Creation of the component graph

We hereby show the creation of our component graph with edges indicating the relationship between each component in a stepwise manner. We start by extracting all components with their low-level characteristics from the dashboard before showing the effect of filtering/highlighting through interacting with each component.

Extract all components

First, we extracted all components from our exemplary use case scenario using the "New Hires" dashboard provided by Microsoft Power BI. We have uploaded the interactive dashboard to our OSF project. The dashboard consists of six components: ▼ one global filter, ↕ two key performance indicators (KPI), ▥ two bar charts and ⌁ one line chart, see Figure 1.
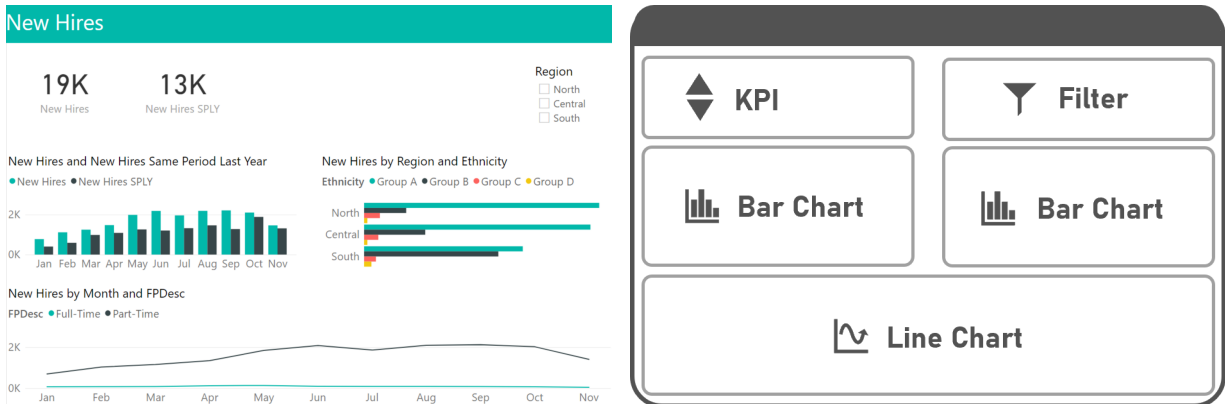

Figure 1: "New Hires" dashboard from
Microsoft Power BI

(a) "New Hires" dashboard   (b) Schematic representation from the dashboard

Figure 1: Example dashboard using the "new hires" data. (a) represents the actual interactive dashboard created and (b) the schematic representation highlighting the six components

As already outlined in our paper (Figure 3), the six components with their low-level characteristics can be extracted first without any relationship (Figure 2).
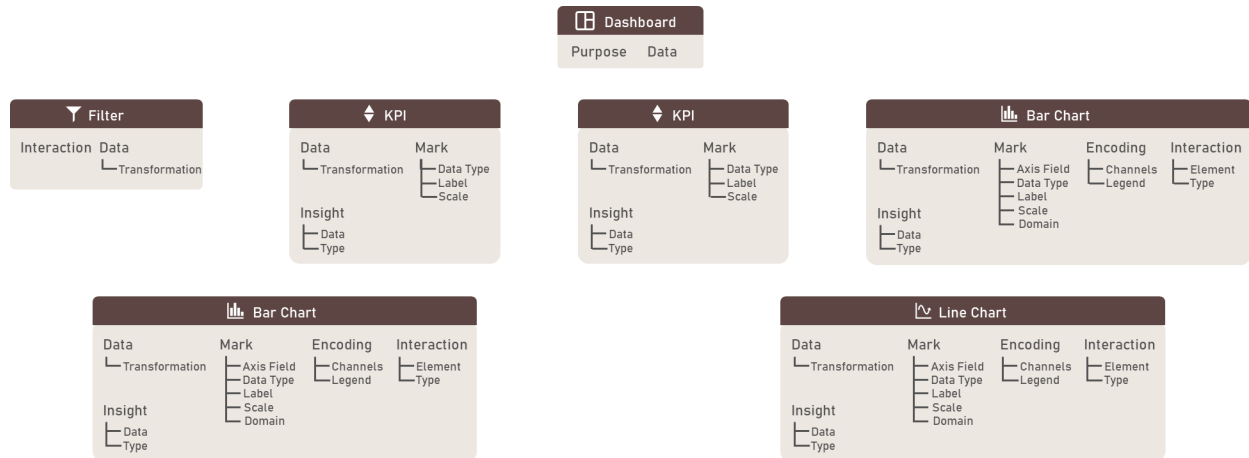
Figure 2: Component graph without relationships for the example dashboard

