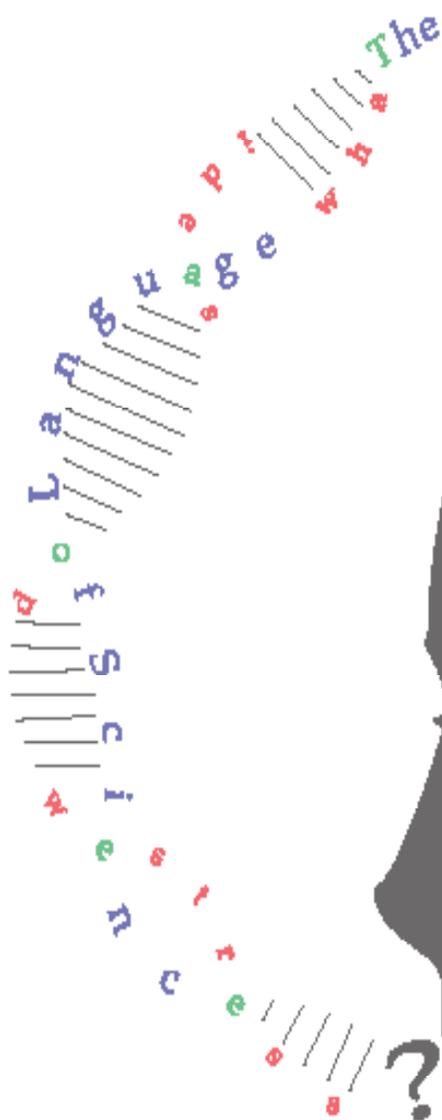


The Language of Science

What ideas do we stress?

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On April 24, 1990,

a piece of equipment roughly the size of a schoolbus was launched into space (Hubblesite, nd). At the time the unit cost \$1.5 billion (\$4.3 billion today), weighed as much as two large elephants and was due to become the world's first space-based optical telescope (BLS Inflation Calculator; Wolfram Alpha). The contraption was the Hubble Space Telescope, and chances are that you have seen the striking images the HST has collected in the decades since. The telescope was named after

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Edwin Hubble, the astronomer who realized in 1929 that the universe is expanding uniformly in all directions. It was a ground-breaking discovery, fundamentally reshaping how we view our universe. As a memorial, NASA elected to honor

Hubble's discovery by naming their own ground-breaking optical space telescope after the astronomer.

It's a great story. Or would be a great story, had Edwin Hubble made the discovery first. Two years earlier, a little-known Belgian priest and astronomer

named George Lemaitre published a finding that the universal rate of expansion is accelerating,

and included a mathematical constant, much like Hubble had, which could account for that expansion (HubbleSite News Center, nd). However, Lemaître's name is not recognized beyond the smallest circles, and we maintain Edwin Hubble as the pioneer. What happened? Lemaître originally published his work in French in 1927, and when it was translated to English in 1931, he elected to omit the crucial passages about his version of Hubble's constant. He believed they were "of no actual interest", certain that others would publish more appropriate figures. Lemaître was humbly uninterested in receiving credit for his discovery, and as he slipped into obscurity, time granted his wish.

So what is in a name? Does it matter that history remembers Hubble, and not Lemaître? When a scientist identifies a new protein, invents a better test for cervical cancer, or finds a new species of pufferfish, what is the most important feature? How do you name it? What idea about that discovery is so fundamental or important that this is the one feature you stress?

This is a big decision to make because at the end of the day, the goal of scientific communication is to share ideas about the world. When human curiosity moves us to look out into the world, then back into our own minds, we wonder: How? Why? What if? Once we answer the questions, we turn to recording those answers. This is the moment that we face the name decision. Each word carries within it some idea that its inventor believed had future value, and was therefore worth remembering by name. Which name to choose? Hopefully one that in some way relates to the form or function of the thing described.

