TIP SHEET 36

Empowering your scientific language by making it "visualizable"

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Francis Crick, the co-discoverer of the structure of DNA, observed, "There is no form of prose more difficult to understand and more tedious to read than the average scientific paper." Most scientists struggle with how to communicate their work clearly and convincingly to journal referees, funding agencies, and colleagues. This is challenging, in part, because most scientific research deals with ideas that we cannot easily visualize with our eyes or even with our "mind's eye": the contours of a quantum dot, the topology of a DNA microarray, the sliding between adjacent layers in a new building material. To make such ideas clearer to our audience—especially those outside our topic—we should try to make them "visualizable". When we can visualize ideas, we often find them more attractive and more convincing than when we work in the abstract. A picture, after all, is worth a thousand words.

This Tip Sheet presents some strategies that may help you make your scientific communication more "visualizable" and therefore more attractive and compelling to specialists both inside and outside your topic.

(1) Metaphors: visualizing the "invisible"

With metaphors, we compare our complicated, invisible situations to situations that people can easily imagine, often because they have experienced them in their own lives.

Metaphors can clarify ideas by helping us explain not only what something IS, but also what it is NOT. For example, we can liken nerves to telephone lines in that they both carry signals. At the same time, the comparison allows us to emphasize a contrast: "signals travel continuously along the entire length of the telephone cable, like 'sliding'; however, in many nerves, signals travel by 'hopping' between distinct points along the length of the nerve cell". The concrete image of a telephone conversation "hopping" along a cable may leave a stronger impression on the average listener than the abstract image of depolarization occurring at periodic unmyelinated nodes of ion channels along the axon.

(2) Using examples and brief definitions: making meaningless jargon visualizable

Most scientists write for people who work on the same or similar topics. Increasingly, however, journal referees, congress attendees and article readers are mixed bags of specialists from diverse fields who speak diverse jargons. Hence the importance of asking yourself, whenever you use jargon, "Will most of my audience understand this?" While jargon is concrete for a small fraction of your potential audience, it is extremely abstract to the rest. If we supplement our jargon with a metaphor, brief definition or 1-2 examples, our language becomes more concrete and therefore more visualizable.

- Instead of saying "These results are supported by molecular genetic techniques (Alvarez et al. 2003)", say "These results are supported by analyses of haplotypes, restriction fragment-length polymorphisms and genomic sequences (Alvarez et al. 2003)".

- Instead of saying "Systemic financial failures have revealed weaknesses in current debt-leveraging schemes", say "Systemic financial failures, such as the collapse of major investment banks in the US and Europe, have revealed weaknesses in how financial institutions increase their earnings through borrowing, a practice known as debt leveraging."

(3) Verbal phrases: making language more concrete and visualizable through action

It is no coincidence that many languages have some version of the expression "actions speak louder than words". Verbs are often more powerful and more attractive than nouns. Many scientists fail to take advantage of verbal phrases in their writing; instead, they prefer long nouns and even longer noun phrases full of jargon (e.g. "sedimentation coefficient correction algorithm"). Whenever possible, try to convert these noun constructions into verbal ones that use infinitives (e.g. to take, to go), gerunds (taking, going) or verbs themselves (takes, goes).

- Instead of saying "The consideration of these factors allows construction of a more accurate model", say "Considering these factors gives a more accurate model" or "considering these factors leads to a more accurate model". We have converted the nouns "consideration" and "construction" into verb forms: "considering", "gives", "leads to".

- Instead of saying "As shown in Figure 1, we observed a significant increase in signal", say "As shown in Figure 1, the signal increased significantly". We have converted the noun "increase" to the verb "increase", which creates more action in the sentence and makes it sound more direct and more attractive to many readers. "Activating" language with verbal phrases also allows us to reduce the word count; in these two examples, we reduce the length by at least 25%.

(4) Active voice: making action even more visualizable

Scientists in most countries have traditionally been taught to communicate in the passive voice, and this used to be the norm for research journals. Many journals have since realized that the passive voice weakens the power of language, since it usually requires more words than active voice, and it increases the distance between the subject ("doer") of the action and the verb.

Consider the common passive construction: "In the present report, a fundamentally new approach to teaching that draws on reader response theory (Ackerman 2006) is described." The action ("is described") is weak, because the doer of the action ("report") lies far away. Readers may need to reread the sentence, because when they arrive at the end, they may not remember what "is described"! The same idea is much stronger if written in active voice: "The present report describes a fundamentally new approach to teaching that draws on reader response theory (Ackerman 2006)."

Using active voice usually forces us to write subject + verb + object, which is more direct and linear than passive voice. For this reason, many research journals urge their authors to use active voice more often, including *Nature,* the *British Medical Journal,* and the *Journal of Marketing Research.*

These four strategies may help you make your scientific communication more "visualizable". None of them requires sacrificing jargon or its precision; rather, they help to anchor that jargon in something concrete and compelling for a wider range of specialists.