Connect the components through edges at a high level

We started by demonstrating the influence of each component on the others using edges connecting the components. We first connected the **dashboard** to all components as it includes the data. For the sake of completeness, we have added the influence of the dashboard on all the other components, however, we do not consider the dashboard as an actual influencing factor as the data is presumed to be provided in advance and cannot be changed by neither the author nor the user.
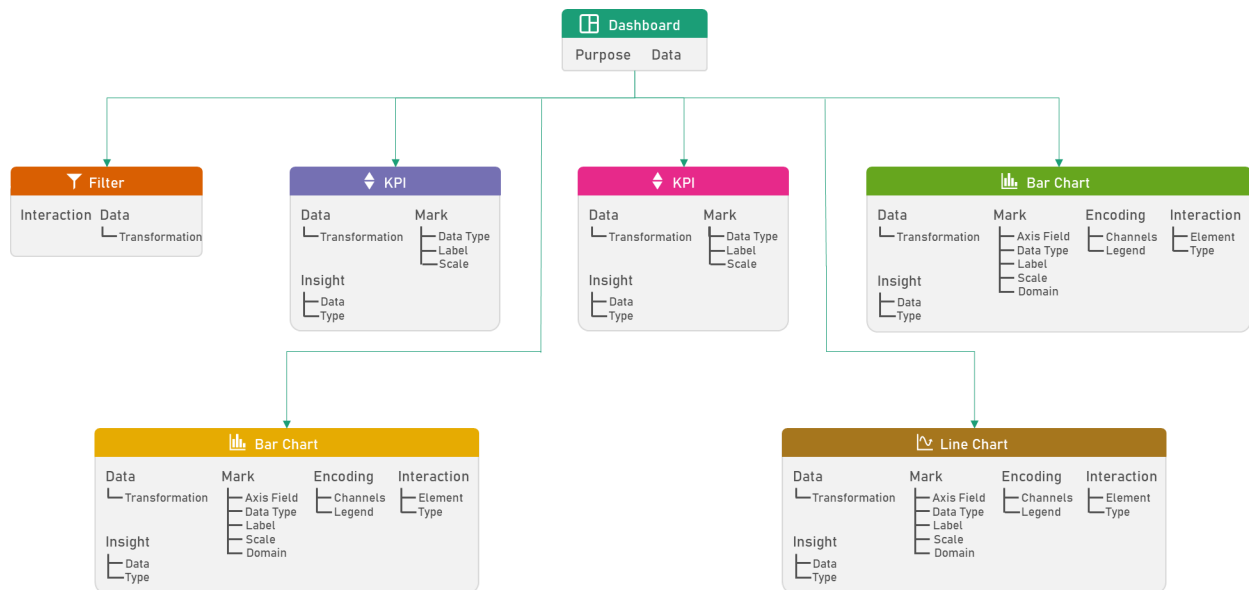

Figure 3: Influence of the dashboard (data) on the other visuals

We continued by indicating the influence of a filtering or highlighting effect in a generalized way without explicitly showing the effect on the low-level characteristics. As no interaction on the KPI visual was supported, no edges can be drawn from them to other visuals. However, the global filter, the bar chart, and the line chart affects almost all other visuals, see Figure 4 (a)-(d).

(a) Influence of global filter
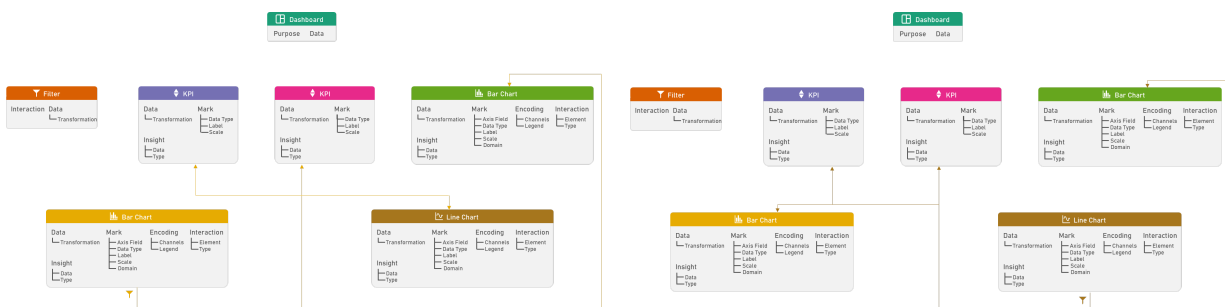
(b) Influence of bar chart

