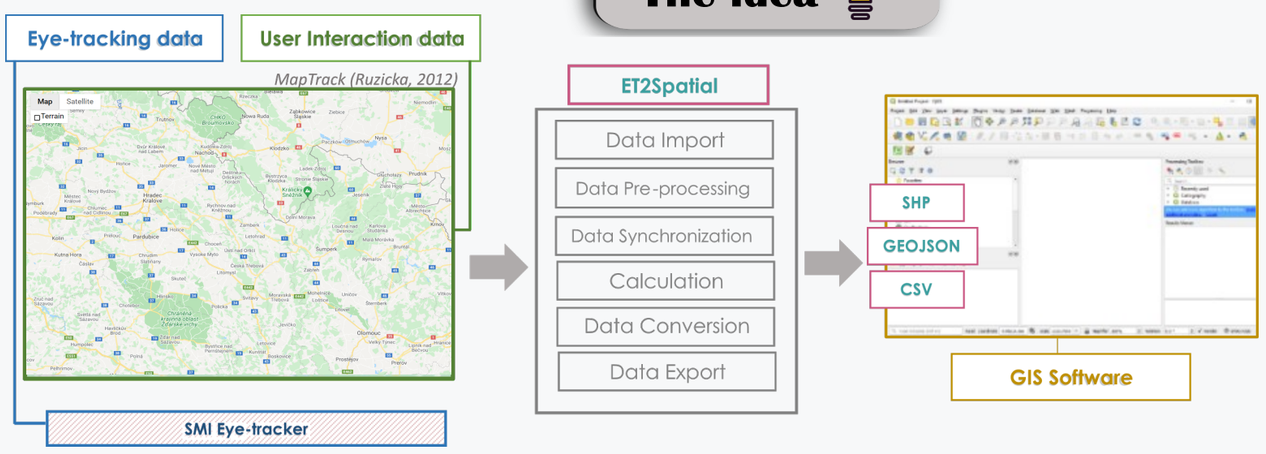
This thesis study focuses on the development of a utility tool for eye-tracking data that is recorded on interactive web maps. The tool simplifies the labour-intensive task of frame-by-frame analysis on screen recordings in the current eye-tracking eco-systems. The tool's main functionality is to convert the screen coordinates of participants to real world coordinates and allow exports in commonly used spatial data formats. The product of this thesis, called ET2Spatial, is tested in depth in terms of performance and accuracy. Several use-case scenarios of the capabilities of GIS software for visualizing and analysing eye-tracking data are investigated. The tool and its associated pilot studies aim to enhance the research capabilities in the field of eye-tracking in geovisualization.

DEVELOPMENT OF A GEOREFERENCED EYE-MOVEMENT DATA CREATION TOOL FOR INTERACTIVE WEB MAPS

Diploma Thesis

The idea

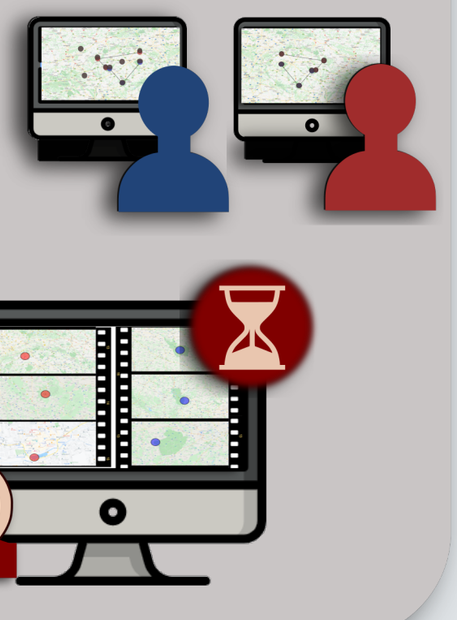


The problem

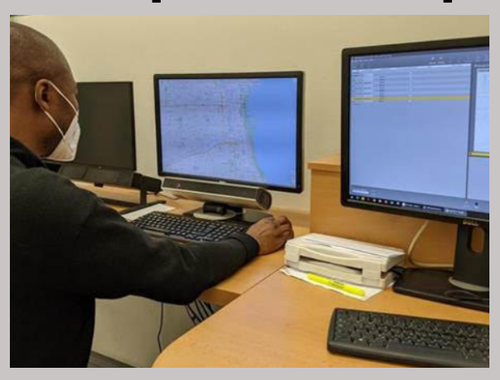
Eye-tracking is an important tool used in the evaluation of cartographic products. But the techniques used for eye-tracking analysis in current ecosystems are not suitable for dynamic & interactive webmaps.

Why?

- The output is a screen recording which requires frame-by-frame evaluation.
- Data of different participants cannot be evaluated simultaneously.
- The analysis capabilities are limited to attention maps, scan paths and fixation points.
- It is very laborious and inefficient.



