POINTS OF VIEW

Gestalt principles (Part 1)

Gestalt principles of perception are theories proposed by German psychologists in the 1920s to explain how people organize visual information[1]. Gestalt is a German word meaning shape or form. The principles describe the various ways we tend to visually assemble individual objects into groups or 'unified wholes'. They are highly relevant to the design of charts and graphs as well as the reports that contain them.

Gestalt is the interplay between the parts and the whole. Kurt Koffka, one of the founding fathers of Gestalt psychology, made a statement about this. He said, "The whole is 'other' than the sum of its parts." This phrase has been translated to the familiar saying, 'the whole is greater than the sum of its parts'. A classic example of subjective contour is illustrated in **Figure 1a**. We clearly see edges of a white triangle that does not exist. Koffka insisted that the emergent entity is 'other' (not greater or lesser) than the sum of the parts. By composing elements on the page according to specific principles, we can add additional layers of meaning.

In the following discussion, to be continued in next month's column, we will explore several Gestalt principles. Here we will examine the principles of similarity, proximity, connection and enclosure. The fundamental concept behind these principles is grouping; we tend to perceive objects that look alike, are placed close together, connected by lines or enclosed in a common space as belonging together. These are simple but powerful ways to build context for information.

The principle of similarity is likely familiar to many. We often use color, size and shape to organize data objects into categories. As readers, we tend to see things that are similar to be more related than things that are dissimilar (**Fig. 1b**). We can apply this observation to all elements on the page; by repeating graphical treatments including font, type size, orientation and white space, we can design elements so they appear more related.

Another quality that inclines us to make associations between objects is proximity. We tend to group objects placed close together. We can apply this principle when organizing figure panels. In a grid of evenly spaced panels, it can be unclear at first glance how one should dissect the information contained within (**Fig. 1c**). Are we to compare the panels or read them in succession? If the reader is to make two pairwise comparisons, then grouping the four panels as two pairs reinforces our natural tendency to relate proximal objects (**Fig. 1c**). If, however, we want readers to review the panels one after another, then arranging the panels in a row provides a natural order that supports reading them sequentially (**Fig. 1c**).

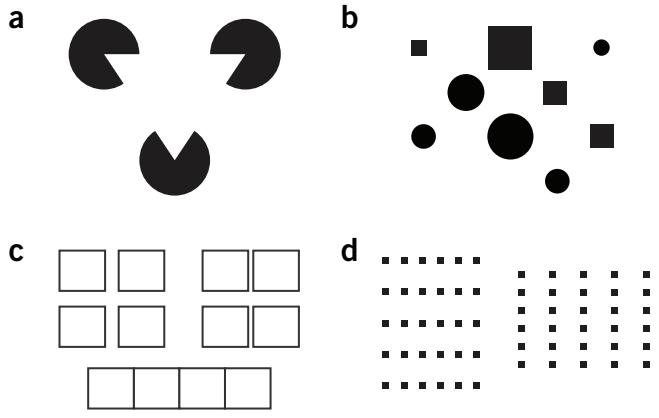

Figure 1 | Gestalt principles. (**a**) An illustration of subjective contour. (**b**) Similar objects are visually grouped. (**c**) Objects placed close to one another are seen as going together. (**d**) Relative proximity elicits vertical or horizontal correlations between objects.

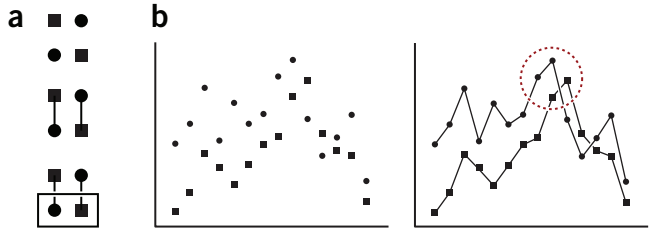

Figure 2 | Principles of grouping. (**a**) Relative strength of grouping by similarity, proximity, connection and enclosure. (**b**) Lines in graphs create clear connection. Enclosure is an effective way to draw attention to a group of objects.

Proximity could be considered a special case of grouping by similarity because of the underlying spacing between objects. Relative spacing between columns and rows can dramatically affect whether we group the components vertically or horizontally (**Fig. 1d**).

Whereas objects grouped by similarity and proximity are seen as loose confederations, grouping by connection and enclosure leads us to associate them as a unified whole. The relative strength each principle exerts on perceptual grouping is illustrated in **Figure 2a**. Lines create clear connection and bring out the overall shape of the data (**Fig. 2b**). They provide a useful method for encoding information in graphs and network diagrams. Finally, grouping by enclosure resulting in elements bounded in a common region is powerful enough to overcome similarity, proximity and connection (**Fig. 2**).

The Gestaltists described phenomena about how we organize bits and pieces of visual information into larger units. This perceptual organization is deeply ingrained in the visual experience. When we present visual information, including blocks of text projected on screen, it is helpful to arrange the elements into a meaningful structure. One framework is simply to group related information. The principles of similarity, proximity, connection and enclosure provide simple rules to draw correlations between visual elements.

Next month, we will examine the principles of visual completion and continuity, which describe our tendency to fill in missing information to perceive shapes as being complete to the greatest degree possible.

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1. Palmer, S.E. *Vision Science: Photons to Phenomenology* (Massachusetts Institute of Technology Press, Cambridge, Massachusetts, USA, 1999).

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