

## POINTS OF VIEW

## The design process

The primary tenets of design are utility and function. Just as objects are intuitive to use when they are well-designed, thoughtfully conceived scientific figures, slides and posters can be easy to interpret and understand. Whereas industrial design focuses on things people use, graphic design is concerned with designs people read. The design process helps us develop a visual literacy to construct presentations that are appealing and convincing.

Design is a requirement, not a cosmetic addition. Objects that are well-designed provide visible clues to their underlying function. For example, a vegetable peeler has a handle and a blade that telegraphs how it should be used (Fig. 1a). The example shown is a classic that has simple form and is highly proficient at peeling. In contrast, despite some obvious features, my office telephone is not so easy to access (Fig. 1b). Making a simple conference call is a bewildering and cryptic process. There is a button marked “conference” but otherwise no hint as to how to enact the function. Poorly mapped visual cues can thwart the normal process of interpretation and understanding.

Good design balances self expression with the need to satisfy an audience in a logical manner and finds the best possible solutions to problems with known objectives and constraints. The effectiveness of a design is determined by the perceiver’s ability to decode the visual scheme.

It might be helpful to think of scientific presentations as products that should perform a function. For example, a subway map is a highly efficient tool for figuring out how to get from one part of a city to another. If the train information were presented in a table of stops and connections, the job of finding the shortest route between two points would still be possible but much more difficult. When designing scientific figures, it helps to develop a well-organized approach



**Figure 1** | Visual clues should communicate a product’s functions and features. (a) A vegetable peeler with easily interpretable function. (b) An office phone with poor visual cues to indicate its operation.

for depicting the information. Having a clear delineation in how different types of information are represented will enable readers to quickly learn the visual vocabulary and interpret the presentation.

For a recent scientific meeting, my colleagues and I created a poster that explains the current efforts of the ‘connectivity map’ (CMap) (Fig. 2). The CMap<sup>1</sup> is a catalog of gene expression data collected from human cells treated with chemical and genetic reagents. We wanted to provide an overview of the entire experimental process. When developing new designs, it is helpful to look for existing solutions. I was inspired by Charles Minard’s flow map of Napoleon’s March (Fig. 2 inset) in which he uses line thickness to denote quantity. For the Map of CMap<sup>2</sup>, we accentuated the tremendous effort required to prepare cells for detection and the data deluge that ensues by creating a metaphorical mountain that divides ‘sample preparation’ from ‘data analysis’. This juncture is placed 8:13 from the right edge of the page according to the golden section (see October 2011 column)<sup>3</sup>. We used color to differentiate steps in the CMap process and to identify the physical location in the Broad Institute where the work is carried out. Finally we used high-contrast headings (that is, white text on black background) to direct readers’ attention to the four major features of the poster.

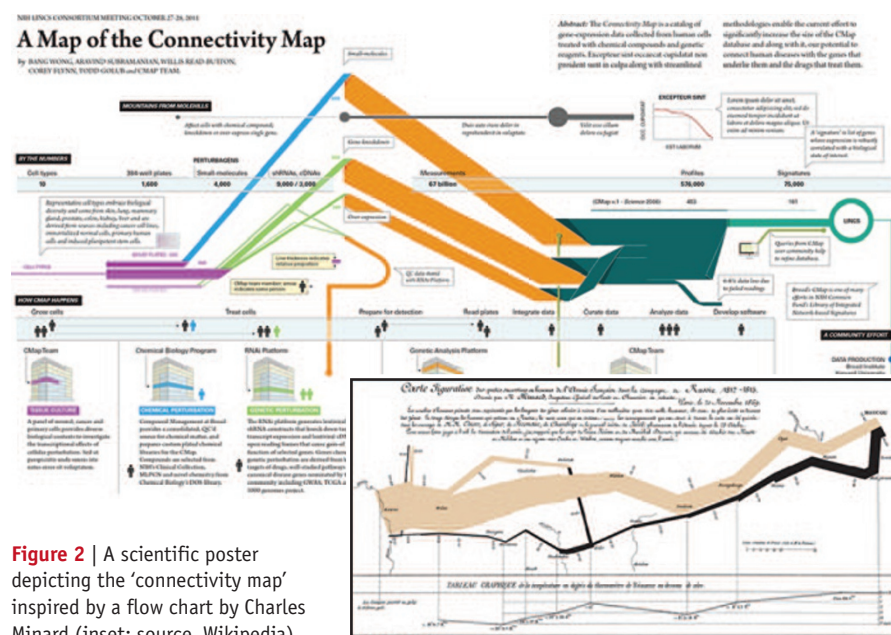
Well-founded design ideas and technical execution are essential to creating professional work. Take the time to master the graphic software you depend on most. It is imperative that the creative process is not restricted by the medium. Design is an exploratory process that requires realizing what is in one mind’s eye and the ability to fluidly refine the graphical characteristics as needed.

In my columns to date I have highlighted a number of design principles I believe are pertinent to visual communication in science. Starting next month I will work with my colleagues as coauthors to focus on several topics in data visualization.

## Bang Wong

1. Lamb, J. *Science* **313**, 1929–1935 (2006).
2. Wong, B. *et al.* National Institutes of Health LINC Meeting (October 27–28 2011).
3. Wong, B. *Nat. Methods* **8**, 783 (2011).

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**Figure 2** | A scientific poster depicting the ‘connectivity map’ inspired by a flow chart by Charles Minard (inset; source, Wikipedia).