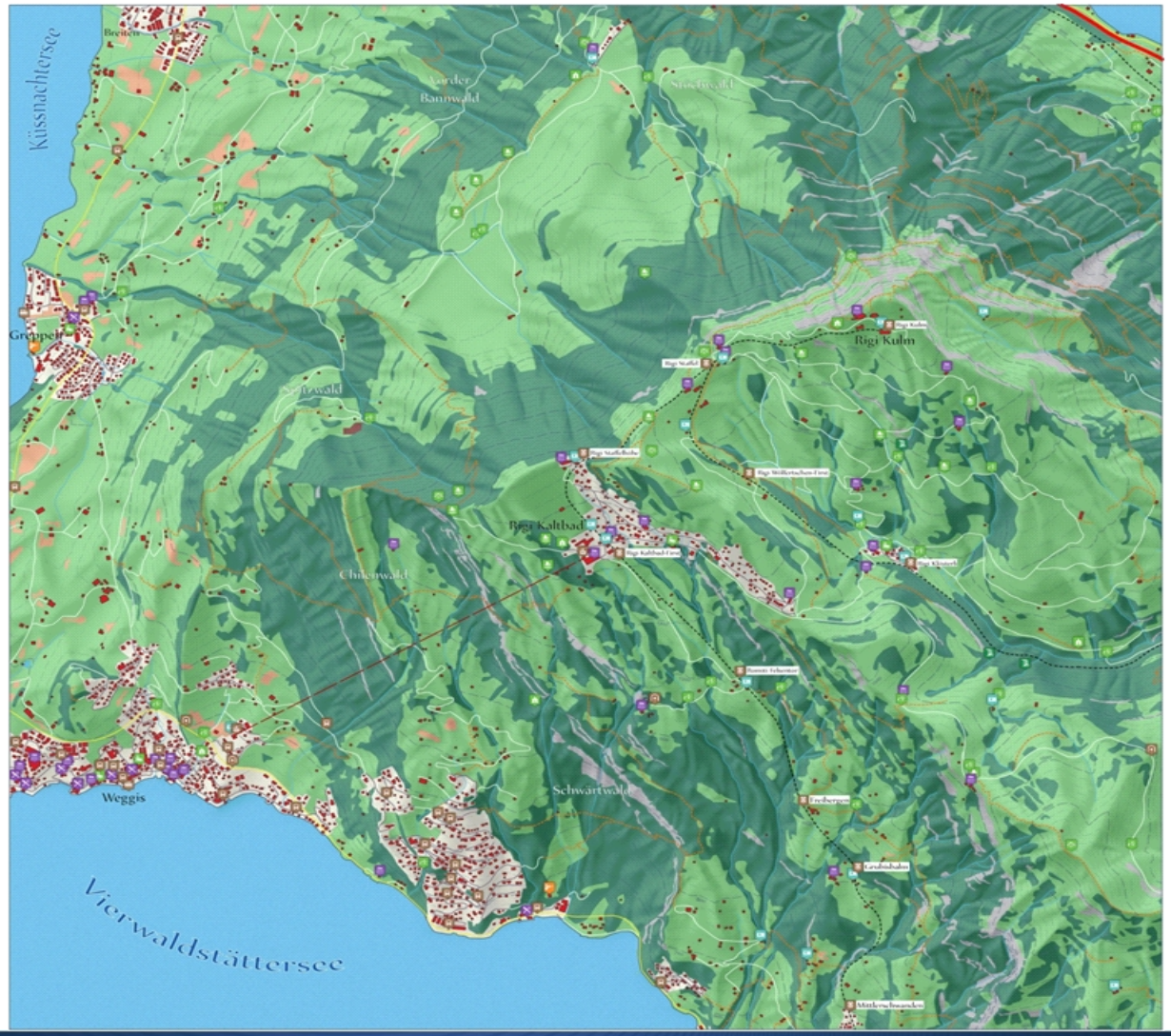
The 2D visualization (tourist map)

Step 4



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Creation of 3D visualization

