Process Book COM-480

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1. Introduction

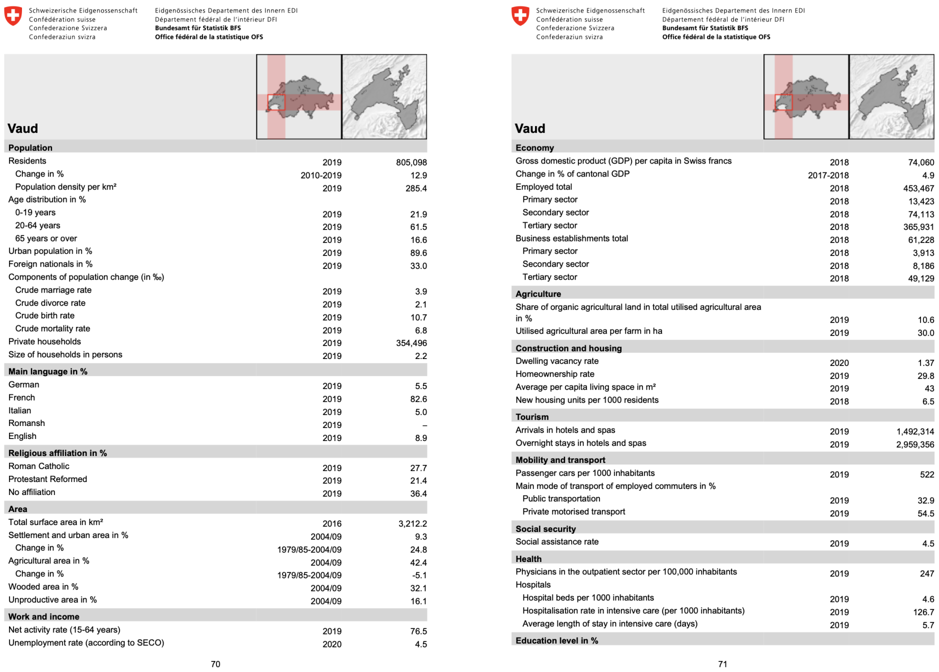
Our project, "Happiness Index Across Swiss Cantons," aims to explore regional variations in quality of life across Switzerland through a multi-dimensional, data-driven lens. We are not going to define happiness with a single metric, but rather to let users interactively explore relevant socio-economic factors and derive their own insights.

2. Path to the final result

2.1. Dataset

Our dataset is sourced from the Swiss Federal Statistical Office[1], which annually publishes key figures for each canton in PDF format from 2012 to 2021. These statistics offer a comprehensive and official overview of each canton across various dimensions, including population, economy, language, and more. This makes them a reliable foundation for our project.

Since our raw data is in PDF form, we used Python scripts to extract the key figures from these PDFs to create our dataset. Our processed dataset is in tsv form, which is easy for future use in the frontend.



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Vaud

Population		
Residents	2019	805,098
Change in %	2010-2019	12.9
Population density per km²	2019	285.4
Age distribution in %		
0-19 years	2019	21.9
20-64 years	2019	61.5
65 years or over	2019	16.6
Urban population in %	2019	89.6
Foreign nationals in %	2019	33.0
Components of population change (in ‰)		
Crude marriage rate	2019	3.9
Crude divorce rate	2019	2.1
Crude birth rate	2019	10.7
Crude mortality rate	2019	6.8
Private households	2019	354,496
Size of households in persons	2019	2.2
Main language in %		
German	2019	5.5
French	2019	82.6
Italian	2019	5.0
Romansh	2019	–
English	2019	8.9
Religious affiliation in %		
Roman Catholic	2019	27.7
Protestant Reformed	2019	21.4
No affiliation	2019	36.4
Area		
Total surface area in km²	2016	3,212.2
Settlement and urban area in %	2004/09	9.3
Change in %	1979/85-2004/09	24.8
Agricultural area in %	2004/09	42.4
Change in %	1979/85-2004/09	-5.1
Wooded area in %	2004/09	32.1
Unproductive area in %	2004/09	16.1
Work and income		
Net activity rate (15-64 years)	2019	76.5
Unemployment rate (according to SECO)	2020	4.5

