# Quantum computing opens new possibilities

## First Haig Farris brought us Science World, now it's a super computer

LOUISE LOIK
EDITOR

Prime Minister Justin Trudeau made headlines with his 35-second soundbite explaining quantum theory at an Ontario university last week.

Haig Farris, co-founder of the world's first commercial quantum computer, D-Wave, thinks it's great that the prime minister was bringing quantum theory into the mainstream, but according to Farris, who lives on Bowen Island, "they say that if you say you understand quantum mechanics, you don't."

Farris, who co-founded D-Wave in 1999, has his own explanation of how a quantum computer works.

"It processes every possible permutation at once. Classical computers take things step by step. In a problem that is extra complex, like chess, or with stock trading, there are a great number of possibilities. It solves the whole problem in one step."

If, for instance, you had to plan a trip, step-by-step you would need to consider every component of the journey, from one point to the next, looking at all forms of transportation, service providers, accommodation, date options and all possible combinations for each leg of the journey. "With quantum computing, an algorithm incorporates all that information, entangled and superimposed. It produces solutions in one computation."

"We are working on 2,000 permutations solved in the blink of an eye," says Farris. "No one is doing it yet."

The company website describes D-Wave as a computer that "taps directly into the fundamental fabric of reality – the strange and counterintuitive world of quantum mechanics." Einstein described the idea of quantum physics as "spooky distance," a place of parallel worlds, or as our PM explained it, where things can be "both a particle and a wave at the same time."

"We've done the work," says Farris. "You can prove it on an atomic level. Particles can exist in two places at once."

What is even stranger than the concept of quantum mechanics is that what happens inside the box of a D-Wave computer. The equilibrium of the computer is maintained within a super-cooled environment, 150 times colder than interstellar space. The balance is so delicate that what happens in the box is unobservable, as observation, heat, or noise would mess with the homeostasis.

NASA and Google acquired a D-Wave quantum computer last summer and the CIA is one of the investors in the company.

Another advantage of quantum computers is that D-Wave "is green technology," says Farris. "It can have a huge positive impact on the environment; one huge D-Wave server can form millions of computations, but it doesn't generate heat, and scaling up doesn't use more information. Currently, what one quantum computer can process in a moment would take a million traditional computers to process over the course of many years."

The human-like ability to assimilate a lot of information in an instant is what is special about the D-Wave computers. For instance, says Farris, "With Google Glass, our computer taught it to distinguish between a wink and a blink."

The possibilities for problem solving with this technology are vast are unimaginable, and for Farris, this kind of business is a perfect fit. He is a man who dwells in the realm of possibilities. Though he isn't one to blow his own horn, Farris has been pushing the boundaries of what can and can't be done in areas ranging from the arts to science and education for decades.


**Bowen resident Haig Farris is the co-founder of D-Wave, the world's first commercial quantum computer.** *photo supplied*

Farris is one of Canada's best-known venture capitalists and experts in high-technology startups. He started out practising law in Vancouver, and true to form, chose corporate law "because it deals with the future." At 28, while working in corporate law, he saw the opportunity for a shift, to work as a financial consultant for startups and in venture capital.

At Ventures West, in one situation, he saw the potential in a company working on commercialized radio technology, the type used by FedEx and cab companies. He helped finance the business that Motorola then purchased. His successes continued and as his accomplishments grew and so did Ventures West. "It got big and I left," says Farris. In 1990, he started up Fractal Capital Corp., a private venture capital company that finances high-tech startups. The next year, as a venture capitalist, Farris was invited to teach entrepreneurship at UBC. He accepted the position as an adjunct professor but wanted to ensure the course would be open to science graduate students, along with other students from outside the faculty of business. He wanted someone with a physics PhD to apply their skills outside of academia and use their knowledge in a business application. For a decade, he worked with some of the brightest young minds in Vancouver and kept an eye out for the "superstars" who could be both analytical and good problem solvers.

One of his superstars was Geordie Rose, who was studying for a PhD in theoretical physics. He impressed Farris with his clear presentation about a complex subject, so much so, that when he came back to Farris years later for support on a quantum transistor, Farris handed him a cheque for a computer and printer to get the business that would become D-Wave started.

Over the years, only a few superstar students got startup funding from Farris.