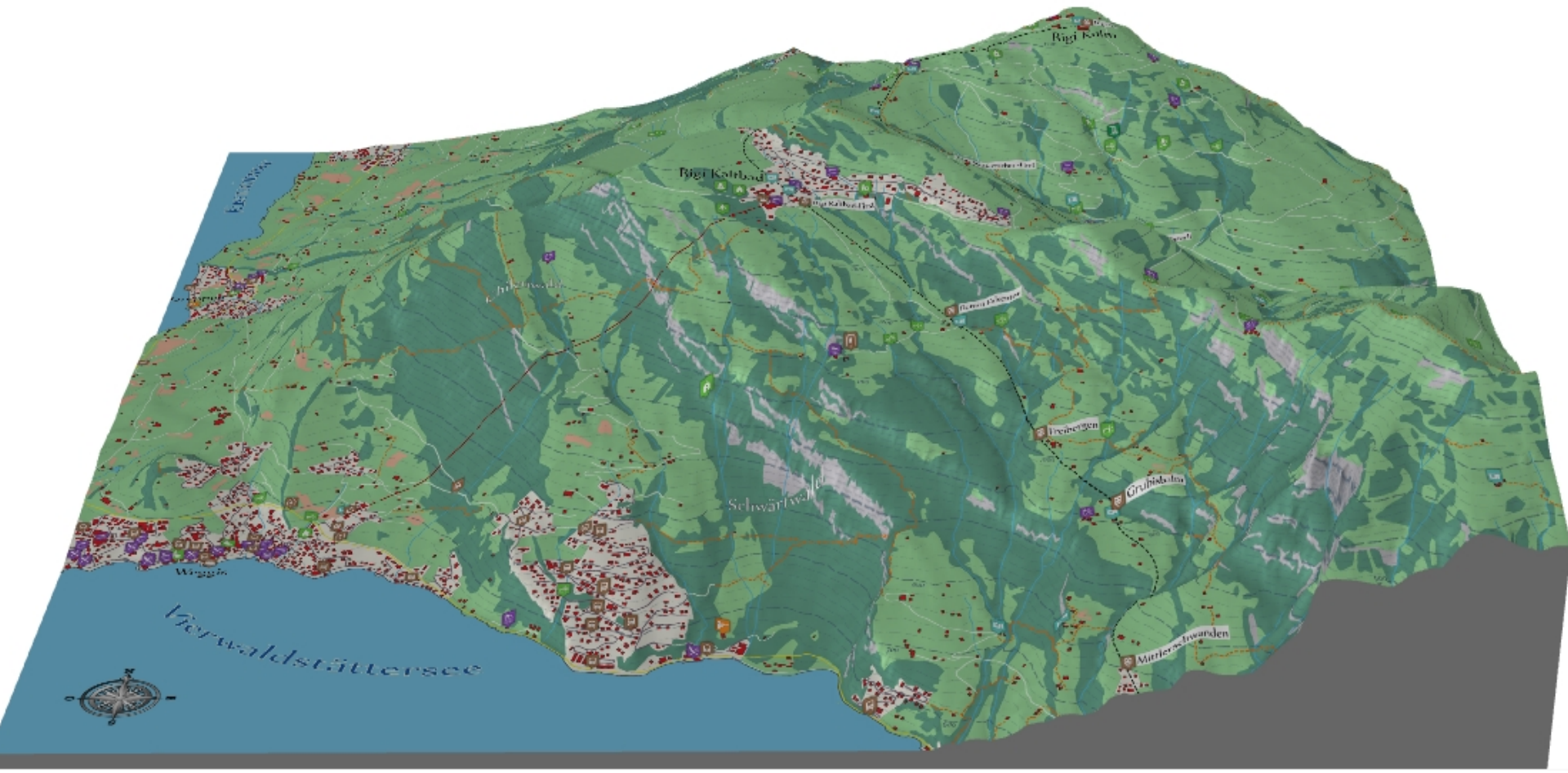
Step 5

- Block diagram supplied by the Institute of Cartography and Geoinformation, ETH Zurich
- Creation of an appropriate texture from the 2D visualization with good resolution
- Integration of a compass sign for the orientation of the test-users

- DHM25 (Digital Height Model) from swisstopo
- Technology used: WebGL, ThreeJS, Adobe Illustrator

The 3D visualization

Step 5



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Formulation of the questions

Step 6

The structure of the questionnaire is:

1. ***Individual characteristics – background information***
   (age, gender, experience on reading maps etc.)
2. ***Map content*** (interpretation of map features)
3. ***Cartographic communication***
4. ***Orientation***
5. ***Map design preference – Map comparison***

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Creation of a poll

Step 6

- Preformed polls for their integration on a website.

