IM942 Visualisation Foundations: Graphical Report

Chun-Wah Luk, David

Student ID: 2222991

Word count: 964

December 5, 2023

# IM942 Visualisation Foundations − Graphical Report
Australian wildfires 2019
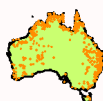
Total fires area
from 05/12/2019 to 05/01/2020

This visualization report of the 2019 Australian wildfires presents the incidents with different views. Under the main map with details of all fire areas, a sequence of small maps shows the progression of fires over the time. Moreover, a heatmap with day and night fire brightness and a line graph that estimates the change of fire size over time are shown.
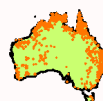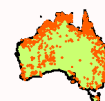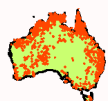
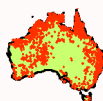Confidence level
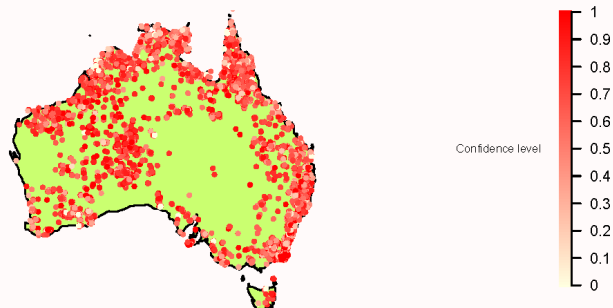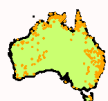
08/12/2019

12/12/2019

16/12/2019

20/12/2019

24/12/2019

28/12/2019

01/01/2020

05/01/2020
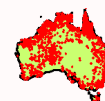
Heatmap of daytime and nighttime fire

Nighttime fire total brightness

Daytime fire total brightness
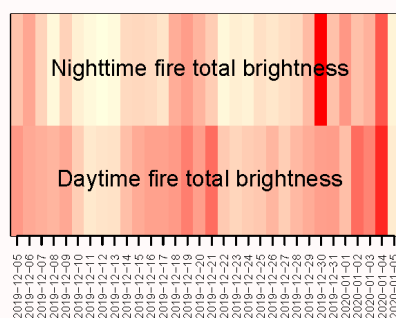
Total fire area per day calculated by scan and track
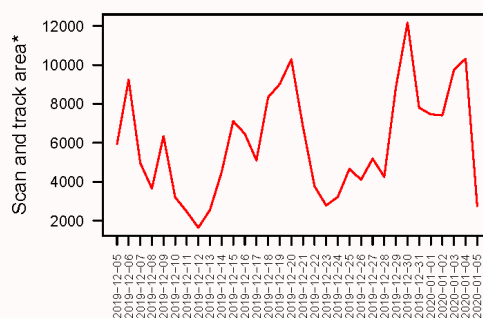
Scan and track area*

*With caution: The fire area are only estimated from MODIS 'scan' and 'track' data
It may be different from the actual size due to increasing pixels toward the edge.

Data Source: MODIS Collection 61 NRT Hotspot /
Active Fire Detections MCD14DL distributed from NASA FIRMS.
Available on-line https://earthdata.nasa.gov/firms. doi:10.5067/FIRMS/MODIS/MCD14DL.NRT.0061
R Core Team (2023). _R: A Language and Environment for Statistical Computing_. R
Foundation for Statistical Computing, Vienna, Austria. <https://www.R−project.org/>.

Figure 1: The Visualisation

1   Introduction

This infographic (Figure 1) presents a visualisation of the 2019 Australia wildfires. According to the news reported, 24 people died, 2,000 homes destroyed and more than 8.4m hectares has been burned from December 2019 to the first week of January. [1] This infographic aims to explore different aspects of this incident through data provided from NASA FIRMS.

