Cartography M.Sc.

Development of a Tool for Visual Comparison of multi-faceted Data by Juxtaposed Map Views

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Important Terms

- **Juxtaposed Map Views:** The data comparison method that specifies the objects to be compared individually as a double view or side-by-side view.

- **Multi-faceted Data:** The dataset that contains generally spatial, temporal, social and thematic or other dimensions. (e.g., Flickr data).

- **Visual Analytics:** Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces (Andrienko et al., 2017)

- **Expectation:** The expectation tells how an activity in a polygon relates to the overall distribution of the same activity over the whole study area(Wartmann & Mackaness, 2020).

- **Popularity:** Popularity tells how an activity in a polygon relates to other activities within the same polygon. In addition, popularity is used to compare different activities for the same year and the same polygon or the same activity for the exact location but different years.

Outline

- Introduction and Motivation
- Research Objective
- Methodology
- Prototype Design and Development
- Evaluation of Designed Prototypes
- Conclusion

Introduction and Motivation

- Social media data contain different facets that provide meaningful information. The common facets are generally spatial, temporal, social and thematic.
- To get targeted information through the map, it is required to visualize and compare the data in visual analytics.
- The visual comparison with various interactive functionalities has become a valuable means for exploring and analysing multi-faceted data.
- Nowadays, demand for visual analytical systems is growing to compare the data with the ever-increasing amounts of the complexity of data.
- Juxtaposing interactive comparison method enables gathering and comparing more information in less time.

Research Objectives

1. To identify and select interactions that support and enhance the visual comparison of multi-faceted data by using juxtaposed map views.
2. To develop a tool that implements interactions with juxtaposed map views to support and facilitate the comparison of geolocated social media data.

Research Questions

1. Which interaction techniques to use in visual comparison of juxtaposed map views for exploring the spatial, thematic, and temporal facets of social media?
2. How can the interactive juxtaposed map views facilitate the exploration of the spatial, thematic, and temporal facets of social media data?
3. Which juxtaposed map (unlinked map views or linked map views) is the most applicable for the data comparison tasks?

Methodology

Data

- The Flickr (2007 to 2018) dataset
- Urban green spaces (UGSs) of Dresden City
  → The datasets were provided by the Institute of Cartography (TUD).