Map user test on the 2D visualization

Part 1: Individual characteristics

*Required

What is your age? *
- 15 to 20
- 20 to 25
- 26 to 40
- 41 to 60
- over 60

Gender? *
- male
- female

Have you ever hiked/been at Rigi, Switzerland? *
- Never
- Once
- Just a few times
- I often go to Rigi!

How often do you use maps? *
- I don't use maps at all!
- I just use them only when I cannot avoid it.
- I often use maps.
- My studies/work are in the field of cartography or a related field.

Google Drive

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Creation of the website

Step 7

- Layout: simple and easy to handle
- Structure concept: three web pages
  1. Introduction page
  2. Map-user-test on the 2D visualization
  3. Map-user-test on the 3D visualization
- Upload to the server **hg.n.ethz.ch**
- Possibility to evaluate first the 2D either the 3D visualization so creation of 5 web-pages, so 4 different polls

- **Website presentation**

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Implementation of map-user-tests

Step 8

- Pre-testing of map-user-tests
- Recruitment of test-users: asked by email
- 60 persons asked, 35 experts
- Duration: May 5th to May 15th, 2014
- Capturing of the answers:
  - collected and automatically connected to a Google spreadsheet
  - summaries of the responses presented through pie charts
- evaluating first the 2D visualization: 12 valid answers
- evaluating first the 3D visualization: 2 valid answers
- Difficulties recognised

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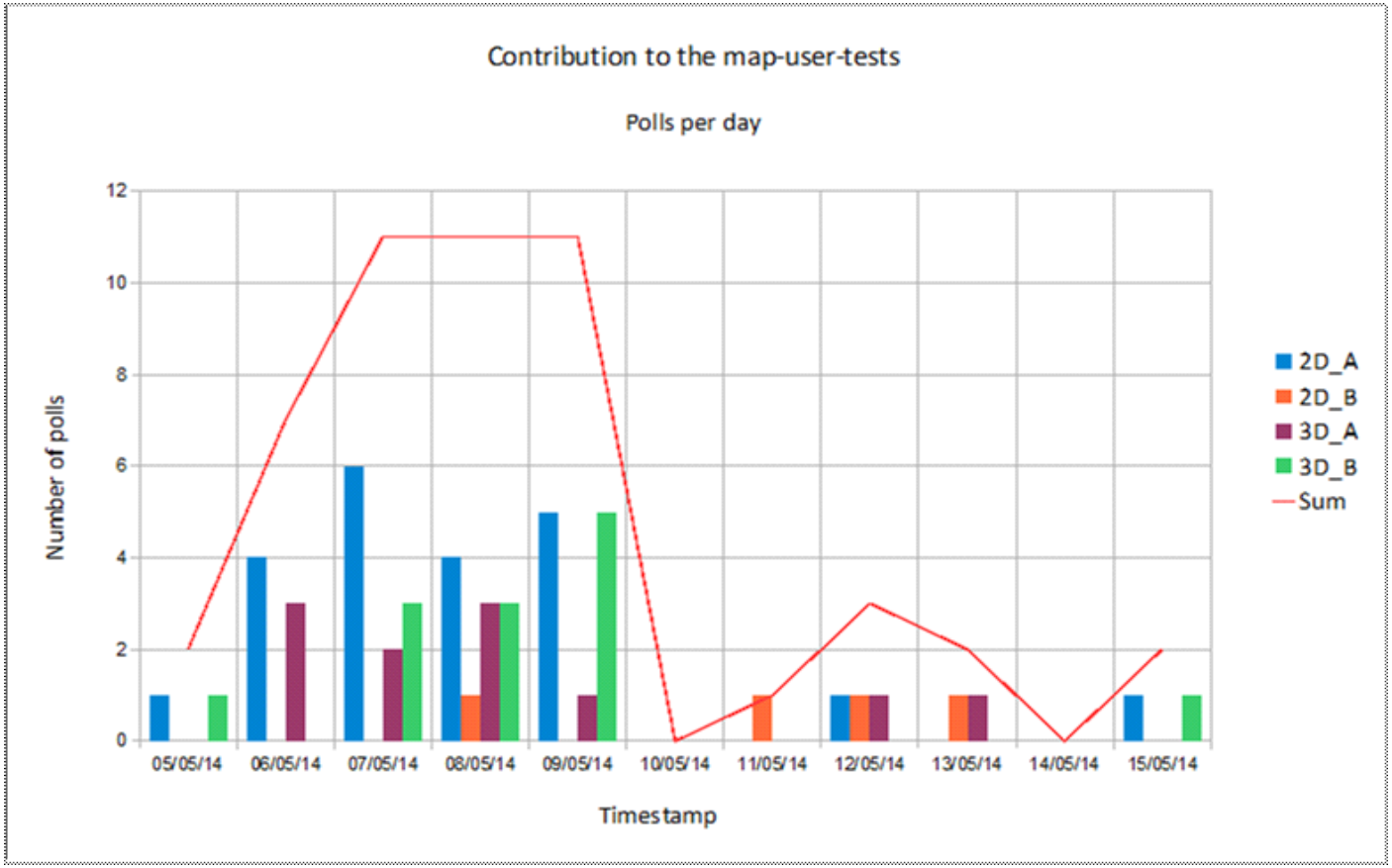
Implementation of map-user-tests