The experiment setup



No of Participants: 8.
Eye-tracker: SMI RED 250
Prompt: To solve 4 different map tasks
Stimulus: Google Maps Basemaps displayed through MapTrack web application
Aim: To collect experimental data for use-case demonstration in GIS environment

Research

Identify problem
Set parameters for study
Explore existing solutions

Sample Data Collection

Eye-tracking experiment
MapTrack tuning

Tool Programming

Environment Configuration
Application Architecture
Coordinate Conversion
Spatial Data export
Accuracy testing
GUI programming

Tool Testing

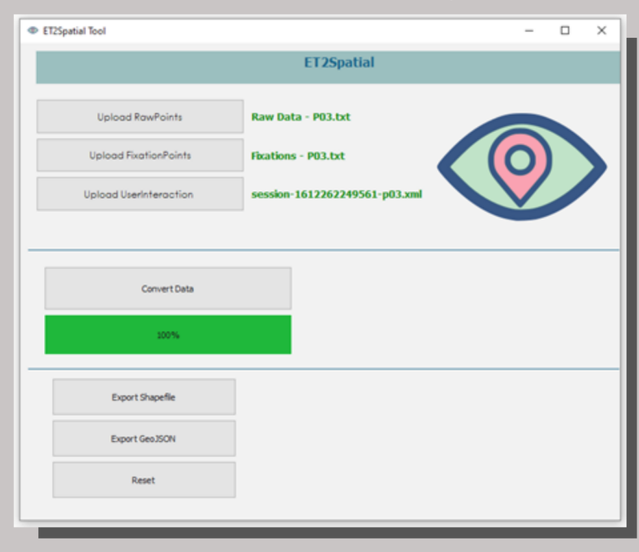
Performance testing
User-feedback
Improvements in tool

Use-case demonstration

Eye-tracking (Map tasks)
Geovisualization
Analysis

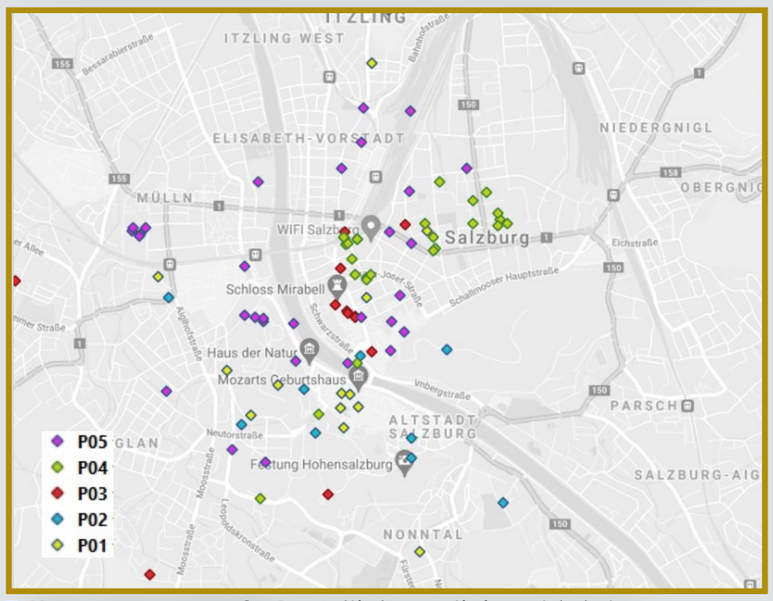
The solution

A tool called ET2Spatial was created as a solution. The tool converts screen coordinates of eye-tracking points into real world coordinates and records the zoom level and fixation duration of each point as attributes.

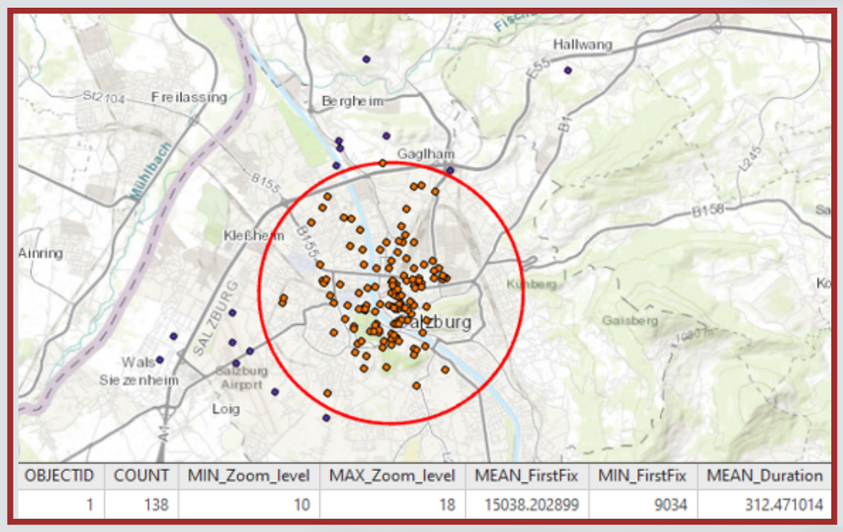


- The output of the tool is a Shapefile or Geojson file of eye-tracking points which can be imported in GIS software.
- The input is raw data from eye-tracking system and user interaction data (zoom, Map center, timestamps) with webmap.