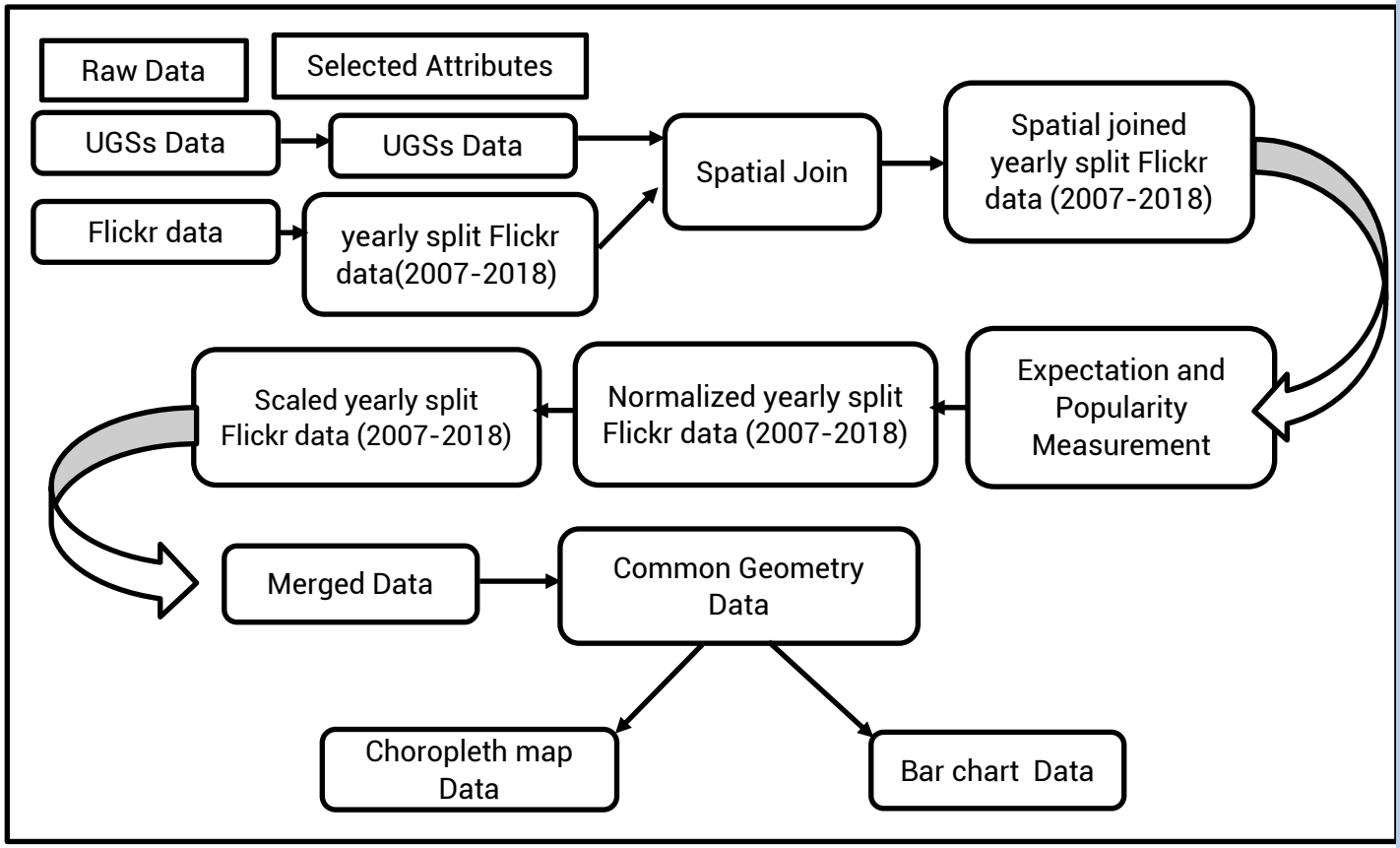
Activities

1. Aesthetic Appreciation
2. Cultural Events
3. Sports
4. Wildlife Recreation

Technologies Used in the prototypes Development

- ❑ Spatial View: Airship, Leaflet
- ❑ Temporal View: Highcharts
- ❑ Languages: JavaScript, jQuery, HTML, CSS
- ❑ Code Editor: Visual Studio Code, Brackets
- ❑ Hosting: Github

Methodology



Parameters

1. Expectation
2. Popularity

Prototype Design and Development

1. Unlinked Map Views

→separate menus, base maps, bookmarks, default map views, zoom in and zoom out buttons for the left and right map views