Another company, Zymeworks got its start because Ali Tehrani took the entrepreneurship class and impressed Farris with his work designing protein enzymes. Zymeworks Inc., is working on antibody and protein therapeutics for fighting cancer, autoimmune and inflammatory diseases. They are about to begin human clinical trials. "It's quantum chemistry with an overlap of chemistry, physics, biology. It's the ultimate medicine – printing organs," says Farris.

Farris was also impressed with Elliott Holtham, a geophysicist that was in his program. Holtham joined forces with Farris to start Tech-X Resources, which creates physics simulation and scientific software. The company created an algorithm that would map out copper deposits that are road accessible.

The investor also saw value in plant genetics research and got behind Creatus Biosciences and researcher is Dr. Hennie JJ van Vuuren, who is focused on the microbiology of genetically engineered yeast for use in wine making. The company is also using yeast in the sustainable commercial production of industrial chemical compounds.

**"Currently, what one quantum computer can process in a moment would take a million traditional computers to process over the course of many years."**

Farris says that what he looks for in a business partner is not just business acumen, but likability. "From the time I was 40 I decided I will only work with people I like."

His guiding principle seems to be working. He has found the right people to work with on an astonishing number of successful ventures. Farris, who "never took a science course, but read a lot," has none-the-less spent decades promoting scientific experimentation at all levels. It was Farris, with a strong team of partners, who took the concept of a science centre from an inspiration in the mid-1970s to the grand opening of Vancouver's Science World by Queen Elizabeth II in 1987. "I toured Prince Philip around," adds Farris, saying that all the work to make Science World happen "was a labour of love." He adds, "At the time, no one had an idea what Science World was." Farris worked on acquiring the location, along with $22 million in funding. "Rudy North, who lives on Bowen, helped out with $40,000," says Farris.

At the conclusion of Expo, Farris also managed to get the geodesic dome to house Science World. "It took a big fight to get the globe after Expo ended," he says, but clearly, the results were worth the fight. His eyes shine with pride over the number of students, teachers and visitors who have walked through the doors of Science World, gaining inspiration and knowledge. "It was fun," he reflects simply.

In spite of all that Farris has accomplished, he is intriguing in his lack of self-importance. He shows curiosity about the people around him and enjoys talking about other people's accomplishments. Farris is just as interested in the person who has been a volunteer teacher in a developing country as he is in an entrepreneur, an artist, a performer, or a physicist. He tries adeptly to focus attention on other people before talking about himself.

Farris is happy to talk about another project that deviates from the high-tech world. *Billy Bishop Goes to War*, a musical theatre production which enacts a piece of Canadian history about a First World War flying ace, made it to the stage in both London and on Broadway in New York, thanks to the efforts of Farris, who brought the various people and pieces together. He also initiated the Disney movie production of Farley Mowat's book, *Never Cry Wolf*.

With so many accomplishments under his belt, you might expect Farris to be feeling burnt out. The opposite would be true. Farris reflects instead that his career "has been a lot of fun." It turns out that in spite of a busy schedule, Farris also takes time to photograph the wildlife around his oceanside home, taking remarkable pictures of marine mammals and birds. He has a strong appreciation for art and museums, nature, and especially for the love of his life, Mary Farris, who is an accomplished artist.

He's invested in things that he's found interesting, and has worked with people that he's

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# Dancer looks back on touring with Prince

LOUISE LOIK
EDITOR

Kelly Konno was 17 when she toured with Prince as one of his backup dancers.

She reflects on the rare experience of working for Prince, the pop icon who died suddenly last week.

"I had every one of his albums," says Konno, who still can't believe the turn of events surrounding herself and Prince. "I'm a huge fan."

Konno was 17, a backup dancer just starting out fresh from Surrey and living in LA. She was living with other dancers, getting by hand-to-mouth, when she auditioned to dance for Janet Jackson. There wasn't an opening for her with Jackson at the moment, but the choreographer who was watching her had another client for Konno. That client was Prince.

At the time, Prince was pushing back against the industry, dropping his well-established name and opting instead to be called The Artist, or The Artist Formerly Known As.

"We were told to call him The Artist," says Konno. "We also called him The Boss." The Artist had one main dancer and needed Konno as one of this two other dancers for his North American tour. Naturally, Konno took the job.

"We weren't a big part of the show. We did two numbers and would sit in the audience and watch the show in between our sets."

Konno says that Prince was exacting in his expectation of everyone involved in his shows. "He could get up and play any instrument from his band, and play it better than anyone in the band. If someone wasn't up to his expectations, anyone, they'd be gone."