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Vaud

Economy		
Gross domestic product (GDP) per capita in Swiss francs	2018	74,060
Change in % of cantonal GDP	2017-2018	4.9
Employed total	2018	453,467
Primary sector	2018	13,423
Secondary sector	2018	74,113
Tertiary sector	2018	365,931
Business establishments total	2018	61,228
Primary sector	2018	3,913
Secondary sector	2018	8,186
Tertiary sector	2018	49,129
Agriculture		
Share of organic agricultural land in total utilised agricultural area in %	2019	10.6
Utilised agricultural area per farm in ha	2019	30.0
Construction and housing		
Dwelling vacancy rate	2020	1.37
Homeownership rate	2019	29.8
Average per capita living space in m²	2019	43
New housing units per 1000 residents	2018	6.5
Tourism		
Arrivals in hotels and spas	2019	1,492,314
Overnight stays in hotels and spas	2019	2,959,356
Mobility and transport		
Passenger cars per 1000 inhabitants	2019	522
Main mode of transport of employed commuters in %		
Public transportation	2019	32.9
Private motorised transport	2019	54.5
Social security		
Social assistance rate	2019	4.5
Health		
Physicians in the outpatient sector per 100,000 inhabitants	2019	247
Hospitals		
Hospital beds per 1000 inhabitants	2019	4.6
Hospitalisation rate in intensive care (per 1000 inhabitants)	2019	126.7
Average length of stay in intensive care (days)	2019	5.7
Education level in %		

71

Figure 1: Statistics of Canton de Vaud in 2021 in our dataset

[1] https://www.bfs.admin.ch/bfs/en/home/statistics/regional-statistics/regional-portraits-key-figures/cantons.html

2.2. Visualization

2.2.1. Visualize Socio-Economic Indicators Across Cantons

A basic feature of our project, is to demonstrate the socio-economic indicators across cantons, such as GDP, population, language, etc. In our sketches, we planned to design an interactive Swiss map composed of cantons. When users use the mouse to hover over cantons, they could view summaries of the statistics of this canton. Our final implementation is in line with our design goals, as you can see in Figure 3. It is illustrating the population statistics in Canton of Bern in 2018. Rich statistics and clear demonstration are our strengths.

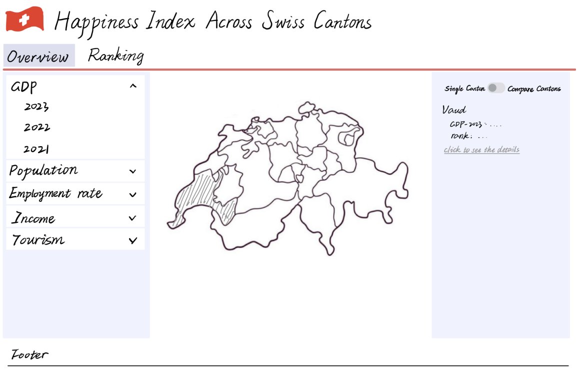
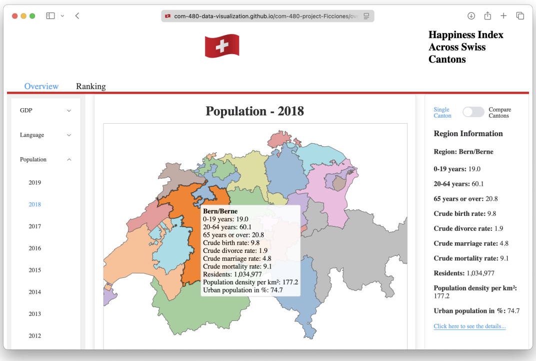


Figure 2: Sketch of socio-economic indicator page



Bern/Berne
0-19 years: 19.0
20-64 years: 60.1
65 years or over: 20.8
Crude birth rate: 9.8
Crude divorce rate: 1.9
Crude marriage rate: 4.8
Crude mortality rate: 9.1
Residents: 1,034,977
Population density per km²: 177.2
Urban population in %: 74.7

Region Information

Region: Bern/Berne

0-19 years: 19.0

20-64 years: 60.1

65 years or over: 20.8

Crude birth rate: 9.8

Crude divorce rate: 1.9

Crude marriage rate: 4.8

Crude mortality rate: 9.1

Residents: 1,034,977

Population density per km²: 177.2

Urban population in %: 74.7

Click here to see the details...

Figure 3: Our Implementation (Population, Bern, 2018)

2.2.2. Compare Statistics Between Cantons

We provide users the option to compare the statistics between two cantons, in order to have a closer look at key indicators. After switch on "Compare Cantons" button on the top-right corner, users can choose the indicator, and pick any two canton to start the comparison. Furthermore, we used bar charts to offer a direct illustration of the indicator. Our implementation has fulfilled the design goal, as is shown in Figure 4, 5.

