A Design Space for Static Visualizations with Several Orders of Magnitude

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How we can effectively visualize values with several orders of magnitude in a single view?

The scope of our study is to explore the design space for visualizing data that spans several orders of magnitude by decomposing the **OMVs** into **mantissa** and **exponent**.

What is Order of Magnitude Values (OMVs)?

Quantitative attributes that span four or more orders of magnitude (e.g., from thousands to billions).

Common in domains such as:

Financial · Social · Environmental · Science

Lin and Log scales are not effective for OMVs

With linear scales smaller magnitudes are visually lost.

Log scales can be misleading for the general public.

Decomposing OMVs

Similarly with scientific notation:

$$OMV = mantissa \times 10^{exponent}$$
$$25\,000 = 2.5 \times 10^{4}$$

Studies [1, 2, 3] have shown that decomposing OMVs into their mantissa and exponent components and visualizing them separately can be effective.

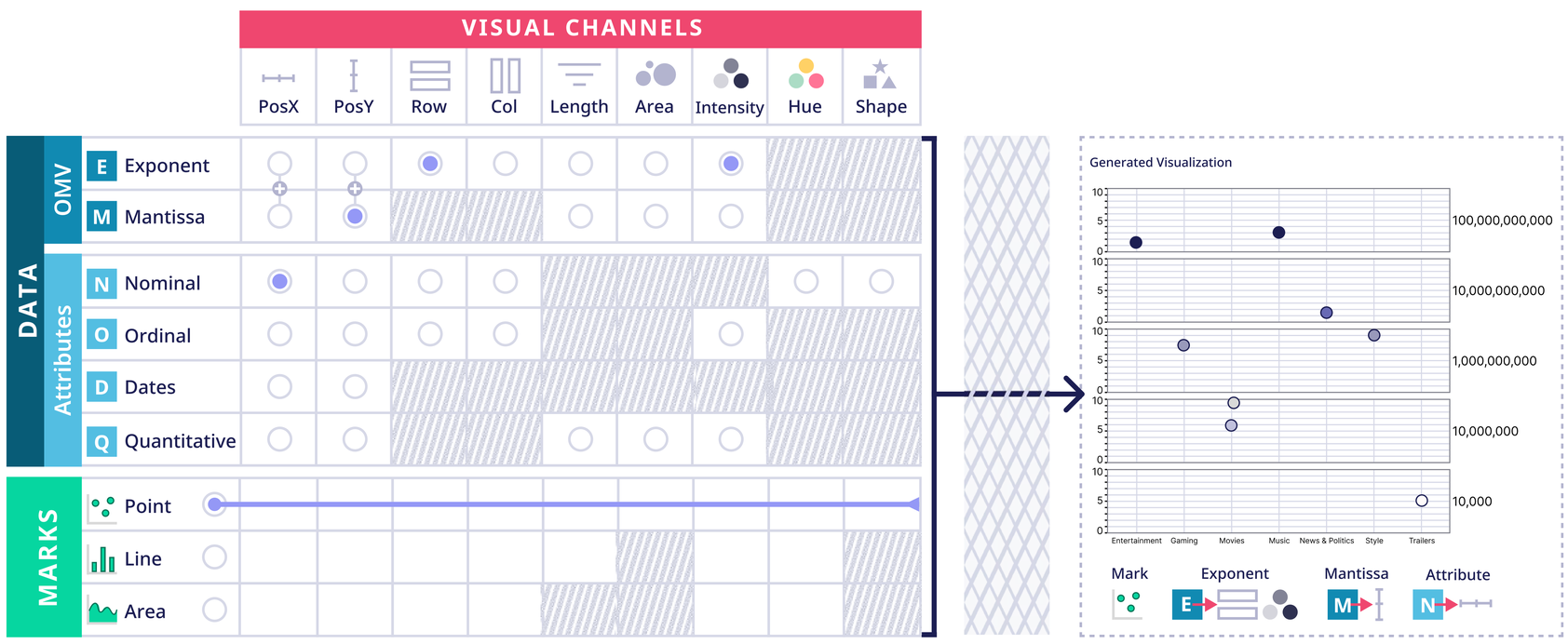
DESIGN SPACE

Dimensions

- DATA
- MARKS
- VISUAL CHANNELS

Constraints

- Expressiveness of channels
- Type of Mark
- Interference effects



1. Choice of **Mark**
2. Assignment of **Visual Channels** to **Exponent**, **Mantissa**, and other types of **data attributes**.
3. Check for integrity constraints
4. Visualization Creation

Examples

METHODOLOGY

1 DESCRIBE AND REFINE

We started from the original design space described by the Grammar of Graphics.

We refined it by enforcing integrity constraints from the visualization literature.

2 EXPLORE AND GENERATE

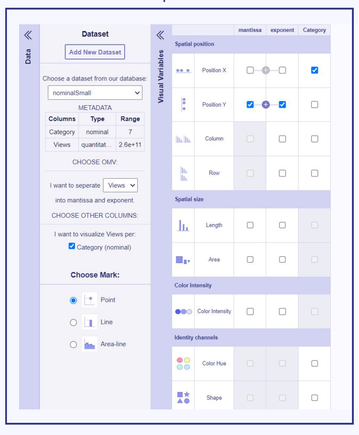
We developed OMVis, a tool for interactively exploring and generating visualizations based on the combination of different dimensions, taking into consideration the defined constraints.

3 NEXT STEPS: EVALUATE

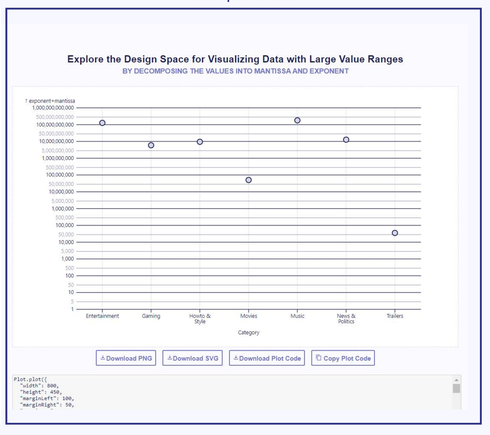
We plan to evaluate the generated visualizations both qualitatively and quantitatively, aiming to propose guidelines for the effective visualization of OMVs.

OMVis Tool

Component 1



Component 2



Component 1: Data management, mark selection and assignment of visual variables to data attributes, Component 2: Visualization and exporting options

REFERENCES

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Learn more about our project:

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