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# Data Trends

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## Quantum computing explained (not)

On 5 October 2015 Australian engineers at the University of New South Wales announced that they had built what they have termed a qubit logic gate in silicon (http://www.engineering.unsw.edu.au/news/quantum-computing-first-two-qubit-logic-gate-in-silicon). This gate makes calculations between two qubits of information possible for the very first time. Previously engineers had been unable to make two silicon quantum bits share information, or even talk to each other.

This news, of course, made less press than Bruce Jenner being named woman of the year, and got less clicks than the 'The Best of Cute Cats Vine Compilation 2015'. Truth be told, I did not see the news myself until the Editor of *Preview* passed on the link suggesting that maybe I could write something serious this month.

To be sure that this news on quantum computing was, in fact, worthy of my column, I did watch the cute cats videos (and maybe 10 or so more after that just to be sure) and I reviewed the in-depth article in my Facebook account about how Bruce (now Caitlyn) Jenner was named woman of the year – for comparative purposes only. As expected, the *Preview* Editor was right… always right…

To understand why the UNSW announcement represents such an amazing first in computing, one needs to first understand what quantum computing is and why it is so different to 'regular computing'. So, here goes a feeble attempt at doing just that. Please note that I turned to Michael Nielsen's blog entitled 'Quantum computing for everyone' to help me (http://michaelnielsen.org/blog/quantum-computing-for-everyone/). Michael has written 60 papers and co-authored the standard text on quantum computing and in his well-written article he explains how even describing quantum computing almost requires a quantum computer.

Okay, I have read Michael's article five times now, and I am still not able to explain what a quantum computer is. In fact Michael agrees that he can't adequately explain it either. The best he seems to be able to do is to explain how one might go about explaining it, if only there was a way to explain it (*Editor's note: Apologies to the author of The Hitchhikers Guide to the Galaxy would seem to be in order*). However, some of the salient points of the article are as follows:

- Quantum computer scientists believe that quantum computers can solve problems that conventional computers are not able to – hence their interest in quantum computing.
- A standard 20 bit computer can be described with 20 numbers, whereas a computer using qubits doubles the numbers required for description with every qubit added…. So, a 20 qubit computer would need over 1 million numbers to describe it.
- The perceived benefits of a quantum computer, when compared to a conventional computer, is that quantum computers can explore many possible solutions to a problem simultaneously – known as quantum parallelism.
- The downside is that quantum parallelism can produce so many possible solutions that it may take another quantum computer to try and figure out which of the possible solutions is the correct one.

Put simply, there is a quantum gap between finding a simple way to describe quantum computers and the way that quantum computers actually work.

All that being said, rest assured that the engineers who created the quantum bit logic gate at the University of New South Wales have expanded the possibilities of computing in a major way. Quantum computers are likely to be the pivot point in computing in our lifetime. Like the calculator to the abacus, or the email to regular post. In the field of geophysics quantum computing will be a very welcome addition to our ability to simulate and test our theories.

The day that quantum computers can be explained to the masses, is the day that quantum computers become available to the masses. In the words attributed to Albert Einstein, 'if you can't explain it simply, you don't understand it well enough'.