→ Unlinked bar charts

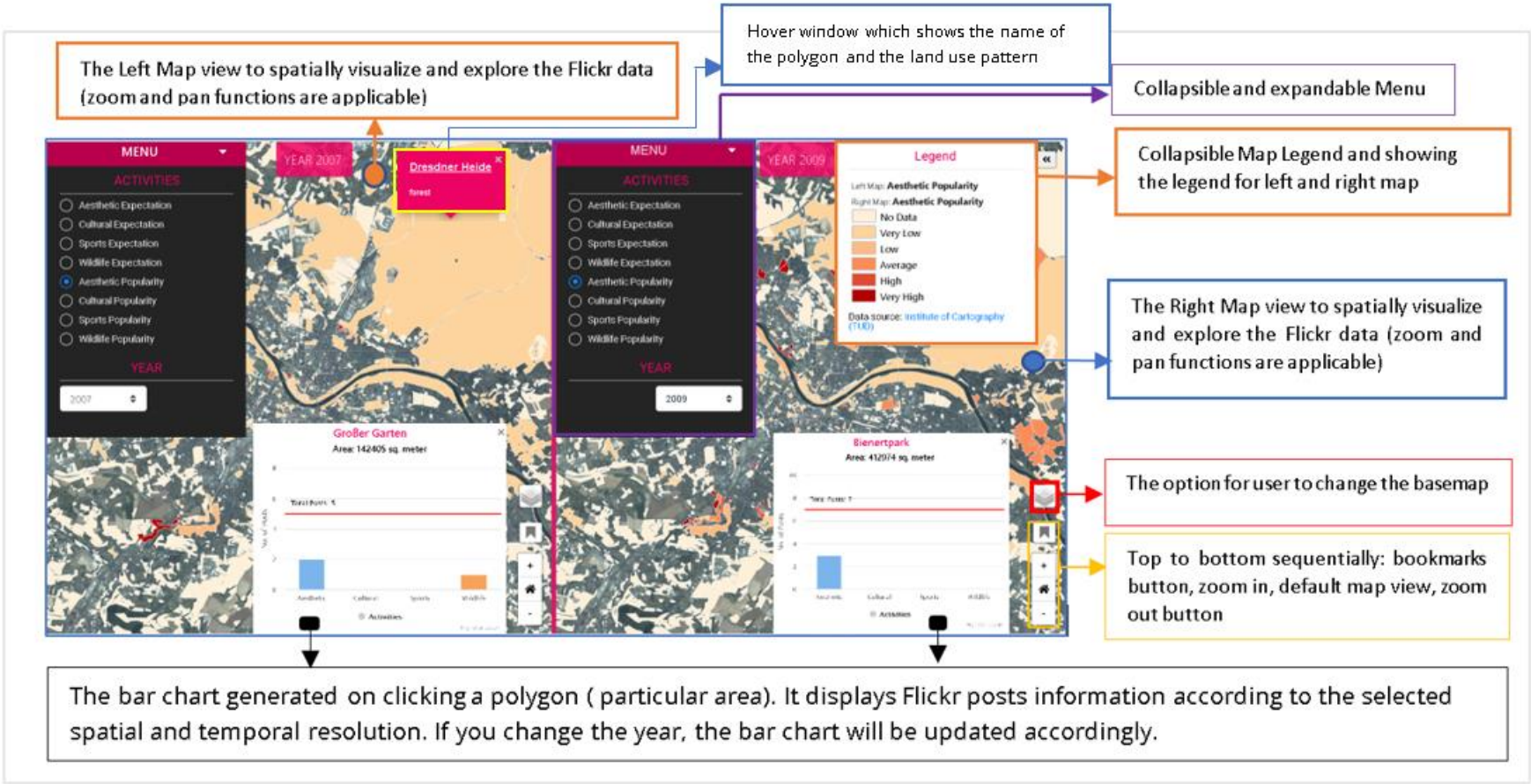
1. Linked Map Views

-→one selecting menu in the left map view with left and right map tabs.

-→ linked background map, foreground visualization

-→ linked bar charts

Unlinked Map Views



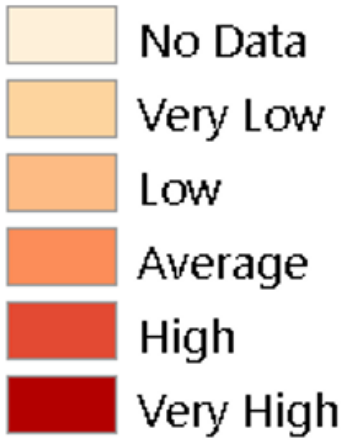
Linked Map Views

https://geomonir.github.io/LinkedMapView/

Prototype Design and Development

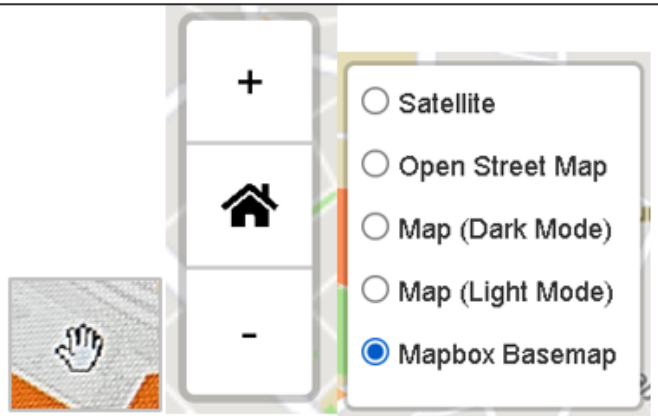
Visualization Styles

Data Category	Visualization Methods
Spatial	Choropleth Maps
Temporal (Yearly)	Bar charts

