Environmental Explorations in Metro Melbourne
Info Viz Group 7

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1 Design Rationale

The target audience is the Victorian Department of Environment, Land, Water, and Planning. Note, permission was received from Alan to broaden the scope to Metro Melbourne, not just Melbourne CBD.

1.1 How to Use the Interface

The page is a single HTML page which contains rows for each topic, with each visualisation in the same row relating to each other. Hovering over the charts and clicking on the maps display additional information. The charts have accompanying filters, and the maps have simple buttons.

1.2 Layout of the Page

The first row (directly below the header) contains a series of summary statistics that are smaller than all of the main visualisations. These summary statistics correspond to each of the topics and visualisations further down the page, and introduce the topics to the user. This row provides an outline of our page.

Each of the rows under the summary statistics are the same size, with one sight line running down the middle of the page to split up the visualisations. Each visualisations is separated by a separating bar to clearly delineate visualisations and sections.

The first row provide an overview of waste management in Metro-Melbourne. The second row further investigates patterns in recycling management. The third row provides insights into energy usage and greenhouse emissions in Melbourne CBD.

1.3 Color Scheme

A neutral colour scheme was used, with grey, green, and yellow being the main colours. To ensure proper colour scales, ColorBrewer was used to select all colour schemes—sequential, diverging, and qualitative.

Green is often used to represent sustainability and environmental initiatives, so it was an intuitive choice for the waste data. Yellow is often used to represent recycling and energy data, which makes it an intuitive choice here as well.

1.4 Choice of Visualisations

The maps provide an exploratory and interactive interface for the data by region. Each of the charts explore the topics in depth and have more of a temporal focus.

The horizontal bar chart is a natural choice for quantitative data, such as tonnes of waste generated. The bars clearly indicate the levels of waste through the years, and are a simple visualisation to get the trends in the date across.

The two line charts are also natural choices for temporal data, with increases and decreases being very easily observed. The use of filling the area between the lines highlights the differences over time as well.

The polar area chart was used to demonstrate the part-to-whole relationship in the data among the sectors. This is further discussed in section 3.3.

1.5 Technical challenges

1.5.1 Data Research and Processing

The datasets used required pre-processing in order to get the data in a usable format for our visualisations. There were 2 waste datasets, which interacted with each other through backend javascript queries based on the specific needs of the visualisation.

1.5.2 Use of Filters and Responsive Charts

The choropleth map of waste data in Metro-Melbourne is connected to the two charts in the row below it. When a suburb is clicked on the map, the accompanying filter and charts beneath it also respond by only displaying the clicked suburb.

The waste chart on the first row also has a filter to filter the data by the type of waste generated. This drop down which contains more niche types of waste. For example, the user can see trends in mattress collection over the years.

The drop down menu for the polar area chart enables the user to select a particular year and further inspect relevant trends over time, again focusing on the temporal element. All of these filters enhance the data density of our visualisations and presents a more cohesive workflow throughout.

1.5.3 Use of External datasets

When a user clicks on the map, javascript is used to query and filter another dataset to get all of the waste data for the LGA that was clicked. This increases flexibility and extensibility of our tool. The same happens for selecting new values in the filter menus. A javascript function is run, and updates all of the maps with dependencies.

1.5.4 Geocoding & Reverse Geocoding

A MapBox Goecoder was added to the overview map to allow the user to enter a particular area of interest. This Geocoder has custom default text, zoom levels, and restricts results to Australia (with a preference to Victoria).

Reverse geocoding was used for the energy map. The data only contained the break down of the energy usage data, with no labels for the areas. Therefore, json query was built using the MapBox GL Geocoding API and the locality of the area clicked on was found and added as the title of the pop-up.

2 Discoveries in the data

2.1 Target User Group / Overview of Project

The target audience is the Victorian Department of Environment, Land, Water, and Planning whose goal is to creating a livable and sustainable Victoria with natural environments at the forefront. The project explores issues around sustainability through a temporal lens, particularly finding trends for insights into the future of sustainability in Victoria.

2.2 General Waste Management

As Victorians starts to realise the importance of recycling, initiatives have begun which mitigate the adverse effects of global warming. These environment-friendly patterns can be identified from our bar chart. Over the years, three main types of collected waste have increased substantially: commingled recycling, hard waste recovered, and organic green waste. Additionally, the amount of cardboard disposal has decreased over time.

2.3 Recycling Collected vs Processed

While this increase in recycling is positive, the percentage of recycling collected that is not processed has also increased. This means that there is recycling collected that still ends up in the land fill. This is shown in the data when Melbourne and Monash LGAs are compared. In Monash LGA the recycling processed has kept up with recycling collected. However in Melbourne LGA, the gap has grown.

2.4 Energy Consumption & Greenhouse Gas Emissions

What sticks out the most is that fuel-powered transportation emits the most greenhouse gasses in Melbourne CBD every year from 2013 to 2020. This shows the reliance Melbournians have on their cars.

Moreover, the emissions generated from manufacturing illustrate a decreasing trend over time, showing the loss of manufacturing in Melbourne. These emissions are still significant, with the manufacturing in the docklands consuming a high amount of energy.

Residential and commercial areas like Parkville, the CBD, and Docklands tend to consume more energy and generate more emissions. Thanks to Melbourne's emissions reduction plan, areas with more manufacturers, such as West Melbourne, tend to consume relatively less energy and generate less emission over time.

3 How the Tools Helps Discoveries

3.1 How the Layout & Design Help

The whole interface has been divided into symmetrical blocks to ensure easy navigation and to provide a neat and professional look to the page. The lines separating each visualisation help keep the page organized. There is one sight line running down the middle of the page, which also aids in this simplicity.

The colour scheme throughout the interface has been kept to shades that are intuitive for the topics. After experimenting with different colour hues, the final colour scheme was easiest on the eye. Saturation, hue, and opacity were all adjusted to aid in the aesthetics.

The interface also minimizes the data-ink ratio used for each visualisation. Unnecessary labels were removed from the maps, grid lines were removed from the charts, and filter values were hidden in a dropdown menu. All of this provides a cleaner look for the visualisation, and allows the user to more effectively understand the messages presented in the data.

3.2 Maps

For both maps, the viewing pattern was taken into consideration. The most important elements were in the top left, with the next important elements being in the top right, and least important towards the bottom. Because the top contained the added map features (Geocoder, title, etc.), the pop-ups were displayed closer the the bottom of the page in order to maintain symmetry.

The data was normalized before making the choropleth to ensure the highest areas of waste generation were accurate, and not skewed towards areas with highest population size. The normalization was done by using the average waste per household, opposed to the total waste. By taking advantage of pre-attentive processing, the choropleth used colour to quickly communicate the highest and lowest areas to the user

3.3 Charts

The bar and line charts relied on a straight forward approach to displaying the data to maintain simplicity. However the polar area chart was a more nuanced visualisation used to effectively communicate temporal changes.

Pie charts display higher values as a larger slice of the circle. It effectively communicates the proportion a particular sector makes up of total emissions. However in a polar area chart, each of the slices are equally sized. What changes is the magnitude, or length, of each of the slides.

This allows the user to see how much a particular sector changes from one year to the next. The scale is kept the same, and the length of each slice changes. The chart shows quantitative changes in a sector over time, instead of showing the proportion of the total emissions for each year.