Quantum tech disappoints, but only because we don't get it

July 16 2014, by Pete Shadbolt

As hard to understand as the movie Matrix. Credit: jurvetson, CC BY

Over the next five years, the UK government will spend £270m on supporting research in "quantum technology". When budget announcements were made in 2013, provisions for offshore wind and shale gas extraction were received with raucous cheers, but the mention of quantum technology received a muted response. While we would expect any MP to have an informed opinion on energy or education, they might be forgiven for having less to say on an active field of scientific research with a fierce reputation for being difficult to understand.

Quantum technologies exploit the paradoxical and unfamiliar behaviour of tiny lumps of light and matter, including single atoms, electrons and photons. Using these "quanta" as building blocks, we can construct machines which exist in quantum "superposition" states. These states are so exotic and unfamiliar that they cannot be adequately described using simple language – we must resort to a mathematical description.

Machines based on these technologies are expected to dramatically outperform their classical counterparts in a variety of important tasks, including secure communication, computer simulation of atoms and molecules, precision measurement, code-breaking and quantitative analysis of "big data".

A recent study by Sciencewise, which is supported by the government's Department for Business, Innovation and Skills (BIS), found there were no opinion polls or surveys looking at the perceived social, ethical and technological impact of quantum technologies. Instead, they had to assess public opinion based on news, blog posts and online comments.

The promise of exotic and powerful new machines, coupled with the air of mystery often associated with quantum theory, has made quantum technologies a topic of constant discussion in the mainstream press. In 2013, a wave of excitement was sparked by investment from global tech giant Google, the US space agency NASA and defence contractor Lockheed-Martin in the Canadian upstart D-Wave. More recently, documents leaked by Edward Snowden revealed an US$80M programme funded by the US National Security Agency (NSA) to develop a "cryptologically useful quantum computer".

Past press coverage of quantum technologies has often focused on their implications for privacy and cryptanalysis (used to reveal hidden information). Quantum technologies provide both a secret communication channel whose security is guaranteed by the laws of physics, using quantum cryptography, and a way to crack most existing secure communication methods, using quantum algorithms.

The latter raises security concerns that are relatively easy to convey. As more and more communication happens via digital channels, people are becoming aware of the risks surrounding their data. Revelations of government surveillance using advanced technologies have generated recent public debate.

Google has been proactive in publicising less well-known uses for quantum technology, such as quantum simulation and machine learning. These applications arguably have greater potential than code-breaking, where side-channel attacks remain cheap and effective. A number of media reports address these ideas, but the complexity and diversity of these applications continues to present a significant challenge for the lay audience.

While strong public and private investment suggest practical quantum technologies are closer to market than ever before, the Sciencewise study notes a certain amount of pessimism in recent coverage. The authors identify a sense of frustration, in newspaper reports and online reader comments, over the idea that quantum computing has been "on the horizon" for more than a decade – and might stay there forever.

This attitude is exacerbated by the stereotype of quantum mechanics as extremely difficult to understand, which means that significant advances in the performance and capability of quantum hardware are often not reported. It does not help that the evaluation and verification of new quantum devices is difficult, even for experts in the field. This has led to a fierce and widely publicised debate over the veracity of D-wave's claimed quantum speedup.

At some point in the near future, it is very likely that quantum machines will have significant implications for our health, privacy, defence and environment. Based on the results of the Sciencewise study, there seems to be an urgent need to improve public understanding, from the existing fascination with the basic mechanisms and phenomena of quantum theory, to ethical and sociological questions.

Source: The Conversation

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