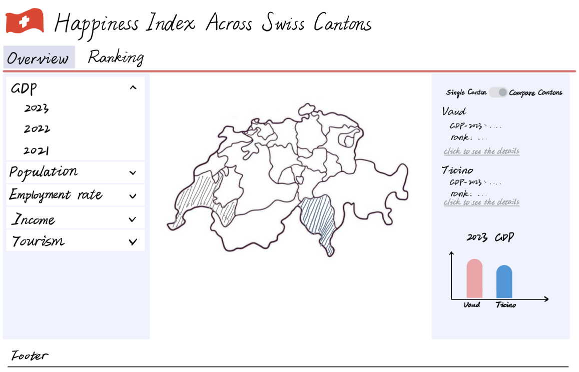
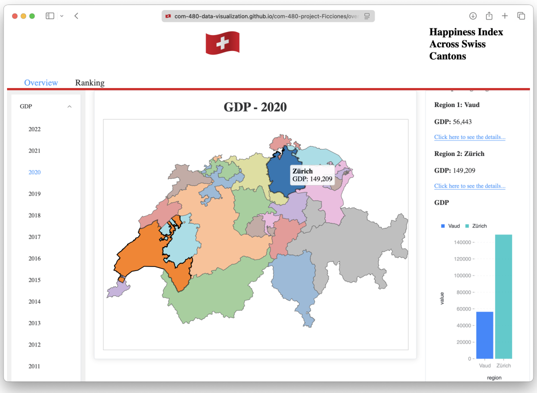


Figure 4: Sketch of indicator comparison



Zürich
GDP: 149,209

Region 1: Vaud

GDP: 56,443

Click here to see the details...

Region 2: Zürich

GDP: 149,209

Click here to see the details...

GDP

Figure 5: Our Implementation (GDP, Vaud, Zurich, 2020)

2.2.3. Visualize Trend Through Time

For a single canton, users can see the trend of selected indicator. For example, in Figure 7, we have the population percentage on speaking-language in canton of Fribourg. It is a perfect example demonstrating the magical charm of multi-lingual situation in Switzerland.

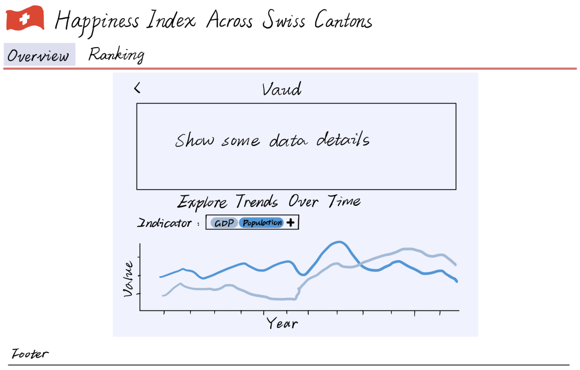
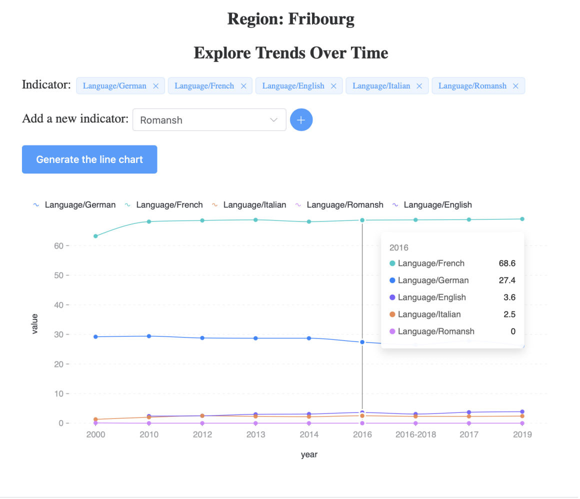


Figure 6: Sketch trend through time



Indicator: Language/German × Language/French × Language/English × Language/Italian × Language/Romansh ×

Add a new indicator: Romansh

2016
- Language/French 68.6
- Language/German 27.4
- Language/English 3.6
- Language/Italian 2.5
- Language/Romansh 0

Figure 7: Our Implementation (Fribourg, language)

2.2.4. Define Happiness Index Yourself

Happiness is highly subjective. The determining factor of happiness may vary significantly across people. As a result, we provide users the opportunity to define their own happiness index by assigning weights to indicators. And then we will display a dynamic "happiness ranking" of cantons based on user preferences. Each indicator is represented by a horizontal percentage bar (slider), visually indicating the current weight assigned to that factor. Users can drag the slider left or right to adjust how important that particular indicator is in their personal happiness definition.

