

# Quantitative Comparison of Treemap Techniques for Time-Dependent Hierarchies

E.F. Vernier<sup>1</sup>, J.L.D. Comba<sup>1</sup> and A.C. Telea<sup>2</sup>

<sup>1</sup>Federal University of Rio Grande do Sul, Brazil

<sup>2</sup>University of Groningen, The Netherlands

## Introduction

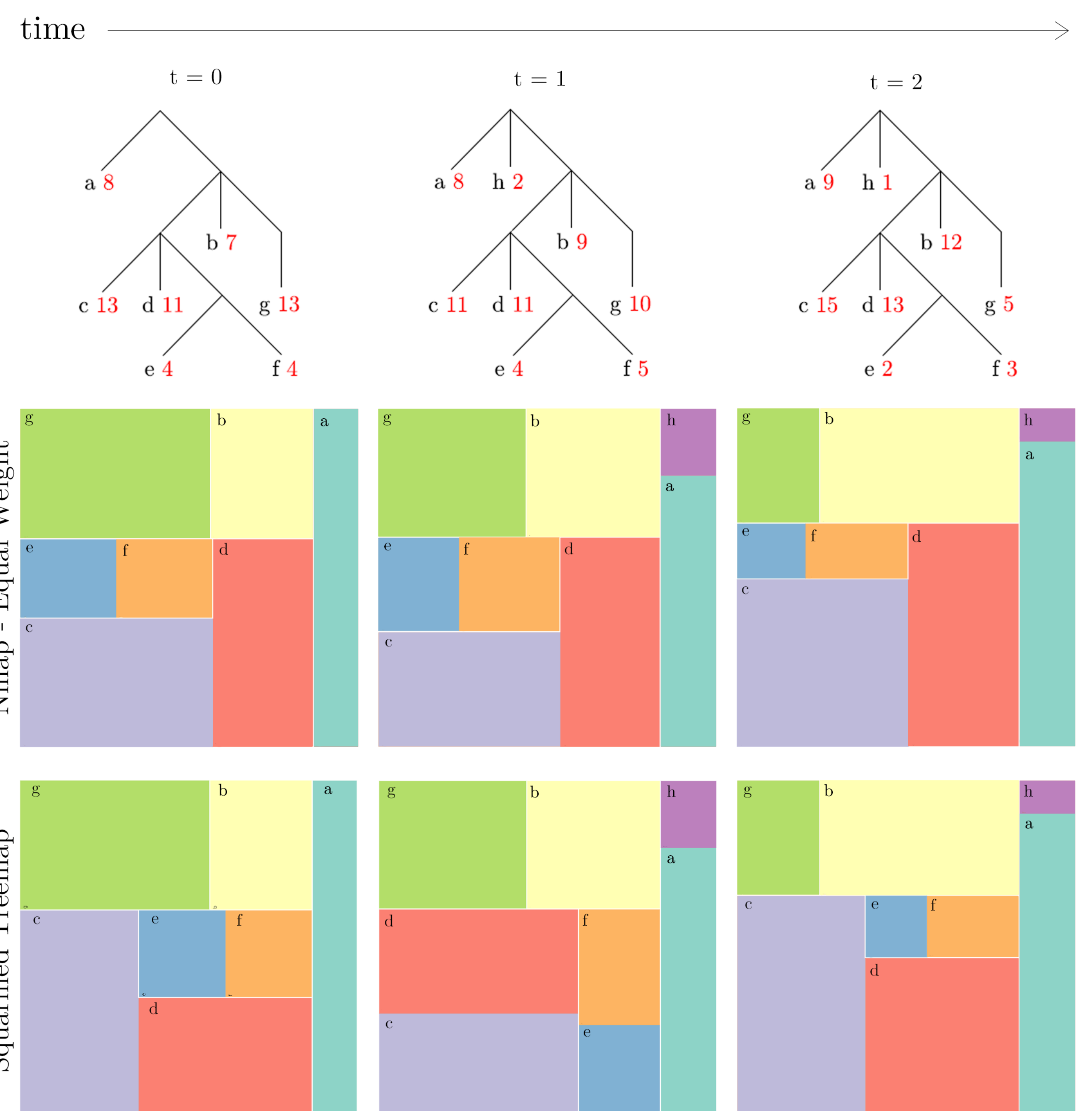
- Treemaps are popular space-filling methods for display of hierarchical data.
- Different treemapping techniques are optimized for different objectives (e.g., aspect ratio, preserve dataset order, semantic grouping).
- These objectives tend to introduce layout instability when dealing with dynamic datasets, affecting user performance in analytical tasks.
- **Dynamic treemaps:** we want to ensure good cell aspect ratios and an amount of layout change that reflects well the amount of data change.
- **Contribution:** we compare four treemap methods on several real-world dynamic hierarchies and measure cell aspect ratio and stability.

## Metrics

- $d_E$  - Euclidean distance travelled by cell center between consecutive time moments.
- $d_A$  - Average aspect ratio of cells, including non-leaf nodes.