Take, for example the task of naming a flower. About a year ago, I toured the historical district of Monterey, CA. Passing through a garden, I spotted a bush whose flowers had enormous, floppy, white petals, with a great golden dollop in the center. I chuckled and remarked to a companion, "And here we have the fried egg plant!" Moving closer, I spotted a small plaque sitting at the bush's base. Imagine my surprise

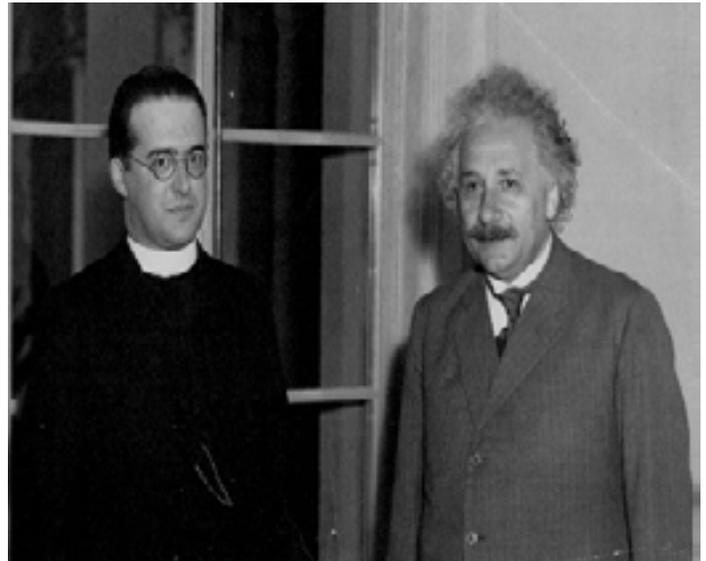


Figure 1. George Lemaître (left) with Albert Einstein (right), California, 1933.

when I read: 'Fried Egg Flower, Romenya Coulteri, S. California and Mexico'. Imagine my delight. The name made sense, of course, but there are almost infinitely many other possibilities. For instance, the fried egg flower has great, sweeping white petals and a splash of yellow. The plant just as easily could have been named after Marilyn Monroe: Romenya Marylini. The name is relatable; it would probably go undisputed in western countries. However, a trip east might reveal a botanist in Cambodia who does not recognize the significance of Romenya Marylini, having no prior knowledge of the great actress.

With so many options, naming a discovery or invention can be a stressful. Sometimes there is guidance (tapping into extant etymological traditions), but other times the decision exists in isolation. Lewis and Clark had no name for the pronghorn

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antelope they first encountered on their journey across North America in 1704. They chose to call it a “buck goat”, in the absence of any other available name (Ambrose, 2002). Looking at an antelope, one can clearly understand the description, but the question remains: Why didn't buck goat stick? It does look like a hybridized goat deer. The answer



Figure 2. Romneya, the fried egg flower (left). Can you see why the flower may also invoke Marilyn Monroe (right)?

is that we now recognize pronghorns to be more closely related to other antelope species than goats. Even Clark noted “he is more like the Antelope or Gazella of Africa than any other Species of Goat” (Smithsonian Museum of Natural History, nd). The name ‘pronghorn antelope’ would not show up until 1826 (Oxford English Dictionary, 2013). The switch to stress a more phylogenetically accurate name would seem almost inevitable, but science is not always so self-correcting.

Systemically, science is full of misnomers that stem from situations similar to the Hubble and buck goat stories. Misnomers can stem from publishing in an obscure language, in a country distant from intellectual centers, even naming a discovery with terminology that is simply not obvious enough -- all of these factors contribute to the at-times chaotic field of scientific taxonomy.

Sometimes the confusion happens by accident. One can’t help but be charmed by the 17 distinct ways Clark spells ‘mosquito’ in his journals chronicling the transcontinental journey. Misspellings aside, the synonym can be just as tricky. In practice, there is considerable overlap between the field of applied psychology and that of user experience, but if a user experience researcher doesn’t know to use the search term ‘applied psychology’, he or she might entirely miss a key reference or potential collaboration.

A more serious incident occurred in 1999. The new Mars satellite disappeared from NASA’s communication lines after dipping too close to the planet. It later surfaced that a misunderstanding between the collaborating American and European teams had led to the accident. One team was using imperial units, while the other was using metric. At \$94 million dollars (\$1.48 billion today), losing the satellite was a costly mistake.

