POINTS OF VIEW

Points of review (part 1)

My goal over the next two months is to show concretely how scientific figures can benefit from design principles. I will review concepts from past columns by applying them to several published figures.

In the design of common objects, such as a door, when a handle is used many people will mistakenly pull even if the door is to be opened by pushing. When the handle is replaced with a flat plate, which affords pushing, people will know to push. When dealing with figures, we depend on visual cues. We want our figure's layout to express its underlying meaning.

The diagram shown in **Figure 1a** is intended to illustrate three parts of a microscopy system[1]. We could redraw the figure so that the threefold nature of the system is apparent even at a glance. The Gestalt principles (November 2010 column)[2] impart trends in visual organization; we tend to organize objects into groups, for instance, when they are placed near one another, connected by lines or contained in a common space. Using the principles of proximity, connection and enclosure we could sketch the general form of the microscopy system as shown in **Figure 1b**. By grouping the components related to each part of the system and placing those groupings in compartments, we create a visual structure that strongly reflects the message. The prominent horizontal feature links the system together.

In arranging elements on the page, we inextricably affect the negative space (January 2011 column)[3]. Similar to the Gestalt principles, white space is another mechanism to organize content. For example, wider gaps can be used to separate major groupings whereas narrower spaces are left between more related objects. In **Figure 1a** there are large unused areas on the top right and on the left. Consolidating the empty spaces into more regularly shaped areas creates uniformity and helps to further delineate our defined groupings (**Fig. 1b**).

Meaningful compositions become more challenging to create when figures have many independent parts. A helpful strategy is to let the intent of the figure guide the layout. In **Figure 2a** a protocol for analyzing gene expression is illustrated[4]. The details of the process are presented in several steps. But the even distribution of graphical elements provides neither an intuitive path through the information nor visual cues for us to relate the parts to one another. One fitting structure is horizontal groupings strung together vertically (**Fig. 2b**). We can rely on the principle of visual completion (December 2010 column)[5] and line up the arrows between steps to connect and order the process. To differentiate the central path that traces the gene of interest from additional reagents, I used orientation and alignment to create salience (October 2010 column)[6] and set them apart. The added reagents are either misaligned or placed at an angle from the central molecules.

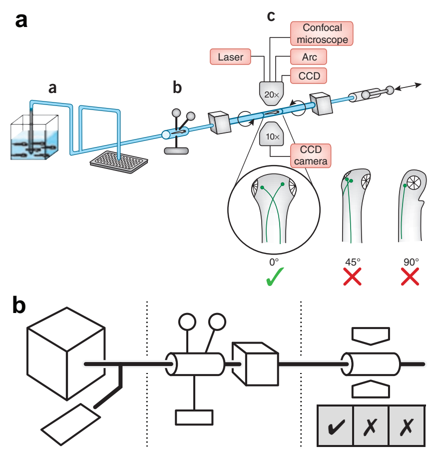

Figure 1 | Layouts can express meaning. (**a**) Diagram of a microscopy system. Reprinted from *Nature Methods*[1]. (**b**) A sketch using grouping and white space to make the three parts of the system being illustrated more apparent.

When showing sequential information, it is also helpful to use consistent language and representations so readers can more easily follow the story. In **Figure 2a**, the identifying barcode represented by the color green at the beginning is not the one captured at the end. These inconsistencies may require readers to redouble their steps when working through the figures.

Conceptual figures like the ones described above have an important purpose; they provide context for readers to understand the experimental design and research results.

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1. Tamplin, O. & Zon, L. *Nat. Methods* **7**, 600 (2010).
2. Wong, B. *Nat. Methods* **7**, 863 (2010).
3. Wong, B. *Nat. Methods* **8**, 5 (2011).
4. Peck, D. *et al. Genome Biol.* **7**, R61 (2006).
5. Wong, B. *Nat. Methods* **7**, 941 (2010).
6. Wong, B. *Nat. Methods* **7**, 773 (2010).

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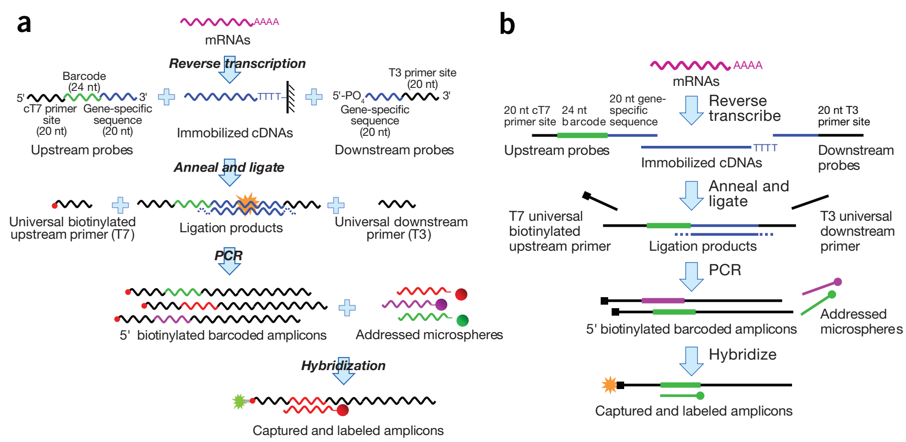

Figure 2 | Visual structure that matches the message. (**a**) Illustration showing a gene expression analysis technique. Reprinted from *Genome Biology*[4]. (**b**) The same elements organized according to the purpose of the illustration, which is to show a sequence of steps.

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