As you can see in Figure 9, we defined several indicators and assigned the weights manually. And the website could provide a race chart to rank the cantons across the years, according to the indicators and the weights.

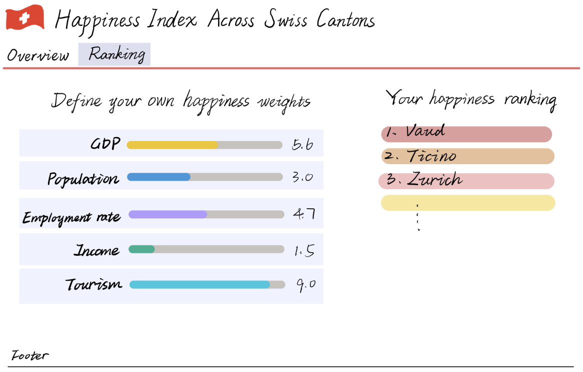
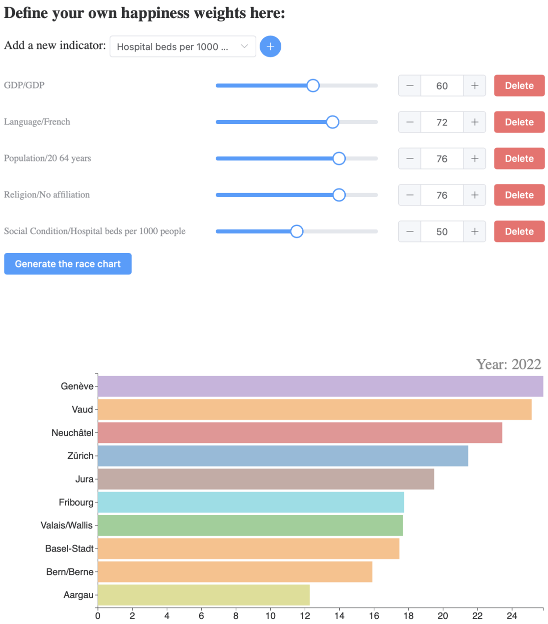


Figure 8: Sketch ranking of cantons


Define your own happiness weights here:

Add a new indicator: Hospital beds per 1000 ...

GDP/GDP	60	Delete
Language/French	72	Delete
Population/20 64 years	76	Delete
Religion/No affiliation	76	Delete
Social Condition/Hospital beds per 1000 people	50	Delete

Figure 9: Our Implementation of ranking

2.3. Technical tools

- **Vue.js + Vite** - For building interactive, component-based web interfaces.
- **Element Plus** - Provides ready-to-use UI components for consistent and responsive layouts.
- **AntV/G2** - Used to create high-quality interactive charts and comparison visualizations.
- **D3.js** — Powers our interactive geographic maps with fine-grained SVG manipulation and generates racing charts to visualize a customized rating system over time.

3. Challenges

One of the main challenges we encountered was integrating data from different perspectives. Some datasets were missing values for certain years, which affected the accuracy and consistency of the final visual comparisons, especially in ranking-based visualizations like the race chart. To address this, we filled in the missing entries by reusing the most recent available data from the previous year, allowing us to maintain continuity while minimizing distortion.

Another issue we faced was inconsistency in the naming of regions. For example, the canton "Zurich" appeared as both "Zurich" and "Zürich" across different sources. This discrepancy became particularly problematic when importing the GeoJSON map using D3.js, since the GeoJSON file uses German names. A mismatch between names and identifiers would cause rendering errors on the map. To solve this, we manually handle special cases when mapping region names to their corresponding IDs in the GeoJSON.

4. Miscellaneous

4.1. Peer Assessment

- Botu Lyu: Built the code framework, implemented the map and the region details page.
- Zhiyao Yan: Designed the UI prototype, implemented the Ranking module.
- Yi Ren: Frame the idea and the story, collect and preprocess the data, final fixes of the frontend.

4.2. Useful Links

- Course repository: https://github.com/com-480-data-visualization/com-480-project-Ficciones/
- Frontend repository: https://github.com/avgstuBoboge/dv-frontend
- Website link: https://com-480-data-visualization.github.io/com-480-project-Ficciones/
- Screecast video: https://www.youtube.com/watch?v=UDNeicv4vqg.