Figure 4: Overview of filtering for each component on a high-level abstraction

(c) Influence of bar chart

(d) Influence of line chart

Figure 4: Overview of filtering for each component on a high-level abstraction

When combining all filter effects, we end up with the following component graph.
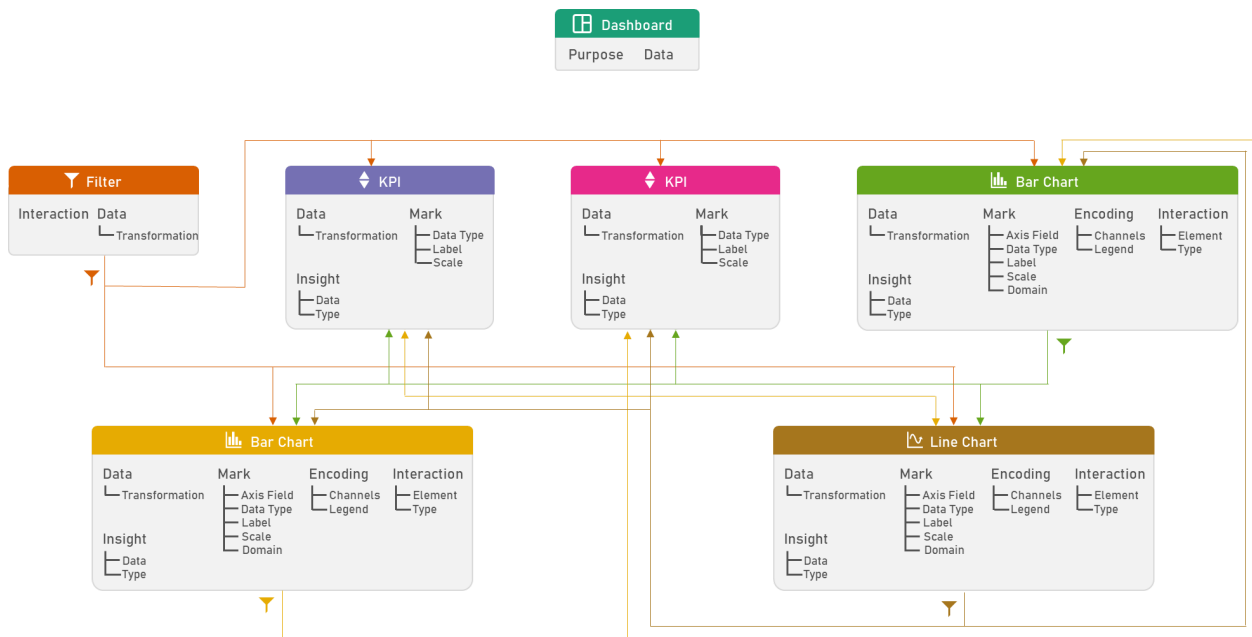
Figure 5: Relational component graph at a high level of detail

Add influence on low-level characteristics

This graph gives a good overview of how each component is related to each other. However, it does not yet reflect the effect of e.g., the filter interaction on the low-level components, such as data, mark, or insight. Thus, we have revised the influences of each component and highlighted in the respective components' color the influence, see Figure 6 (a)-(d).

(a) Influence of global filter

(b) Influence of bar chart
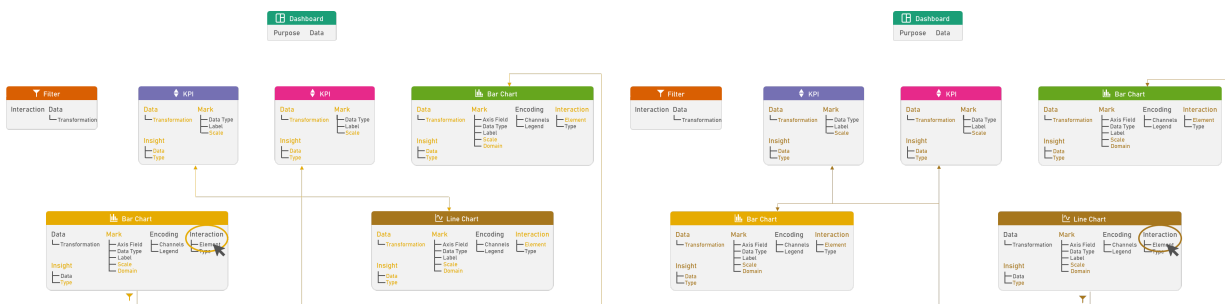
(c) Influence of bar chart

