Necklace Map

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Background – Necklace Map

Combines elements of proportional symbol maps and boundary labeling

- Adds visual weight to quantitative variables
- Great for densely populated area
- Preserves geographic association

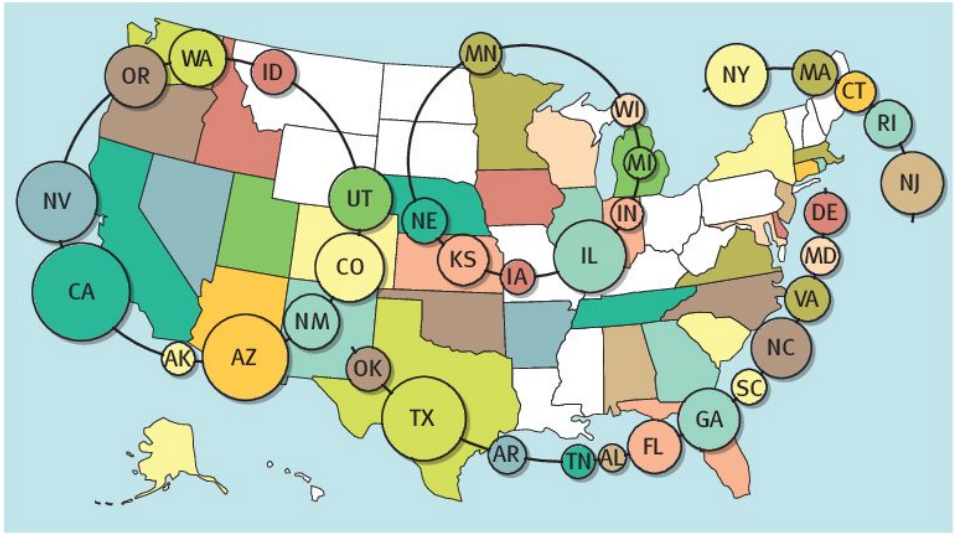


Fig 1. Bettina Speckmann and Kevin Verbeek. Necklace maps. IEEE Trans. Vis. Comput. Graph., 16(6):881–889, 2010.

Scope – Extension to the Necklace Map Algorithm

- Interactive Environment
  - User’s Selection of Countries
  - User’s Selection of Dataset
- Dynamic Necklace Generation
  - Generate necklace around selected countries
- Multiple-Necklace Display
  - Visualize multiple variables with concentric necklaces

Dataset – Our World in Data

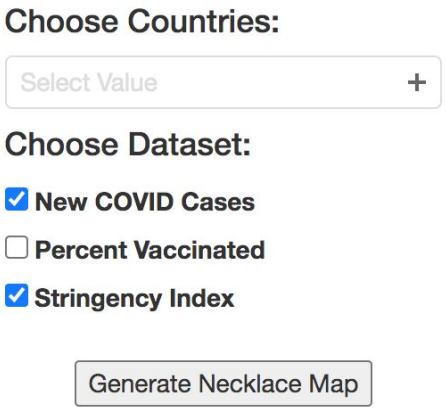
Following variables for each country

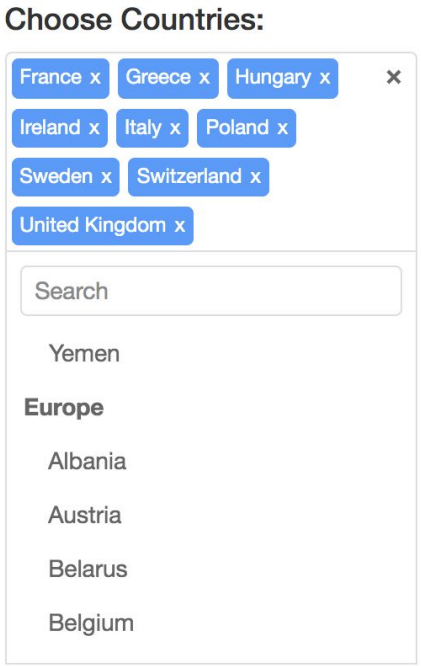
- Confirmed COVID-19 Cases
  - Case count per million
- Vaccination Rates
  - Percentage of vaccinated people
  - Both partially and fully vaccinated
- Stringency Index
  - An index (0-100) measuring how strict the response policy is
  - Calculated based on: Containment and closure policies; Economic policies; Health system policies; Vaccination policies and Miscellaneous policies