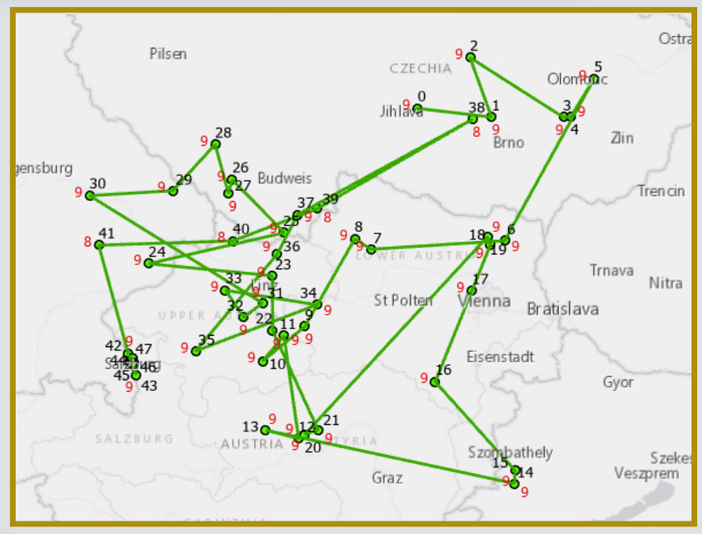
Proof of concept



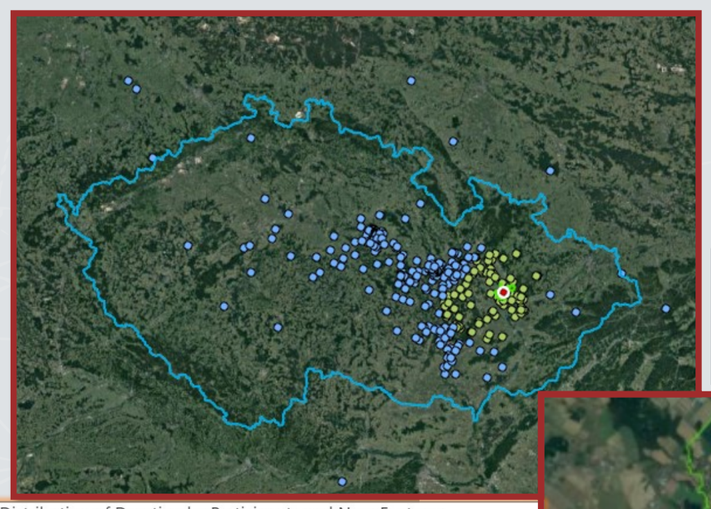
Use-case example 1: Multiple participants' data overlaid on the same basemap for easier analysis in ArcGIS Pro.

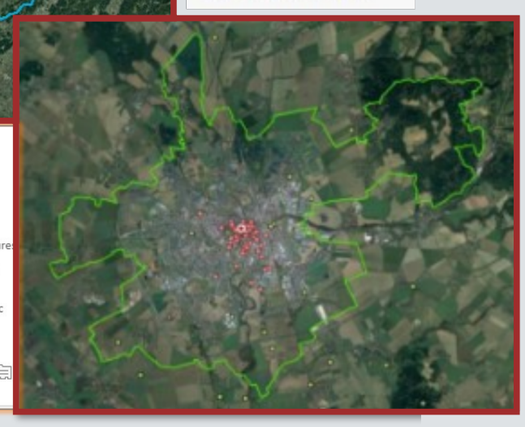


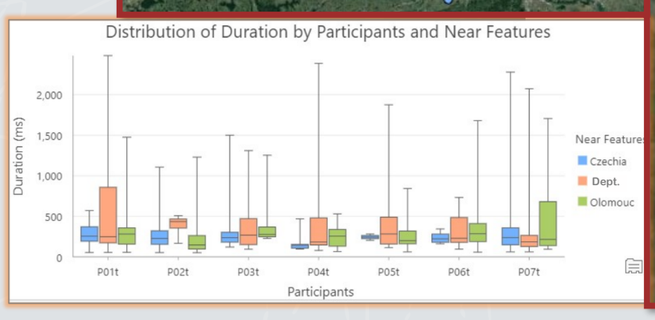
Use-case example 2: Buffer analysis on participant's eye-tracking data who were asked to find city of Salzburg on map.



Use-case example 3: Custom scan paths, recreated in ArcGIS with zoom level info







Use-case example 4: Proximity analysis done in ArcGIS for participants' eye-tracking data combined with supplementary spatial data

Links

Download the tool

View sample experiments

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