(d) Influence of line chart

Figure 6: Overview of filtering each component considering the effect on low-level characteristics

Figure 6: Overview of filtering each component considering the effect on low-level characteristics

Consequently, when combining all four models, the effect of each interaction becomes apparent, see Figure 7. It has to be said that we have tried to keep the visual clutter at its minimum as this model is still a simplified version of the relational component graph. It highlights the effect of filtering through keeping the edges visible and affected low-level characteristics are highlighted. *Note*: Non-affected low-level characteristics are displayed in smaller font and in light gray.
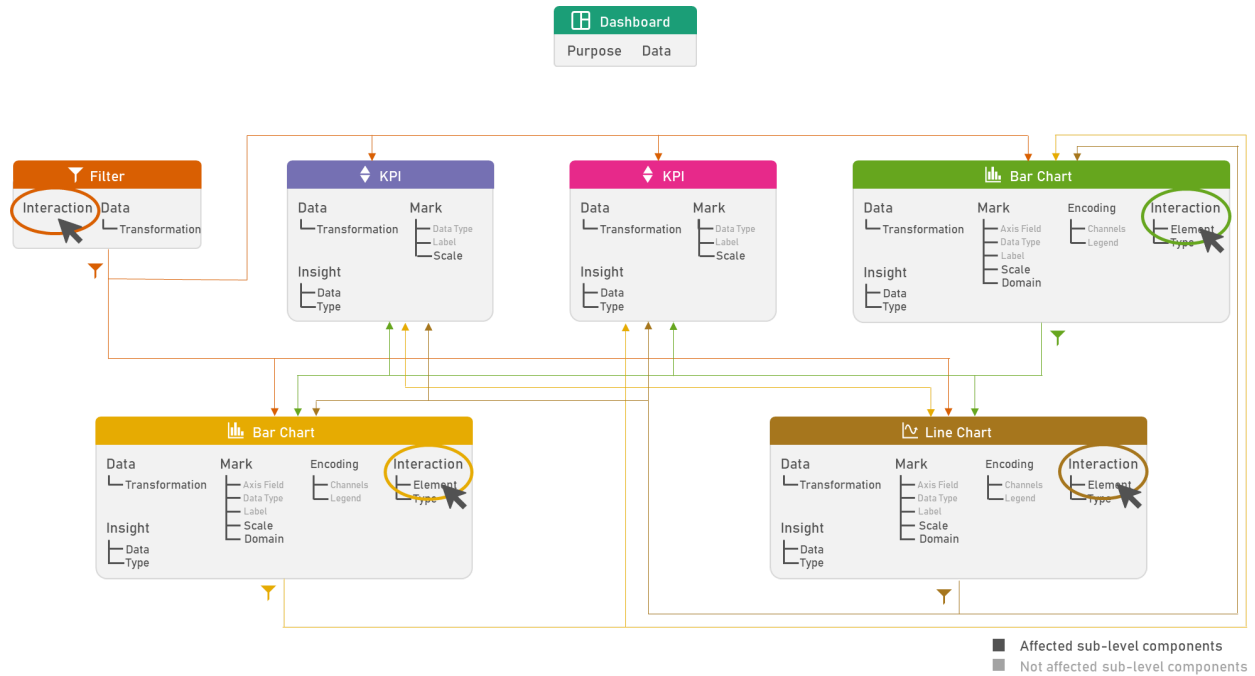
Figure 7: Component graph with edges going from one visual to the others. Additionally, the affected low-level characteristics are highlighted for each visual component.