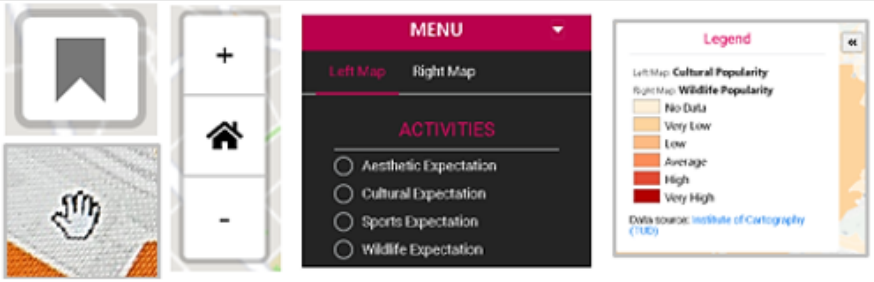
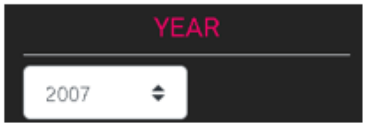
Visualization Style	Visual variable	Colour Scheme
Color(Sequential)	Color	

Taxonomy of Used Interaction methods

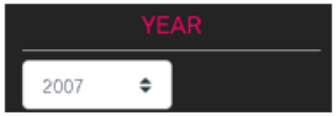
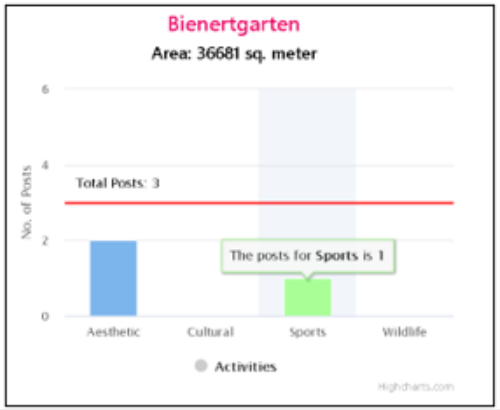
1. Interaction with the background map
2. Interaction with the foreground visualization
3. Interaction with the temporal component of the data

1. Interacting with the background map			
Category	**Tasks**	**Interaction**	**Snapshot from the designed prototype**
Locating	overview	zooming, panning, scrolling, re-centring	
	zoom		
	Default map view		
	navigating		
	Basemap selection		

Taxonomy of Used Interaction methods

2. Interacting with the foreground visualization			
Comparison	select explore relate Default map view bookmarks	clicking, scrolling, panning, zooming, collapsing and expanding	
	abstract / elaborate	mouse hover	
	filter connect	brushing as conditioning	

Taxonomy of Used Interaction methods

3. Interactions with the temporal component of the data			
Associating	filter	brushing as conditioning, mouse hover, clicking, linking the views	  
	connect		
	making comparisons		

Evaluation of Developed Prototypes

Comparison of different facets

Facets of dataset	Comparable topics/issues
Spatial facet	targeted area identification based on the spatial distribution
Temporal facet	year identification
Thematic facet	identify any place based on the value of any activity