Step 8



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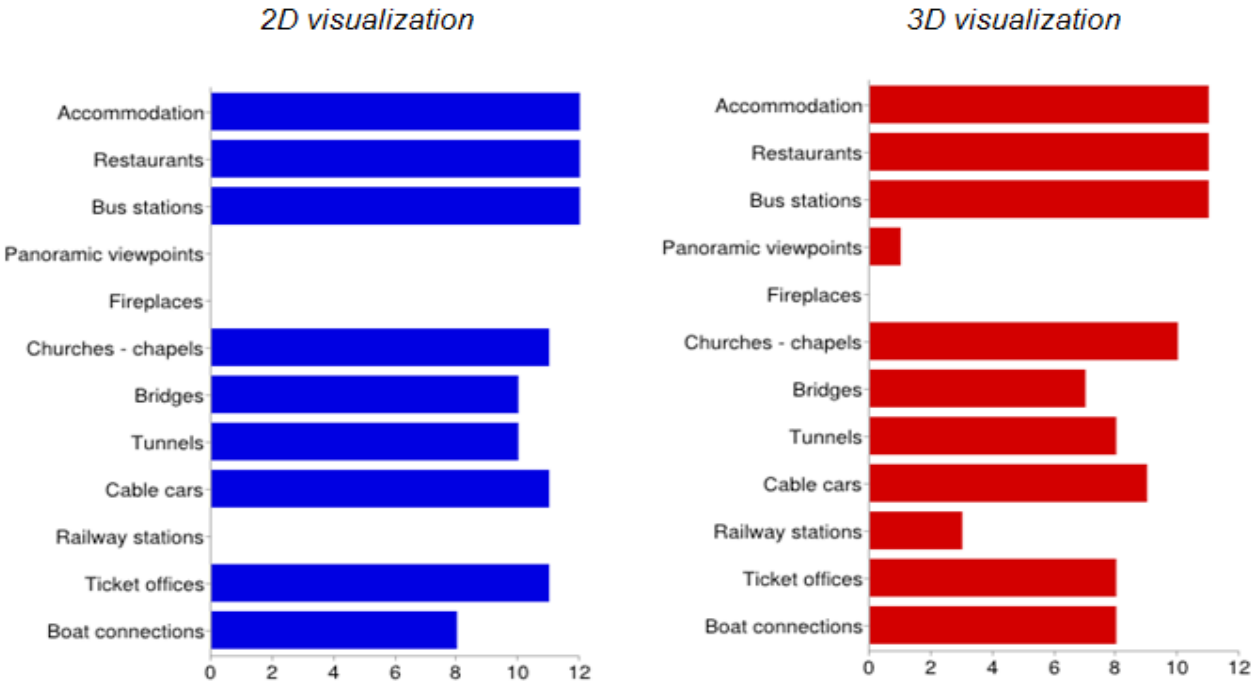
Analysis of the results

Evaluating first the 2D and then the 3D visualization

Part 2: Map content

What information is available for Weggis?



