Redesigning Climate Risk Heatmap for Improved User Experience

By: Gbemisayo Adelaja

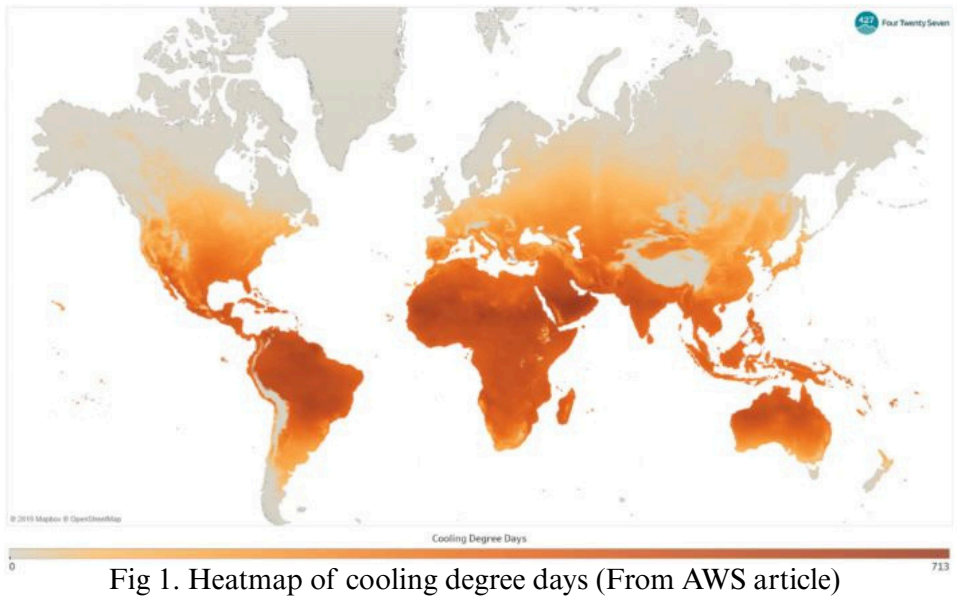

Fig 1. Heatmap of cooling degree days (From AWS article)

Critique of the Original Visualization

The original AWS heatmap showed CDD across regions. It lacked **color contrast**, **geographic markers** and **metadata**. it had no interactivity or legend which **reduced accessibility**. The original dataset was not found which violated **FAIR principles** (transparency, reusability, interpretability).

Theory: Visualization Principles and FAIR Framework

Heatmaps: Show spatial/scalar patterns (Munzner, 2014, p. 145).
Snake race bar charts: Highlight temporal trends (p. 125).
Radial bar charts: Emphasize cyclical data (p. 130).
All support FAIR goals: **clarity**, **metadata**, and **accessibility** (Wilkinson et al., 2016).

Research: Role of LLMs in Visualization Accessibility

LLMs help **non-experts** interpret data visuals (Choe et al., 2024).
Tooltips reduce cognitive load and improve understanding (Ware, 2012).
Supports **inclusivity** and informed **decision-making.**

Tools Used

Used Python libraries: pandas, numpy, plotly.
Simulated data due to lack of original dataset.
Chose Python over QuickSight for better **flexibility** and **customization.**