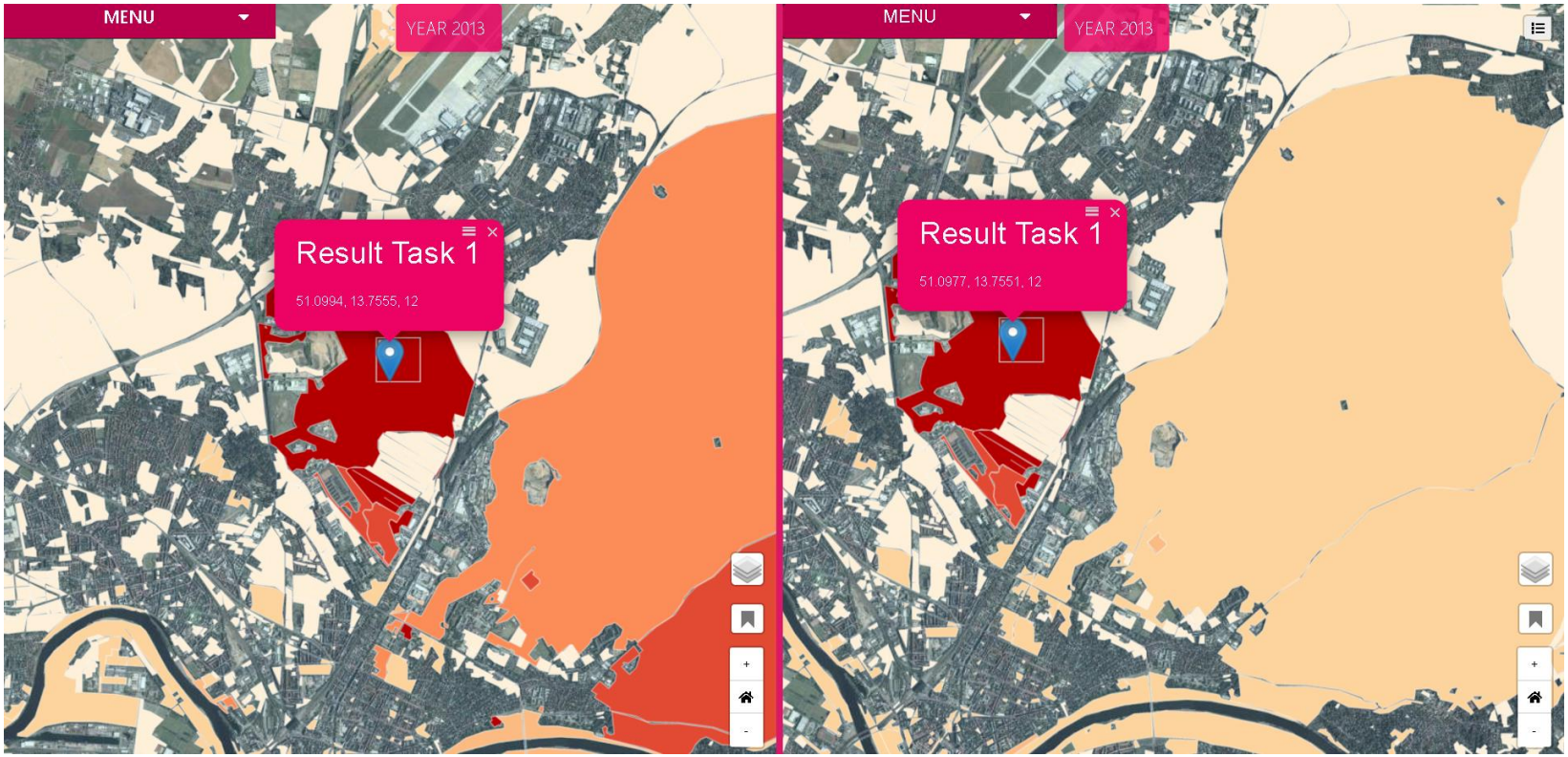
For the design of the survey, the case study titled “Monitoring the urban green spaces (UGSs) utilization pattern changes among the visitors." was considered.

There were 12 tasks in which all tasks were related to the comparison of the three facets.