She says that he wouldn't warn anyone, but he would change up his set list and his song list, keeping everyone on their toes. "One day the other dancer and I were in the audience between our sets and our song starts playing. We flew down the steps to race onto stage. I think he saw us sitting there and wanted to make sure we were paying attention."

Konno's one role as his dancer was to come running down from the audience area, looking like a journalist trying to get a story. Once she got to the floor in front of the stage, she had to follow him in a choreographed style, back and forth in front of the stage, while he pretended to push her away before he finally pulled her up onto the stage where she would continue in character.

Prince regularly performed for two hours straight in concert, says Konno, and then, "around 2 a.m., he would let a club know that he was coming and then he and his band would show up and play for another two hours." He had unstoppable energy and talent, and attracted an entourage of the rich and famous.

Before each show, Konno says that the performers would gather with The Artist for prayer.

"One day I ran in, held hands with the person beside me, and when I opened them, I saw that I was holding hands with Lenny Kravitz – he ended up being a surprise guest in the show."

Konno said that Prince spoke in a soft voice and kept his distance from the dancers. "We were allowed to come to the club parties after the show," says Konno, who was underage and amazed at her own circumstances. "I would just sit in the wings and watch him play and I'd see all kinds of stars who were there too."

She says he treated everyone well, putting the crew and dancers in five-star hotels while on the road.

"Prince was always very respectful. One day at the end of the tour, his bodyguard told me that Prince wanted to talk to me. I was waiting at a table, trying to think of what he was going to say. Prince didn't speak to us individually," says Konno, "so I was worried, I didn't know what to expect. He came and sat across from me and in that soft voice said that he really liked what I had been doing on the tour – and then he asked me if I would like to do the European leg of his tour."

Konno said she was electrified. "I was so excited." She accepted, but then she was offered a chance to tour with Janet Jackson "with lots of dancing," so she turned down Prince's offer. "I can't believe that I turned down Prince at 17," says Konno looking back.

Before switching bosses, Konno had a chance to go to Prince's estate, Paisley Park, near Minneapolis. "He had a recording studio there, clubs, a sound stage, it was amazing. I feel pretty lucky I got to see it, and to have a chance to work for Prince, especially at 17. I'm sorry that he's gone. He was an amazing performer."

# Canada still in the 'Dark Ages'

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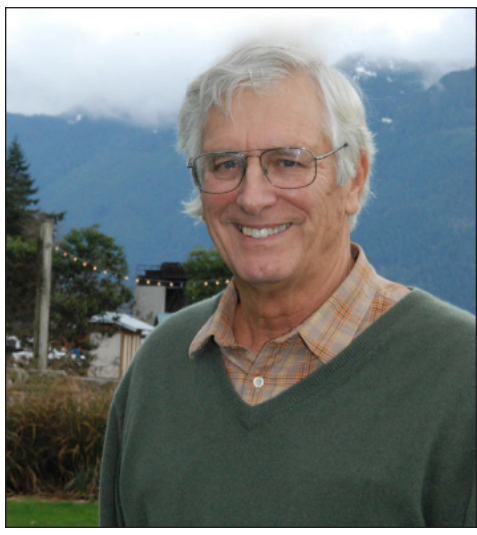
liked. In the process, he happens to be helping "create an entirely new technology with the potential to solve some of the world's most challenging problems."

Farris is president of Fractal Capital Corp., co-chair of the Creative Destruction Lab at the University of Toronto, and chair of the advisory committee for UBC Centre for Molecular Medicine and Therapeutics at B.C. Children's Hospital. Farris is involved with Quest University, and is a patron of the arts, among other things.

His list of awards is also lengthy, and includes an award presented by the Governor General of Canada for his role in developing the Canadian venture capital industry. He's invested in more than 100 startups and early-stage companies.

In spite of his own personal efforts to promote science and the advance of new technology, and regardless of the show of enthusiasm by the prime minister for quantum physics, Farris says the reality is that "Canada is still in the Dark Ages." He says that China understands the role of new technology and "treats it as something of major importance; the U.S. is beginning to move in that direction, and with Canada – we may as well be in horse and buggies we are so far behind." It's a comment consistent with what we've heard on Bowen from technology experts ranging from a plasma physicist to a number of renewable energy experts.



**Haig Farris has made numerous contributions to the world of science innovation and the arts.** *photo supplied*

Farris has advice for the next generation of innovators. "Learn coding, physics and math. Learn to think and to debate." Another thing? "Read a lot."