

## Visualising the difference: revealing pattern and structure through graphical techniques

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When using visualisations to identify pattern and structure in often complex data sets, what is the difference that makes the difference? In this presentation, I will explore how we can make use of powerful data visualisation techniques to extract meaning and story, pattern and structure from a wide range of data types.

Whether using visualisation as an active analytical process, or as a static communication device designed to convey a particular message, we must often make a wide range of decisions (that is, distinctions, or differences that make a difference) to coerce the data into an appropriate logical shape and physical representation that our software tools or visual perception can work on. Getting a feel for the data in a very tangible way is the first part of the visualisation process and one that, if done correctly, allows us to generate the beginnings of complex visualisations for very little effort. Shaping data appropriately is a precursor to revealing in a visual way structures we have already identified logically. But how does the information required to generate a visualisation from a given dataset compare with the information contained within the dataset that we hope to reveal by means of the visualisation itself?

In a very real sense, the tools we use nowadays to create a wide range of data visualisations are cognitive technologies. Software encodes increasingly powerful abstractions, embodying mind as well as algorithmically represented forces of nature. Different visualisation types work to tell different sorts of story, depending on the form of the dataset itself, whether time series, hierarchical data set, network, or comparative data from different populations. Mapping a dataset from its natural form to an alternative form might also reveal insights through visualisation types that now become possible, or allow datasets to be rendered using visualisation tools not intended for that sort of data. By making the right distinctions in the way you prepare your data, the tools can work with those distinctions on your behalf.

Identifying how we might reveal a difference of interest in a visually compelling way requires that we appreciate how different visualisation types are capable of expressing different structural or relational properties through graphical means. The way our visual perception interprets the composition and layout of a visualisation allows the designer to amplify certain differences using techniques that the Gestalt psychologists identified as meaningful in the visual field. For the visual analyst, working with a raw data set in order to discover structure or process, finding ways of encouraging these differences to reveal themselves, much as a sculptor reveals the story hidden in any given piece of stone, is an important part of the visualisation process. As an example, part of the analytic process can often involve using different layout algorithms to try to find the one most in sympathy with the hidden structure of a complex data set.

The remaining step in the visualisation cycle is the interpretation of the visual scene, in which we attempt to make sense of a graphic in terms of both the processes that created the original data set and the processes that transformed the dataset into the graphical domain. It is not uncommon for the interpretation of a visualisation to lead to further questions, and either a refinement of the visualisation itself, or the creation of a new one entirely, albeit one whose genesis was based the differences that may have been hinted at, but not quite revealed, by the previous viewpoint, or maybe suspected to be there, but originally missed entirely.