POINTS OF VIEW

Elements of visual style

Translate the principles of effective writing to the process of figure design.

We all use words to communicate information—our ability to do so is extremely sophisticated. We have large vocabularies, understand a variety of written styles and effortlessly parse errors in real time. But when we need to present complex information visually, we may find ourselves 'at a loss for words', graphically speaking.

We can rationalize figure creation by applying principles of effective written communication. By leveraging our training and experience with words, we can turn graphical improvisation into a structured and reproducible process in which we assess and optimize each part of a figure just as we would each paragraph, sentence and word in a manuscript. Let's look at how Strunk and White's classic but stern *The Elements of Style*[1] can be applied to figures. (I encourage you to revisit your own favorite writing resources in the context of visual representation.)

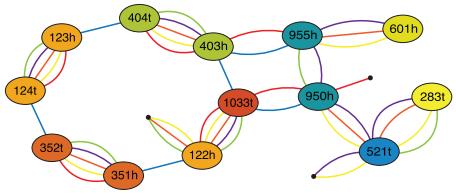

Figure 1 | A flood of identical symbols triggers semantic satiation, a phenomenon in which overwhelming repetition results in loss of meaning. As an accurate but visually unparsable representation of a breakpoint graph[5], the figure breaks Strunk and White's rule "Do not explain too much."[1]

A popular example of disregarding Strunk and White's dictum "Do not take shortcuts at the expense of clarity"[1] is the syntactically correct but incomprehensible sentence "Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo"[2]. Unfortunately, visual analogs of this construct appear all too frequently in the literature. If we cannot parse this eight-word sentence, how can we cope with the complexity of **Figure 1**?

Strunk and White also ask us to avoid overwriting because "rich, ornate prose is hard to digest, generally unwholesome, and

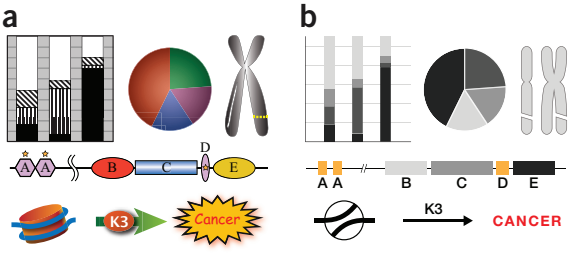

Figure 2 | Use the simplest visual representation[6] for objects and "omit needless words"[1]. (**a**) Visually garnished elements shout at the reader, who is at a loss to determine what is important. If you wouldn't write it this way, don't draw it either. (**b**) Simple shapes provide an elegant presentation. Complex shapes may carry unintended meaning (such as unduplicated versus duplicated chromosomes). In schematics, reserve the use of color for emphasis, where possible.

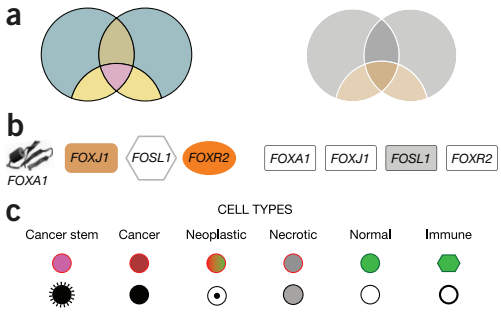

Figure 3 | Objects that interact or share common meaning should be formatted in a similar way that appeals to intuition. (**a**) Venn diagram colors should be selected to naturally communicate overlap. This can be automated by using blend modes in applications such as Illustrator or Inkscape. (**b**) Entity similarities in pathway diagrams are hard to identify when diverse icons are used. When only tone varies, *FOSL1* immediately stands out from the *FOX* gene family. (**c**) Symbols in a series should reflect the concept of progression as naturally as possible. For example, immune cells aren't actually a different shape, and it is not intuitive that pink cells should give rise to red cells.

sometimes nauseating"[1]. The visual equivalent is "chartjunk," a term coined by Tufte[3]. Examples are shimmering textures, gradients and a proliferation of shapes (**Fig. 2**), which all make interpreting the data more difficult, act as exclamation marks that make selective emphasis impossible, and "can never rescue a thin data set"[3]. If you cannot easily emphasize an element in your figure, chances are that it is overstated.

To reinforce the content and function of related ideas, use the visual equivalent of parallel construction and "express coordinate ideas in similar form"[1]. Choose shapes and colors that intuitively embody overlap, category hierarchy and importance (**Fig. 3**).

Keep in mind the needs and experience of your audience and "place yourself in the background"[1]: do not rely solely on your personal aesthetic (for example, black text overlaid on your favorite color may lack sufficient contrast to be legible). Instead, strive for simplicity and clarity. "Use definite, specific, concrete language"[1]. Be legible without shouting. Concise, but not opaque.

In his play *Horace*, Corneille wrote, "Un premier mouvement ne fut jamais un crime" ("A first impulse was never a crime")[4]. But in the process of making figures, it can be. Avoid the temptation of going with your first idea. Instead, use it as the starting point and then refine and clarify your message. A good figure, like good writing, doesn't simply happen—it is crafted. "Revise and rewrite"[1] becomes "revise and redraw."

COMPETING FINANCIAL INTERESTS
The author declares no competing financial interests.

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