Comparison of spatial facet

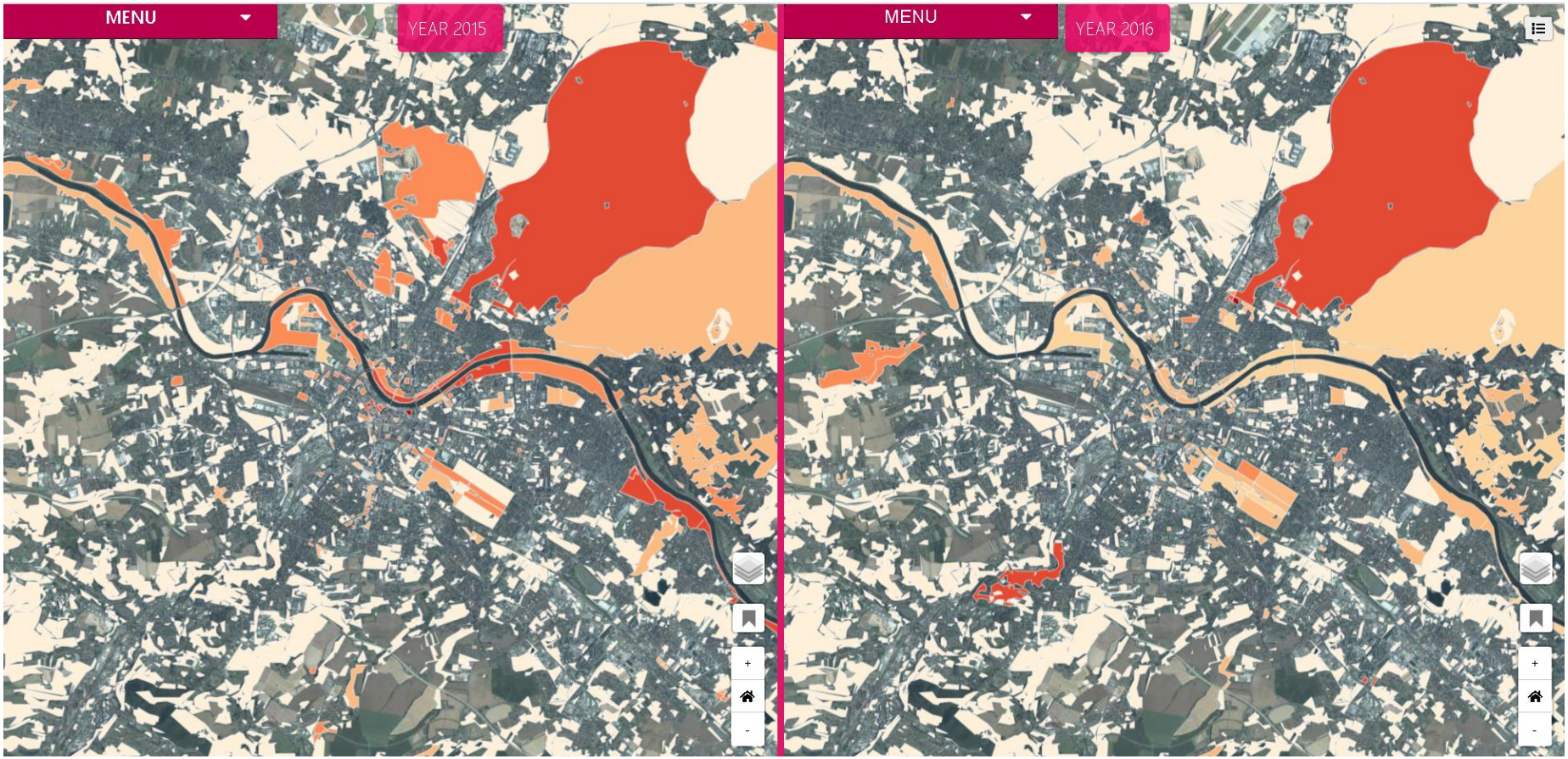
1. Find out if there are any green spaces that were highly frequented by Flickr users for both aesthetic appreciation and wildlife recreation activities.

(a). To do so, you will compare the popularity of urban green spaces for the aesthetic and wildlife of 2013.

