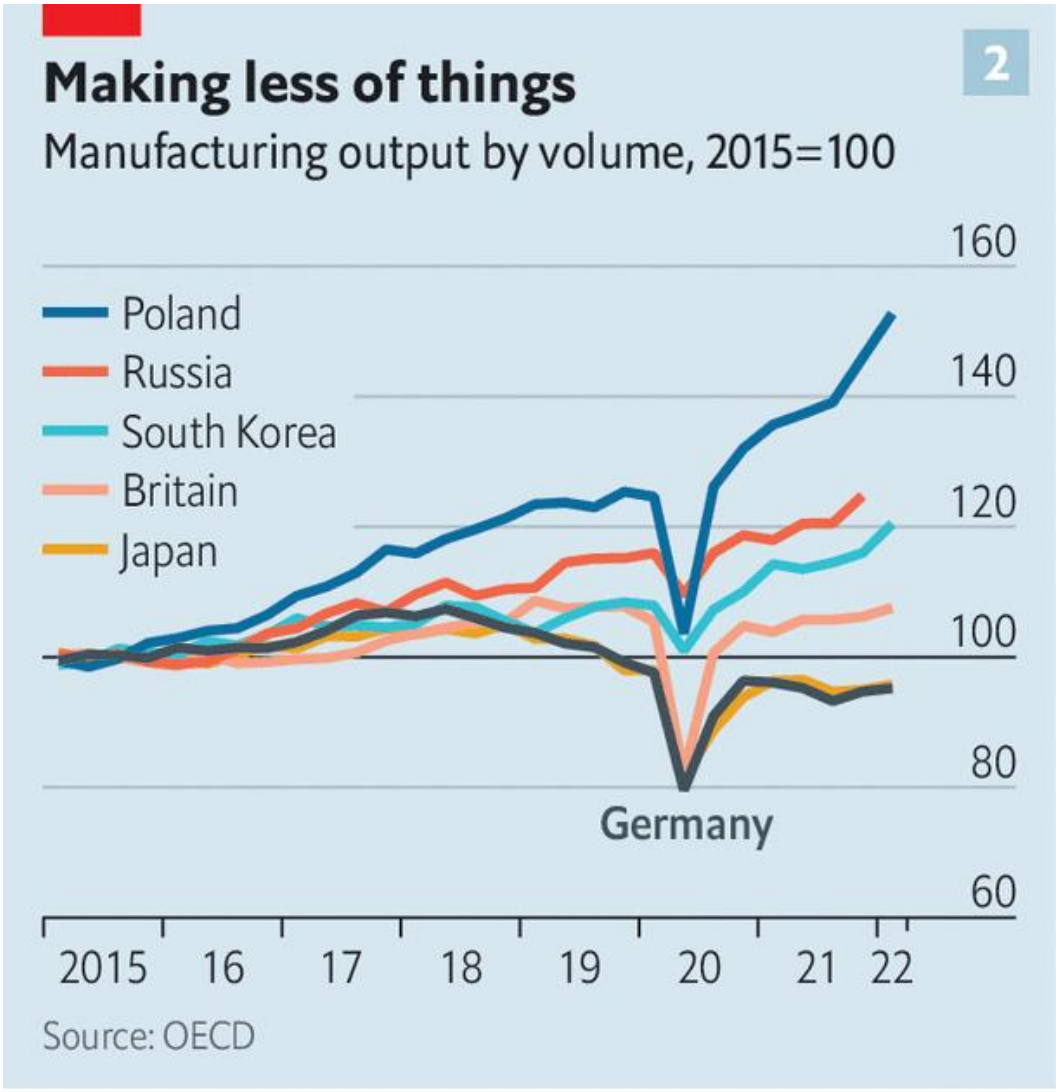
Visualization component

Part 1. Graphic Inquisition

Figure 1

Making less of things: Manufacturing output by volume, 2015=100



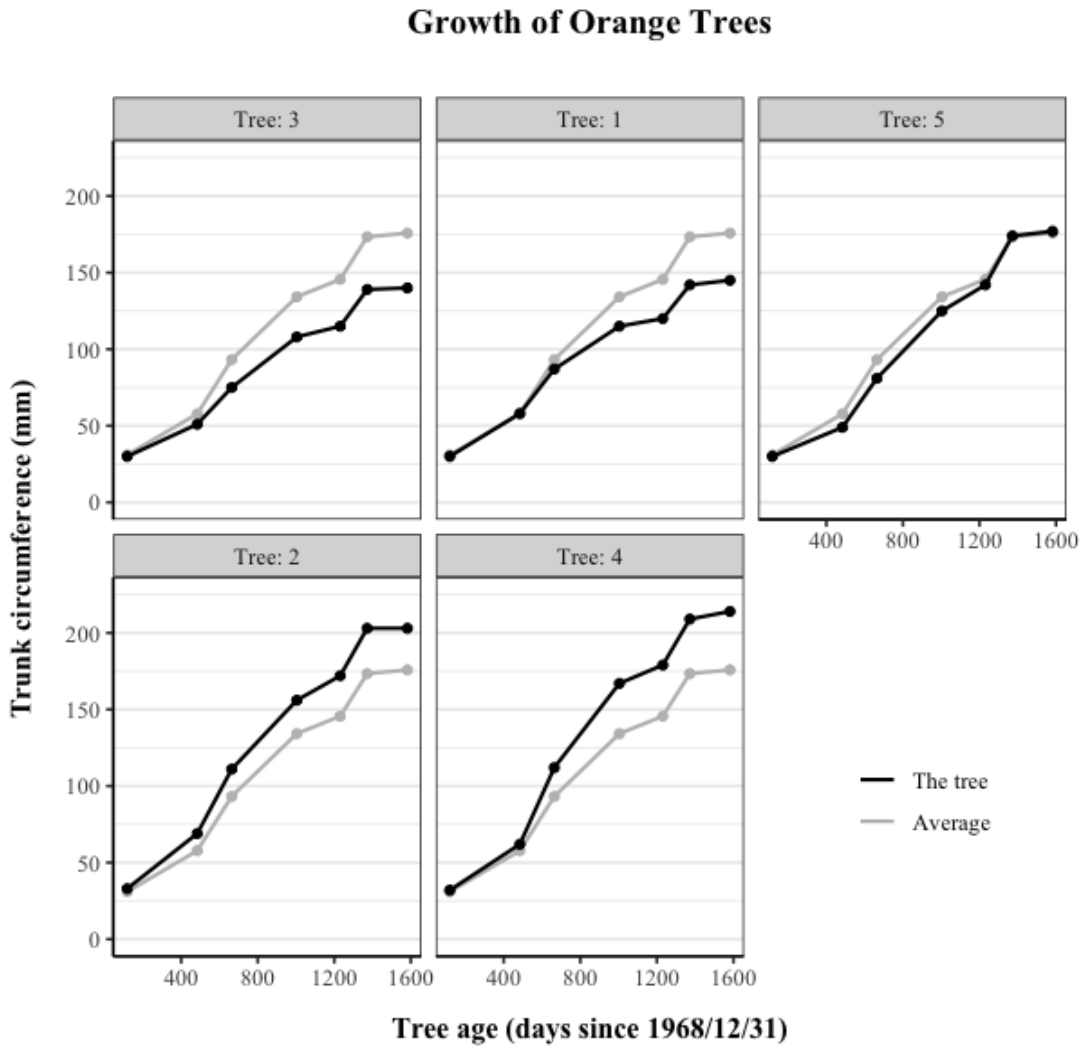
Note. The Economist. (2022). Schafft Deutschland das? Retrieved October 06, 2022, from https://web.archive.org/web/20220811214418/https://www.economist.com/briefing/2022/08/11/germany-is-facing-dramatic-change-in-many-dimensions-all-at-once

*1. Keep it simple:*The figure intended to show that "German manufacturing is no longer growing in absolute terms", according to the source article and the figure title. However, this intention is not that easy to be perceived by the readers. Since there are too many colors in one plot, and the colors may not easily be distinguished by everyone. We may take more effort into distinguishing and comparing different color lines. *2. Gestalt principles & visual structure.* The colorful lines overlap a lot at the left end of the x-axis, and it is especially difficult to visibly separate the yellow line (Japan) from the other lines since it is hidden by the dark green line and other lines most of the time. The grid line of 100 is in bold, maybe it was designed to be a reference line, but I doubt if this can be percieved. Besides, we may focus more on the valleys in the year 2020 that stands out, rather than the general decreasing trend in German manufacturing after 2018. *3. Annotation & stand-alone readability.* Neither the x nor y-axis have labels. But we may guess that x-axis represents years, and that y-axis represents manufacturing output by volume (from the subtitle). Besides, there is no clear legend for dark green. We do not know which country dark green represents, although we may guess Germany. *4. Less is more:* The data-ink ratio is low, e.g., the light blue background is not needed since it does not give extra information. The red square in the upper left corner is also not needed. "2015=100" in the subtitle may be confusing and unnecessary since we can see that all the countries output around 100 volumes in 2015. *5. Graphical data integrity & lie factor.* The y-axis is distorted as it does not start from 0, and it is visually deceptive. For example, it seems that for Britain, Japan and Germany, the lowest volumes in the year 2020 are almost only half, compared with the volumes in the year 2015. However, the true decrease is from around 100 to around 80, which is less than perceived.