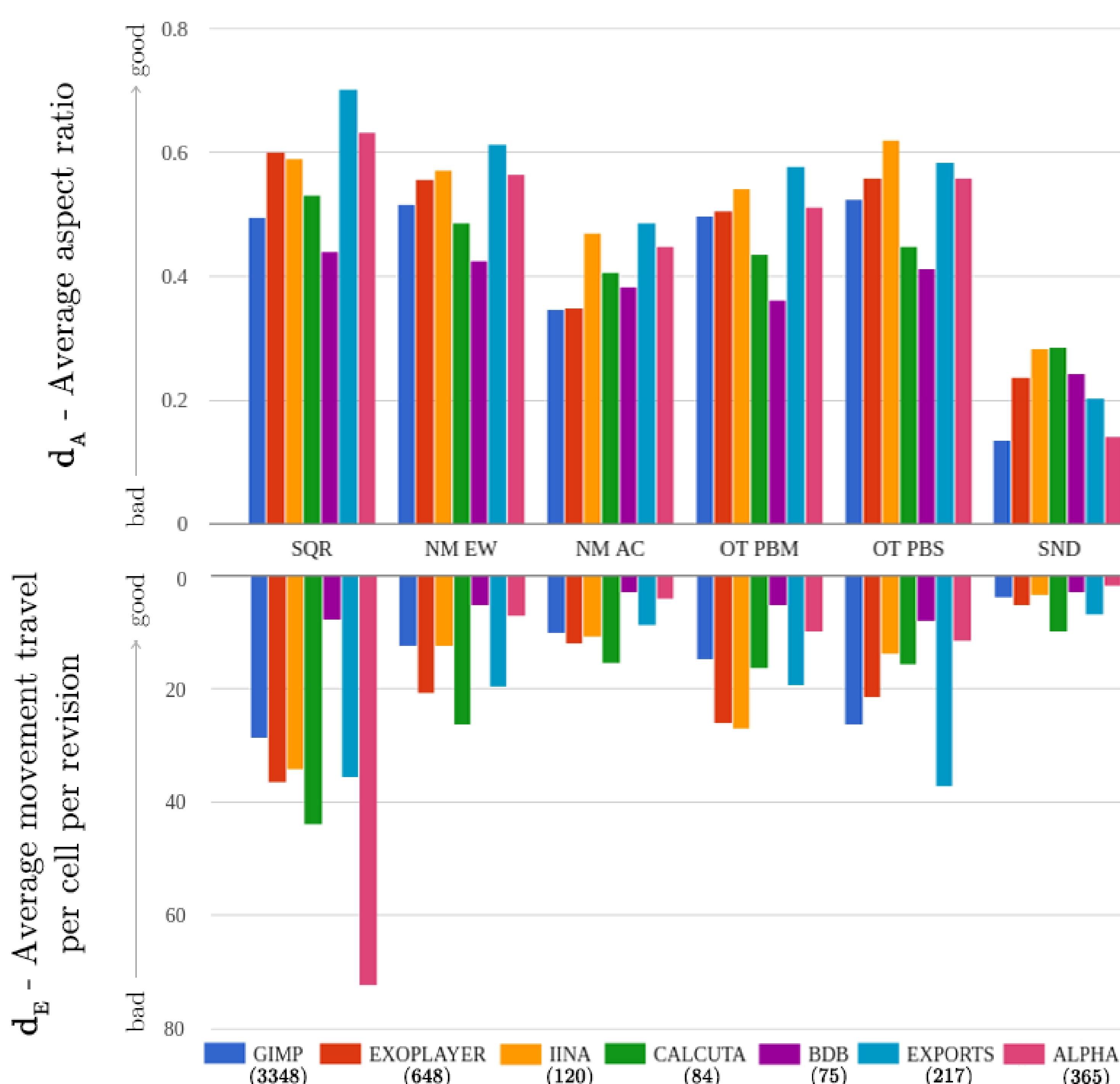
## Techniques

- Slice-and-dice (SND) [1]
- Squarified treemap (SQR) [2]
- Ordered treemap [3]
  - Pivot-by-Middle (OT PBM)
  - Pivot-by-Size (OT PBS)
- Nmap [4]
  - Alternate Cut (NM AC)
  - Equal Weight (NM EW)



Layouts generated by squarified treemaps and Nmap EW demonstrating the visual confusion generated by unstable cell arrangements on a simple time-dependent hierarchical dataset.

## Results



Results generated by running the techniques on 7 real life datasets. The number of leaf nodes in each hierarchy is shown between parentheses.

## Findings

- In one end of the spectrum we have squarified treemaps: best aspect ratios, but large layout instability.
- On the other end we have slice-and-dice: very stable layouts, but poor aspect ratios.
- Compromise: Ordered treemaps and Nmap both offer a good trade-off between aspect ratios and temporal stability.
- **Main result:** Nmap — which was not designed, nor promoted, as a dynamic hierarchy visualization technique — is a **more suitable method for showing dynamic hierarchical datasets than the current state-of-the-art technique** in this context, ordered treemaps.

## Main References

- [1] SHNEIDERMAN B.: Tree visualization with tree-maps: 2-d space-filling approach. ACM Trans. Graph. 11, 1 (Jan. 1992), 92–99
- [2] BRULS M., HUIZING K., VAN WIJK J.: Squarified treemaps. In Proceedings of the Joint Eurographics and IEEE TCVG Symposium on Visualization (1999), Press, pp. 33–42. 1
- [3] SHNEIDERMAN B., WATTENBERG M.: Ordered treemap layouts. In Proceedings of the IEEE Symposium on Information Visualization 2001 (INFOVIS'01) (Washington, DC, USA, 2001), INFOVIS '01, IEEE Computer Society, pp. 73–. 1
- [4] DUARTE F. S. L. G., SIKANSI F., FATORE F. M., FADEL S. G., PAULOVIH F. V.: Nmap: A novel neighbourhood preservation space-filling algorithm. IEEE Transactions on Visualization and Computer Graphics 20, 12 (Dec 2014), 2063–2071. 1