

Two bits on qubits

I greatly enjoyed reading David Mermin's last two Reference Frame columns on factoring and quantum computing (PHYSICS TODAY, April 2007, page 8; October 2007, page 10). However, as the proud one-time owner of the California license plate QUBITS (which I had occasion to park beside a QUARKS license plate from New Mexico), I feel I must cheerfully disagree with Mermin's choice to denote quantum bits as qbits. His slander of the traditional shortened spelling of quantum bit as "the vulgar spelling *qubit*" lays down the gauntlet to the proud worldwide community of heterographic homophone lovers, many of whom I call friends.

Mermin's arguments are deceptively enticing:¹ that *qubit* violates the English rule that *qu* should be followed by a vowel, that no one would ever call the swab a Qutip, and that Paul Dirac with good reason called them q-numbers, not qunumbers. One reason might have been enough, but cube it and certainly no one will argue back at you.

Let us rebut those arguments one by one. First, if Mermin is serious about his respelling of the shortened form of quantum bits, then certainly he should choose q-bit instead of qbit, because the only word with a consonant following a *q* in the *Oxford English Dictionary* is the crippling child of circumstance, *qwerty*, to describe a keyboard. And, having settled on q-bit, one faces a dilemma. Writing "q-bit" immediately conjures up Q-tip and, worse for those of us from

the video game age, Q-Bert (or Q*Bert), the name of an addictive video game featuring an eponymous alien who hopped on a tricolored pyramidal staircase. Mermin may find no discomfort in hearing echoes of "Q-tip," but I think the majority of physicists—not to mention computer scientists—would prefer not to be reminded of either ear infections or hopping aliens when they transcribe their serious scientific work.

I note that q-number and Q-tip arose at the same time. (Originally called "Baby Gays," Q-tips were renamed in 1926. The Q stood for quality.) With no disrespect to Dirac, who seemed to have a thing for full-letter initials, history, as measured by the success of *q-number* versus the ubiquity of *Q-tip*, has clearly decided that the *q-* prefix works better for brand names than for scientific terms. In short: Let us keep the corporate branding of science off our beloved quantum bits.

Most importantly for the progress of science, the fact that *qubit* is an intentional homophone of *cubit* is not vulgar but rather a blessing in disguise. A cubit is an ancient unit of length, roughly equal to the length of a forearm. And that "roughly" should offend the heart of any physicist. Like the foot, the cubit is an imprecise unit whose lack of precision makes me think it deserves to die. Can you use *cubit* on your physics tests? No! And I can think of no better death than its replacement by *qubit*, a precise unit of quantum information.

As an addendum to the beauty of this homophone, one should not overlook the fact that the cubit is most often associated with lengths in biblical texts. And despite Mermin's claim to the contrary, *qu* followed by a consonant does appear in English words, albeit proper nouns, notably Qumran, the name of the settlement nearest where the Dead Sea scrolls were discovered.

Long live qubits. And may qbits and their dirty cousins Q-bits only rear their heads in a future quantum computing company or in a medical journal describing bits of cotton swab lodged in the ear.

Reference

1. N. D. Mermin, *Am. J. Phys.* **71**, 23 (2003).

Dave Bacon

(dabacon@cs.washington.edu)
Seattle, Washington

Mermin replies: The enticing arguments that Dave Bacon tries so well to refute were not in my Reference Frame columns, which I'm delighted he enjoyed. The point is put best in my new book,¹ where I also note that *q-bit* would indeed be better than *Qbit*, were it not that common expressions such as 2-*Qbit gate* fail to work when written in the form 2-*q-bit gate*. To solve the problem, I drop Dirac's hyphen but put Q in uppercase (which the *qbit* Bacon wrongly attributes to me does not) to emphasize that it functions as the name of a letter and not as part of another grotesquely spelled word.

Qbit for the quantum object parallels the equally important Cbit for the classical object (*clbit* would be ridiculous). The capitalization convention gives rise to the useful term *Bit*, which refers collectively to both kinds of physical objects, as opposed to *bit*, which refers only to a number that can be 0 or 1.

I agree with Bacon that *qubit* has achieved its current status because of its spurious resemblance to *cubit*,² but I do not agree that the foot deserves to die. It should be redefined 5 millimeters downward to a light nanosecond³ a couple of years after our backward nation finally goes metric, which I confidently expect to happen in a century or two.

Setting aside the fact that transliterations of foreign proper nouns notoriously violate all kinds of rules, I note that *Qumran* is pronounced *k'mran*. This class of examples would require *qubit* to be pronounced *k'bit*.

It may be quixotic (but certainly not *Qxotic*) to try to correct the spelling of an entire community, but I owe it my best shot. What else is retirement good for?

References

1. N. D. Mermin, *Quantum Computer Science: An Introduction*, Cambridge U. Press, New York (2007), p. 3.
2. Ref. 1, p. 4.

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