Accidents happen in scientific communication,

but what happens when the scientist intends to confuse or obscure? What if the author chooses to stress non-intuitive features, or to emphasize complexity at the expense of readability? Sir Isaac Newton chose to publish *Principia Mathematica* in Latin, to ward off any who might pester him about its content. Indeed, William Cropper called it “one of the most inaccessible books ever written” (Cropper, 2001). Newton aimed to exclude amateur readers with the *Principia*’s impossibly dense prose, but he was also serving a personal vendetta against Robert Hooke -- Hooke had published statements crediting himself with Newton’s equation for the inverse square law. Newton vengefully struck Hooke out of the acknowledgments, and went on

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to write the key section in propositional logic and Latin thicker than molasses (Inverse Square Blog, nd).

When we step back to consider the amount of confusion that can arise from nomenclature fraught with error and inconsistency, why bother to name something at all? The physicist Richard Feynman’s father once taught him, “You can know the name of that bird in all the languages of the world, but when you’re finished, you’ll know absolutely nothing whatever about the bird. You’ll only know about humans in different places, and what they call the bird (Feynman 1988). Was Feynman’s father right? Is naming something far less important than knowing its nature? In part, the wisdom holds. Naming all of the periodic elements is impressive, but doing so without regard for how they interact in the world, or with each other, seems to defeat the purpose of chemical knowledge. Can’t we just stress their properties? Well, sure, but at the end of a day, we come back to our naming traditions.

Naming systems are ingrained within our ability -- and human tendency -- to categorize and catalogue information (Tran, 2012). At the end of the day, it is simply inefficient to refer to ‘neon’ as

'that gas naturally occurring in our atmosphere that rarely reacts with anything, and is frequently found in Las Vegas signs.' What's more, there are features of the physical world we can never observe directly. For example, we could hardly hope to understand the activity of subatomic neutrino particles passing through the space between our atoms without someone telling us about them -- and that telling requires some standard of scientific language. As natural categorizers, it is unsurprising that humans spend quite a bit of time classifying everything we encounter.

We have been classifying things since the dawn of language, but perhaps the most significant shift in science taxonomy came in 1753 when Carolus Linnaeus began published the tenth edition of his *Systema Naturae* (Systems of Nature). It became the first text to consistently use what we now call the 'Binomial Nomenclature,' a system for naming and cataloguing organisms based on their most prescient features (Bellows & Fisher, 1999). We have since adopted the system, and nearly every discovered organism now has its own dedicated name that follows Linnaeus's original patterns. This is not to say that the naming is easy. "Taxonomy is described sometimes as a science and sometimes as an art, but really it's a battleground" (Bryson, 2003). There are constant skirmishes in the physical and life sciences regarding names. We can look to the recent discovery of several skulls in Dmanisi, Georgia to hear a modern debate about our ancient ancestry (Sample 2013). Anthropologists are now disputing whether several specimens previously thought to be separate species are actually one and the same.

Where does that leave us then, in the 21st century? Are we improving our science communication? Should we focus more on how to teach individuals varying levels of scientific specificity? For the child, the language of science begins with a first question like, "Why are the cows walking away?" The parent might answer simply and truthfully, "They are looking for something to eat." In these first years, gathering scientific information happens purely through direct sensation. In time, the child will discover reading. The textbook, the science fiction novel, newspaper, magazine, internet article -- these have all become standard media for communicating ideas in science through written language. By the time the child has grown to young adulthood, and entered college, the scope of scientific education will begin to shrink with specialization. The language becomes more specific, tailored, and precise. Now "the

bovine strategically positions itself to maximize alimentation through the harsher winter months." With each additional degree -- Masters, PhD., etc. -- the scope of discourse will narrow to the point of novelty -- with hope leading to new discoveries that will each require tailored names -- names which stress the vital features of the discovery. These names will then enter books and classrooms, and so the cycle continues.

As we learn more about the world, our experience becomes more rich. "This small cluster of white flowers, fanning out atop a spindly green stem? We call this plant 'Queen Anne's Lace' -- doesn't it look like lace?" You may know this plant in another context entirely. Pull it up by the roots and under the dirt you will find a wild carrot. Furthermore, in the academic community of botany, the flower is known as *Daucus carota*. Can we afford this kind of layered lexicon for so many of our plants, proteins, planets? Sure. We can afford them, and we need them, if we want to continue conducting science at so many distinct levels of detail. It can be confusing, or even stressful, when one level leaks into another. However, new knowledge is where curiosity and learning intersect to add meaning to our world, and for that we can thank the language of science.

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Image Source

- 1) George Lemaître with Albert Einstein
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 - 2) Romney and Marilyn Monroe
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