2   Background

During the wildfire crisis, there is an artist called Anthony Hearsey who uploaded a visualisation of the Fire Hotspots Data in Australia (Figure 2), which went viral on the internet due to the 3D-like map was mistaken as a real photograph rather than a visualisation. According to the paper by L Suhardjono, this visualisation raised the concern of the balance between aesthetic dimension and the data accuracy. [2]
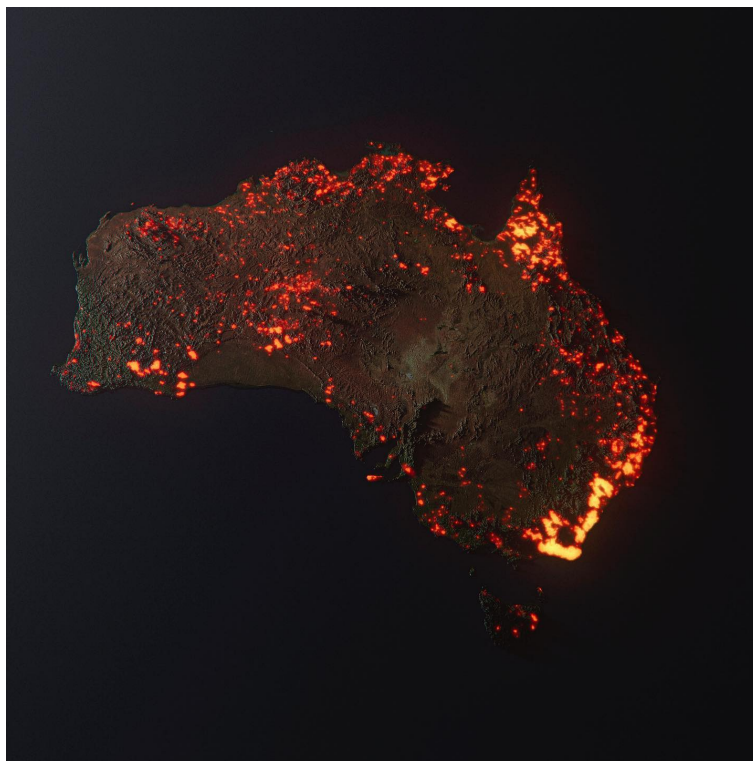
Figure 2: Fire Hotspots Data in Australia © Anthony Hearsey
(Source: https://www.instagram.com/p/B67bRtPnVzR/)

Therefore, during the process of redesigning the visualisation, the key question is: How to present the different dimensions of the data accurately? My approach is to explore the data and to present the accuracy through simple visualisation techniques. The main narrative is to tell the story straightforwardly, with minimalist principles in designing the visualisation.

3   Methodological framework of design

To address the question with my approach mentioned above, this task to re-design the visualisation can be considered as a case of problem-driven visualisation. Therefore, I studied the paper by Michael Sedlmair, Miriah Meyer and Tamara Munzner, who proposed an effective and methodological framework for problem-driven visualisation design. [3] This framework contains nine stages, which can classified into three categories: the Precondition phase with thinking what question to be solved before design; the Core phase with steps conducting the design; And the Analysis phase with focusing the analytical reasoning.

The framework provides lots of design guidelines for me to consider during the re-designing. Another key point of the framework is it mentions the steps are highly iterative. In fact, I spent lots of time on designing the layout of the infographic (Figure 3), which I kept back and forth between design stage and the winnow stage, in order to find the best presentation of data for my main objective, which is to present the data with different perspectives.
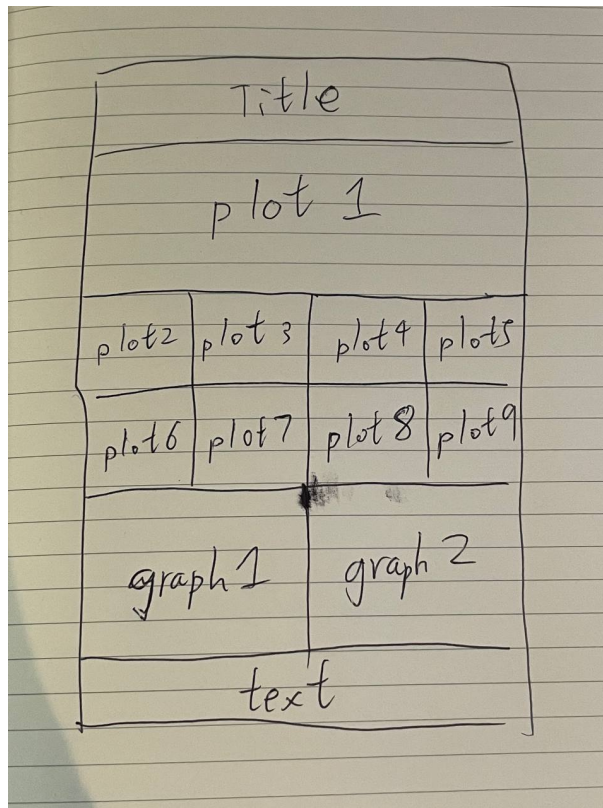