We extended our component graph with edges on the level of our low-level components. Thus, for instance a selection of a check box in the filter visual always triggers a transformation of the data for the KPI visuals, which might change the type of insight that can be gained from the updated bar chart, and might change the displayed scale and domain of the line chart. The effect of these interactions are reflected in the following Figure for the global filter , both bar charts and the line chart .
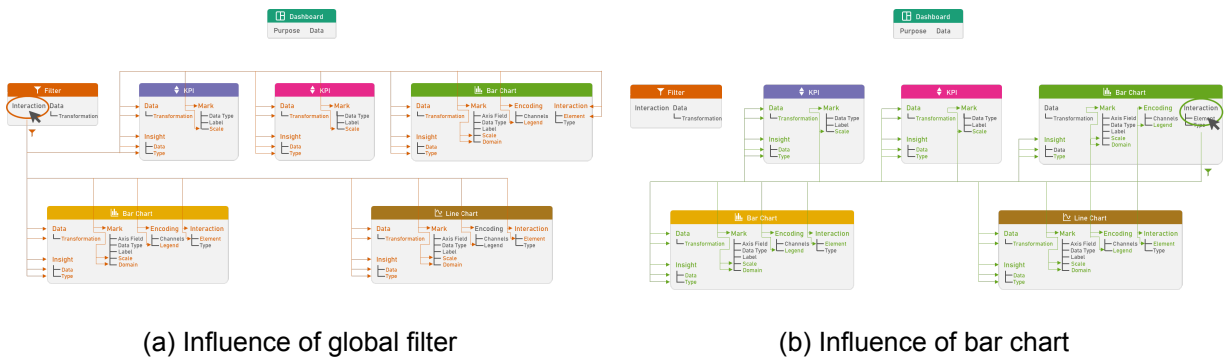
(a) Influence of global filter

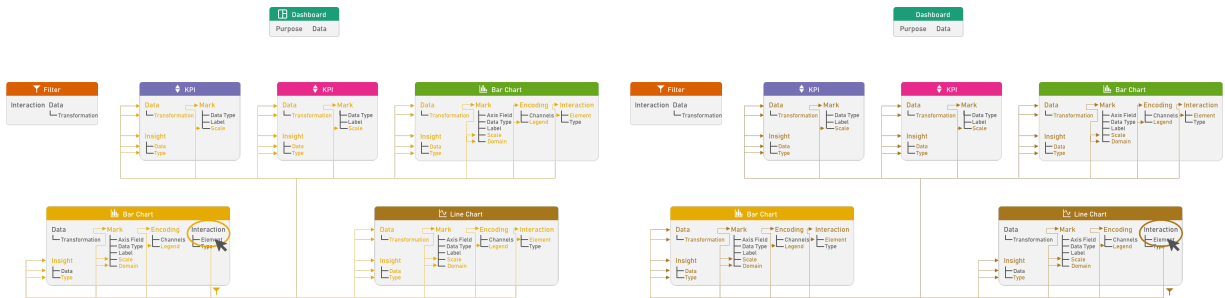(b) Influence of bar chart

Figure 8: Overview of filtering each component on the level of the low-level characteristics

(c) Influence of bar chart

(d) Influence of line chart

Figure 8: Overview of filtering each component on the level of the low-level characteristics

Combining all of these individual component graphs, results in the following Figure, where the effect of interaction for the filter, both bar charts and the line chart are highlighted.
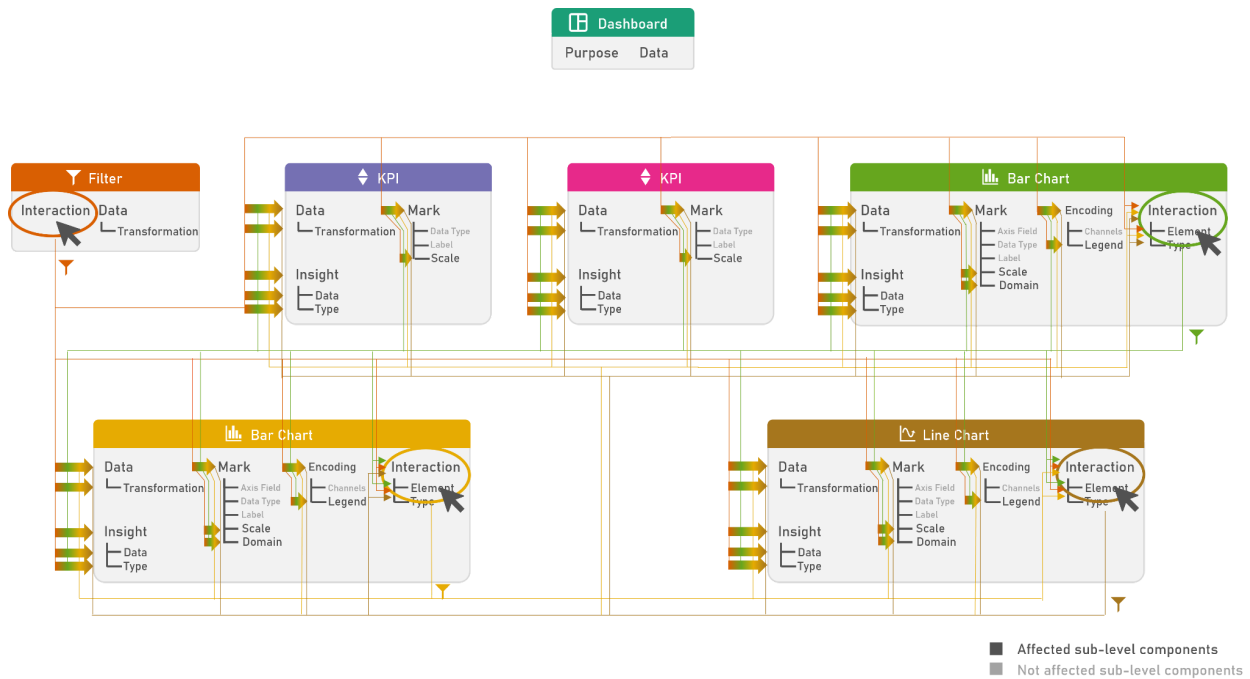