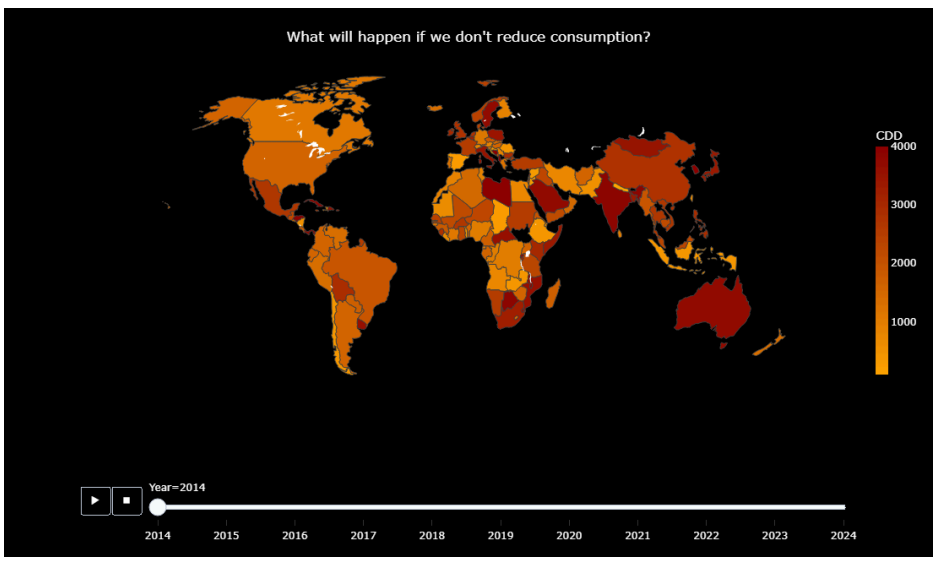

Fig 2. Heatmap redesigned (created using python code)

Final Redesign Explanation

The redesigned Heatmap improved the **contrast** between the colors. There is an **interactive** hover for data values. It has an **animation** control which allows the viewers to play the video and see changes over the years. They have **LLM-guided tooltips** that off real-time explanations. This enhances **user engagement**, **accessibility** and **climate data insight.**

Additional Visualizations

Based on the type of data (**Quantitative and Categorical**), here are other ways to visualize the data that can also help improve interpretability of the data. The **snake race bar chart** shows animated CDD rankings by year while the **radial bar chart** shows seasonal changes. They also have similar interactive feature with the Heatmap.

The target audience for the redesign is the general public

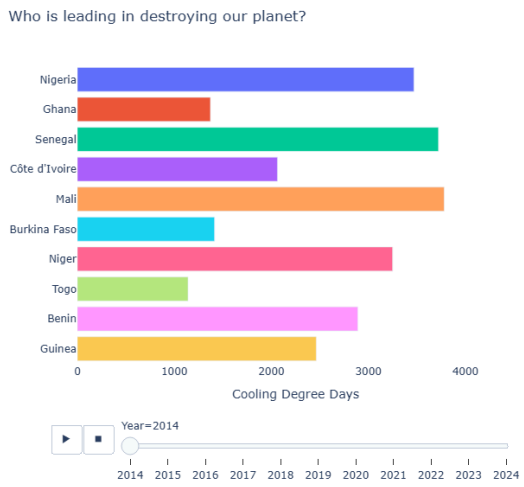

Fig 3. Snake race bar chart (python code)

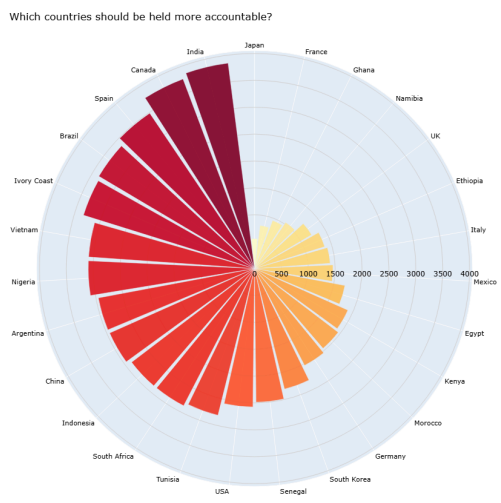

Fig 4. Radial chart (python code)

Sustainable Development Goal

This project improves the accessibility of climate data visualizations, supporting informed action against climate change by making critical information clearer and more inclusive (United Nations, 2015).

Fig 5. Sustainable development goal logo (gotten from their website)

Future Research

Inspired by the Zhouzhuang Mystery of Life Museum, future research proposes redesigning anatomical exhibits into an immersive AR experience with multilingual support, promoting ethical, accessible, and community-based learning.

Fig 6. image taken at the Zhouzhang Mystery of Life Museum

Disclaimer: Course project for INFOSCI 301–Data Visualization and Information Aesthetics, instructed by Prof. Luyao Zhang at Duke Kunshan University, Spring 2025.
GitHub link: https://github.com/Gbemisayo1/Re-design
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