Figure 3: One of the draft I made for the layout

4 Methodology

First of all, I included a clear title at the top of the report. After that, I added a large map of Australia using R map package [4], presenting the total area affected by the wildfires. This is the most crucial part of the visualisation, as it captures viewers' attention once they look on the infographic. Other than those data points representing the location of the fire area, I added the colour range from light yellow to red for the points, indicating the confidence levels of detection process by Spectroradiometer [5], so viewers can understand the reliability of the fire identified. A brief description is provided on the left hand side of the main map to serve viewers to understand the context of this infographic.

Following the main map, I used the small multiple technique to show the accumulate fire areas from the start(05/12/2019) to the end of the time frame(05/01/2020). This is a very suitable technique to show changes over time, especially in this case of fire incidents.

I have also added two more graphs to present data beside geographical representations. The lower left one is a headmap [6], which illustrating the total fire brightness divided by daytime and night fires. This plot can translate and visualise the abstract concept of how serious of the fire, other than measured by area. The lower right one is a line graph displaying the total area affected by the fires, calculated by scan times track from the data provided. These two graphs emphasise the characteristics of the fire incident, providing extra information than displaying just through geographical plotting.

From the design aspect, I selected snow as background colour from R colour palette to have a visual contrast with the fire colour, which is in the range from light yellow to red. On the other hand, in the small multiples, the colour transits from orange to red over time, gives viewers the sense of fire progression in the visualisation.

All the above methodologies applied are based on one assumption, which is that the target audience of this visualisation are people without specialised background knowledge. We should be reminded that it is our responsibility to analyse the scientific data and present them in a way without misinterpretation, which is the issue caused by Anthony Hearsey's visualisation. I suggest this plain design can balance between data accuracy and aesthetic.

5 Critique of this visualisation

Though this infographic aims to provide a straightforward overview about the 2019 Australia wildfires, there are still some limitations of the design.

First of all, there is inherent limitation of the data from the data sources. As stated in [5], though the 'scan' and 'track' attributes of the dataset can represent the fire pixels, it may not be accurate due to the technical reason of spectroradiometer's viewing angles. I have added a note on the infographic to notice viewers of this potential misleading.

Moreover, the basic functions in R are insufficient to create a complex infographic. The approach I choose to include different type of plots and graphs is based on the reason to display various dimensions of the data. However, by only using basic R packages somehow failed to fulfil the task, in terms of layout flexibility for designer to adjust manually the positioning of plots and graphs.

6   Conclusion

The design of this infographic is based on the reflection of Anthony Hearsey's visualisation, which it somehow misled viewers into believing it was an actual photograph. Therefore, this visualisation aims to present the data simply and directly, which explores the possibility of such design can effectively deliver the message. Though by using R basic packages there are still some limitations of the presentation, we still demonstrated some valuable methodologies in this visualisation.

References

[1] N. Kommenda and J. Holder, "Visual guide: how australia's bush-fires are raging across the country," *The Guardian*, 01 2020. [Online]. Available: https://www.theguardian.com/australia-news/2020/jan/07/visual-guide-see-how-australias-bushfires-are-raging-across-the-country

[2] L. Suhardjono, A. Oscario, L. Luzar, and B. Sriherlambang, "Infographie, data visualization, and the danger of reality distortion: The case study of australia fire 2020," *IOP Conference Series: Earth and Environmental Science*, vol. 729, p. 012127, 04 2021.

[3] M. Sedlmair, M. Meyer, and T. Munzner, "Design study methodology: Reflections from the trenches and the stacks," *IEEE Transactions on Visualization and Computer Graphics*, vol. 18, pp. 2431–2440, 12 2012.

[4] "Package 'maps' title draw geographical maps," 2018. [Online]. Available: https://cran.r-project.org/web/packages/maps/maps.pdf

[5] N. Earth Science Data Systems, "Earthdata," Earthdata. [Online]. Available: https://www.earthdata.nasa.gov/learn/find-data/near-real-time/firms/mcd14dl-nrt#ed-firms-attributes

[6] "heatmap function - rdocumentation," www.rdocumentation.org. [Online]. Available: https://www.rdocumentation.org/packages/stats/versions/3.6.2/topics/heatmap