Figure 9: Combined Influences of all components on the level of low-level characteristics

Thus, for our paper, we decided to reduce the visual clutter and therefore only show (1) the dashboard, (2) the component graph with its high-level connectors, and (3) an excerpt of a depth-first narrative in Figure 3.
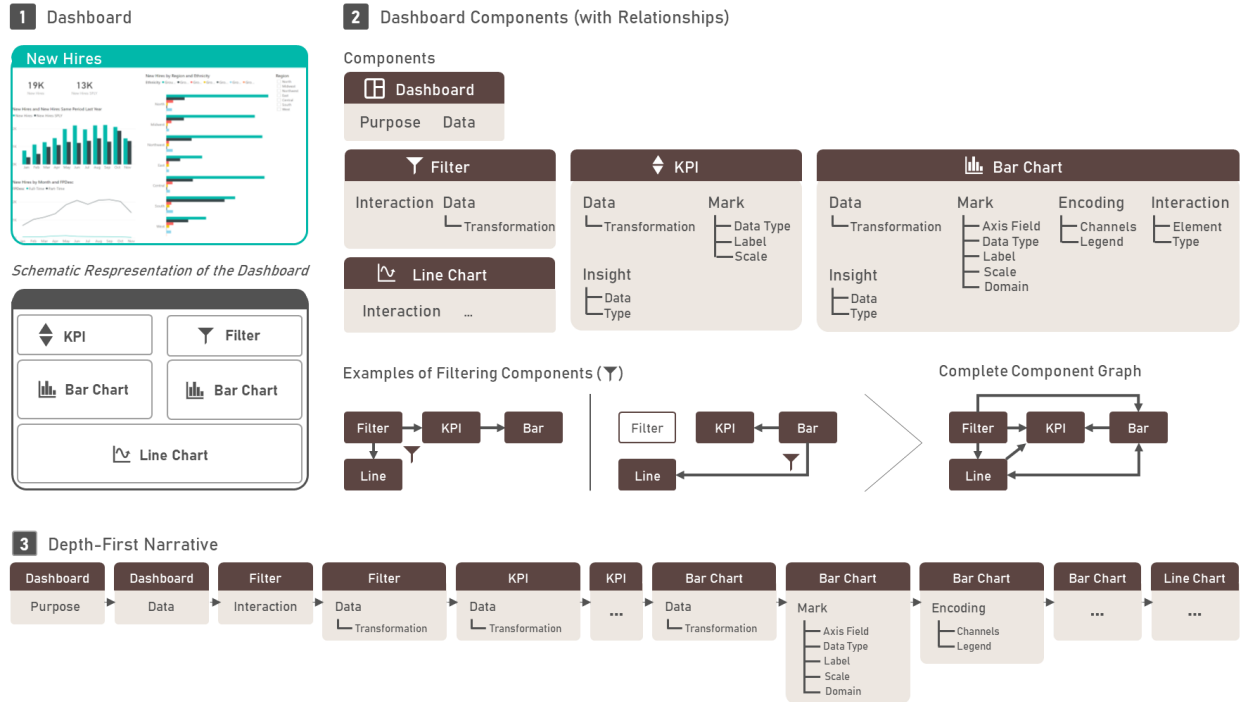
Figure 10: Figure 3 in our paper showing an excerpt of the complex component graph with relationship information.