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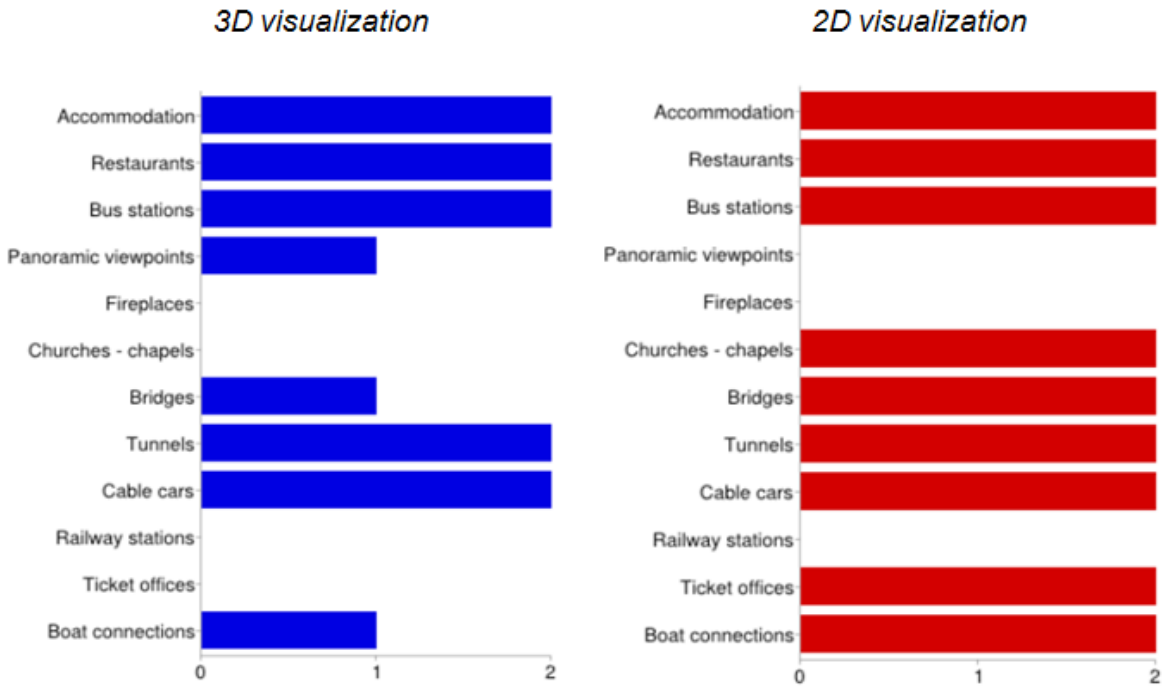
Evaluating first the 3D and then the 2D visualization

Part 2: Map content

What information is available for Weggis?



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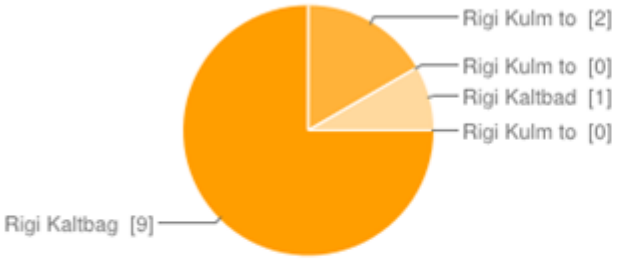
Part 3: Cartographic communication

There is the possibility of transportation with cable cars from ... and reverse.