Part 2. Graphic design

Figure 2

Growth of Orange Trees



Note. The trees are sorted by maximum diameter from smallest to largest. The grey lines represent the average trunk circumferences at different tree ages of the five trees that were measured.

Figure 2 intends to deliver three messages. First, the circumference of an orange tree is positively associated with its age. Second, we can compare the growth speeds of the five different orange trees, tree 3 grows the slowest and tree 4 grows the fastest. Third, we can compare the growth speed of each tree with the average. Trees 1 and 3 are below the average, and trees 2 and 4 are above the average. Tree 5 was below the average at the beginning, but caught up in the end. I used the small multiples instead of a plot with many lines, to make it easy and effective to understand, and reduce the difficulty of comparison for the readers.

1. Keep it simple: Each small plot contains only a black line and a grey line, which is easy to decode and compare the trends. The data points and the grid lines help to anchor the x and y values. The positive association between the circumference and age can be perceived at the first glance. *2. Gestalt principles & visual structure.* The grey line provides a reference and allows for a direct comparison between the tree's growth speed and the average speed. Even the colorblind can identify the difference between black and grey and printing in black and white will not lose information. The trees are ordered by increasing the maximum diameter for easier comparison because the two adjacent plots are more similar. *3. Annotation & stand-alone readability.* Proper X and Y-axis (with units of measurement) titles, facet and legend labels are all clearly provided, as well as the figure title. Thus the figure contains all the main information. *4. Less is more:* The background and colors are designed as simply as possible, and the data-ink ratio is maximized. The grid is non-prominent. The figure does not have unnecessary or redundant information. *5. Graphical data integrity & lie factor.* The X and Y-axis are forced to have the same scale, and Y-axis starts from zero. So we show the true effect size of data in the graph and avoid visual lies. The five small multiples are comparable.