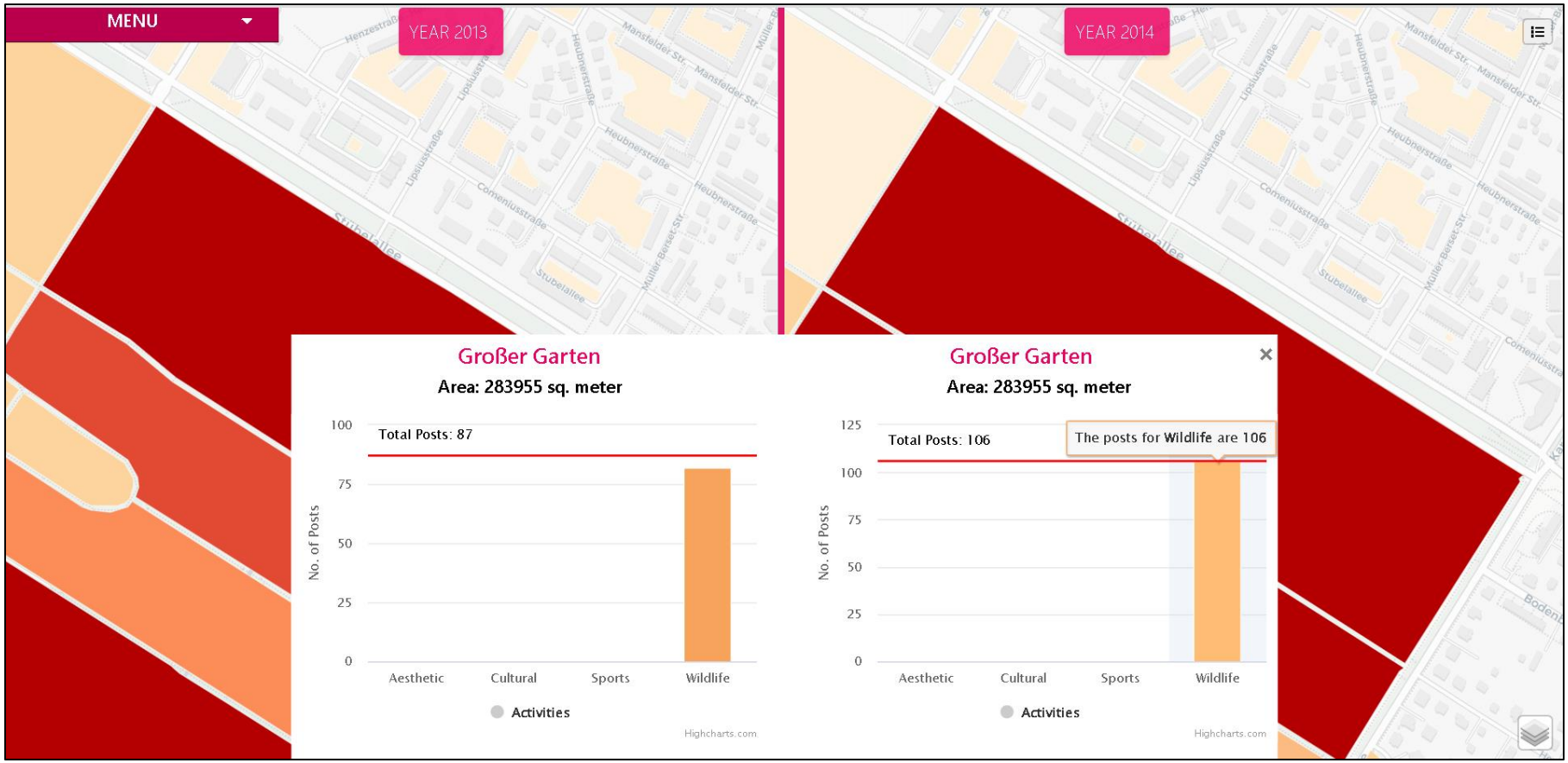


Comparison of temporal facet

Task 9 was to identify a year between two given years in which the urban green spaces near the riverbank were highly visited for aesthetic appreciation by Flickr users. The given years were 2015 and 2016 for the aesthetic expectation measure for the unlinked map views



Comparison of thematic facet



Task 12: find out one place which place was mostly visited for wildlife

(a). select the wildlife popularity from very high or high for 2013 and 2014.

Advantages and limitations

Advantages of Unlinked Map Views

- more freedom to choose random places for the left and right map view
- separate bookmark options to locate arbitrary places for both map views
- more opportunities to explore, compare and to know the insight data for the random places

Limitation of Unlinked Map Views

- select the attributes from a separate menu
- one more click need to collapse the menu during the comparison task
- open the bar charts separately require one more click for a specific place
- locating or navigating a particular place needs to do separately
- need more clicks to compare the data
- time-consuming for the data exploration and comparison

Advantages and limitations

Advantages of linked Map Views

- faster data comparison
- less time and click required for the data exploration and the comparison
- navigating a specific location for both views is incredibly faster
- linked bar charts make the comparison task very rapidly
- only one click is necessary to collapse the menu

Limitation of linked Map Views

- can not compare two different polygons bar charts together
- linked bookmarks can only bookmark in one side view (left map view)
- still needs separate hovering to see the data insight in the bar chars
- the left and right tab in the menu requires two clicks more to select the variables.
- years need to select separately for both views, but the year could be linked

Conclusion

- The developed prototypes can compare the three facets of the dataset used.
- Linked map views could compare data faster than unlinked map views.
- In addition, identified interaction methods played a significant role for both views.
- Therefore, the developed prototypes are presented as a powerful and functional means for comparing Flickr data in the scientific domain.
- The developed prototypes can be improved and usefully applied by urban landscape planners and in other cities.

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