2D visualization



Rigi Kaltbag to Weggis	9	75%
Rigi Kulm to Weggis	2	17%
Rigi Kulm to Greppen	0	0%
Rigi Kaltbad to Greppen	1	8%
Rigi Kulm to Breiten	0	0%

3D visualization

Rigi Kaltbag to Weggis	11	100%
Rigi Kulm to Weggis	0	0%
Rigi Kulm to Greppen	0	0%
Rigi Kaltbad to Greppen	0	0%
Rigi Kulm to Breiten	0	0%

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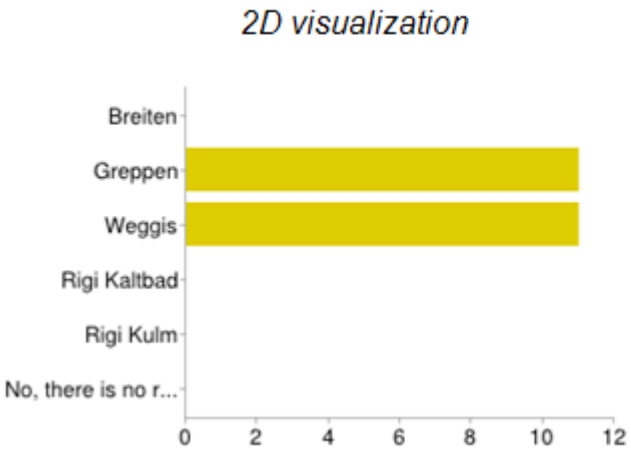
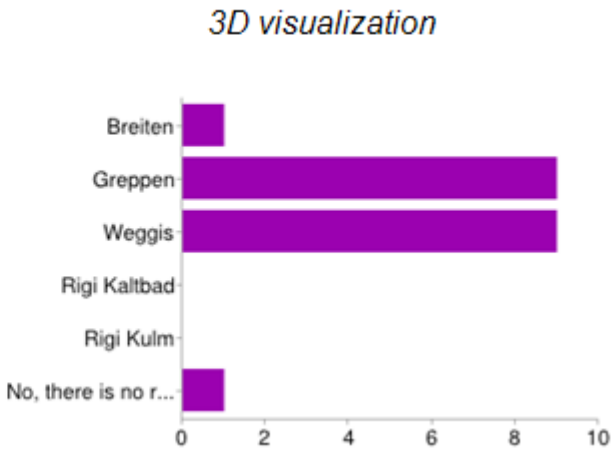
Evaluating first the 2D and then the 3D visualization

Part 3: Cartographic communication

Is there any region which offers the possibility for a boat trip? And if yes, which one(s)?





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Interpretation of the results

Step 8

- The results are ***not*** really ***representative*** because only "a few" test-users participated.
- ***More correct answers*** recorded at the map-user-test of the ***2D*** visualization
- ***More correct answers*** recorded at the map-user-test of the 3D visualization when ***first evaluating the 2D*** visualization
- ***No important differences*** at the answers of ***experts*** and ***non-experts***
- The ***older age group*** (26-40) gave ***more correct answers*** than the younger one (20-25).

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Interpretation of the results

Step 8

- ***Preferred*** visualization: ***2D*** visualization
- Better depiction of the ***reality***: ***3D*** visualization
- ***Easier to read***: ***2D*** visualization
- More accurate visualization:
  - males: 3D visualization
  - females: 2D visualization
- 2D and 3D visualizations proved equally efficient for cartographic communication
- 3D visualization: females not easily oriented

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Conclusions (1)

Step 9

- Main goal achieved: an easy-to-handle and useful workflow
- 2D visualization: easily designed by an expert map-designer
- 3D visualization: difficulties with the functionalities of the block diagram and the presence of icons/labels
- The creation of a website does not require expert programming skills
- The questions for the 2D and 3D should have been different but same level of difficulty
- Easy formulation and integration of GoogleDrive polls on the website
- Carefully selected sample and sufficient number of test-users

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Conclusions (2)

Step 9

- Email: not the optimal technique for the conduction of user-questioning
- The submitted answers lead to some general, but important conclusions about the two visualizations
- A comparative evaluation is possible even if the two visualizations are evaluated separately.

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Outlook

Step 9

- Other visualizations may be integrated on the web-pages for their comparative evaluation
- 2D visualization: more interactivity is possible

  richer GUI
- 3D visualization: panning of the block diagram

  creation of billboards of the icons/labels

  interactivity and richer GUI
- Formulation of questionnaires examining more specific aspects on cartographic visualizations (eg. design aspects etc.)
- More optimal data collection technique for the user-testing on the visualizations (eg. combination of questionnaires and interviews)
- Probably a more careful selection of the sample (eg. only experts in one session, only non-experts map-users in another session etc.)

Questions?

Thank you for your attention!