Task Abstraction

- Look Up: e.g. specific data of certain country
- Compare: e.g. comparison of vaccination rates between countries
- Discover Trends: e.g. patterns between case number necklace and stringency index necklace

Implementation – User Interaction



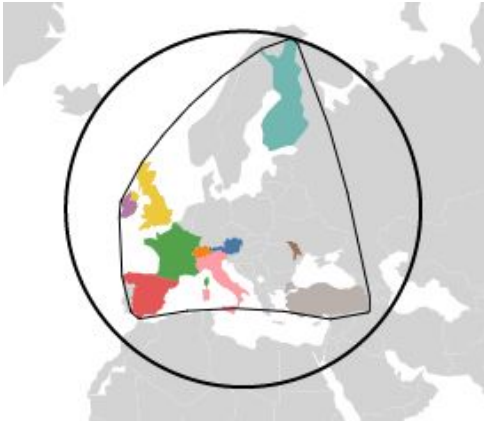


Users must:

- Choose countries by searching or scrolling through the list
- Choose the data variable(s) to be displayed on the necklace(s)
- Click on “Generate Necklace Map” button to display the necklace map

Implementation – Necklace Generation

1. Find the convex hull of all selected countries
2. Based on the convex hull and the geometric center, determine the radius of innermost necklace
3. Calculate the radii of remaining necklaces based on the maximum marker size



Implementation – Marker Size

Same method used in the Necklace Map paper

1. Calculate feasible intervals for each country
2. Define radius of marker: $z_i' = asin(\frac{\rho\sqrt{z_i}}{r})$
3. Find rho that maximize size of the markers such that each marker is still within the feasible intervals

Fig 5. Bettina Speckmann and Kevin Verbeek. Necklace maps. IEEE Trans. Vis. Comput. Graph., 16(6):881–889, 2010.

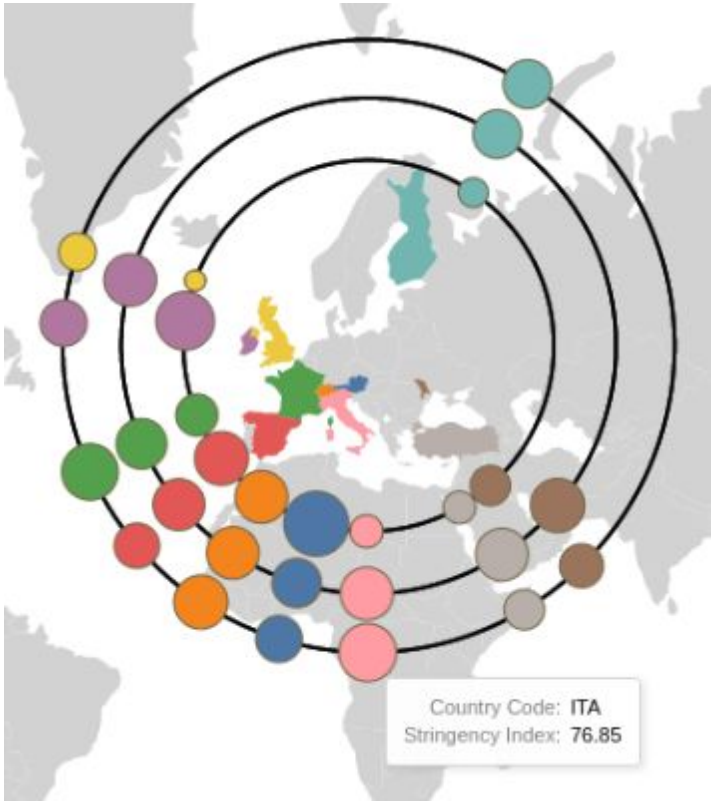
Implementation – Marker Position

Same method used in the Necklace Map paper

- Repelling force between markers
  - $Frep(i) = f_r(\frac{1}{d_i} - \frac{1}{d_{i+1}})$
- Centering force for each markers
  - Use middle point of each feasible interval as reference
  - $F_{mid}(i) = f_m(m_i - \alpha_i)$
- Minimize the total force for each marker
- f_r and f_m are coefficients to be tuned

Results/Evaluation

- Maximum of 3 necklaces, each representing a variable from the dataset
- Hover over the markers or the countries to view the precise data
- Complete within a few seconds



Future Direction

- Potentially more debugging
- Irregularly-shaped necklace
- Separate selected countries into clusters before drawing the necklaces
- Performance optimization

Questions…