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INNOVATIONS MAP

HOW AUSTRALIA STACKS UP



Raymond Kurzweil solves problems in his sleep

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MANY of Raymond Kurzweil's best ideas have come to him in his sleep.

The US-born serial entrepreneur has been responsible for breakthrough innovations in fields ranging from optical character recognition and speech recognition to musical synthesisers, as well as authoring several books on health, artificial intelligence and the human mind.

But it is through the somewhat unorthodox technique of lucid dreaming that many of his best innovations have been derived.

"Every time I go to sleep I assign myself a problem, which could be a technical issue with an invention, it could be a business strategy issues, or it could be an interpersonal problem," Kurzweil says. "The next step is in the morning, in that halfway stage between dreaming, I return to that problem."

He says the technique works because in dreams the censors in our minds that normally shut down irrational thinking are inactive, which is why dreams can explore territories which might otherwise be unorthodox for the dreamer. Being partly awake however enables him to retain some rational basis for interpreting his thoughts.

"I'll go through these very creative dream ideas and try to make sense out of them and try to see if I can get insights," he says. "And I try to spend 15 or 20 minutes doing that in the morning. I've come up with whole new inventions that way, or I can have confidence in a decision."

Kurzweil says he has come up with whole new technologies using this technique, including the algorithms that are the basis of a company he founded that makes short term predictions about the stock market. Technology for simulating the presence of another person through virtual reality also came out of a lucid dream.

"And I do that routinely if I have a decision like whether I should hire somebody or do a deal," he says.

Visiting Australia to speak at the Creative Innovation 2011 conference, Kurzweil says much of his recent thinking revolves around health and the convergence of artificial and human intelligence, which he believes will lead to an evolutionary stage known as the singularity where our bodies and minds are augmented with technology.

Kurzweil points to the fact that the device he carried in his pocket is able to perform that which would have required a room-sized computer 25 years ago as evidence supporting his assertion of future technological capability.

"We will do that again in 25 years, so this mobile device will be a billion times more powerful per dollar and 100,000 times smaller, which will make it the size of a blood cell," he says. "So technology is going to become basically invisible, and it is going to be embedded in everything, including our bodies and brains."

Kurzweil's current project is to better understand the human brain. He proposes that the law of accelerating returns, through which the rate of improvement of technological development increases exponentially, will mean that by 2029 we will have the technology to understand the principals of operation of human intelligence, and we will have simulated brain regions at the human scale.

At that point artificial intelligence will be able to pass the Turing Test, named for the pioneering British computer scientist Alan Turing, which put simply is a test whereby a human test operator is unable to determine that the responses from a test subject have come from a machine or another human.

Kurzweil says the IBM supercomputer Watson, which this year beat the all-time champions of the quiz show Jeopardy!, uses computing methods inspired by the biological processes of the brain.

"The idea is not to copy mindlessly the mechanisms that we find in the brain, because a lot of the machinery there has to do with biological support functions for the fact that these are biological cells," Kurzweil says. "We need to understand the key information processing principals by which the brain produces intelligent decision making. And we are making exponential gains in doing that."

He says this work is currently being held back by shortcomings in brain scanning technologies, as the resolution required needs to show individual connections in real time in the living brain.

"fMRI (functional magnetic resonance imaging) produces colourful pictures and shows you where things are happening, but not at enough precision to understand how they work," he says.

Should such technology become available, it would be possible to map and then simulate human thought processes. This could lead to a whole new wave of machine-driven innovation, as Kurzweil says there is no reason to assume that a machine mind could not innovate as well as a human mind, or indeed much better.

"That stems from the way that the neocortex is designed," Kurzweil says. "It can make connections in terms of patterns. It will see something from one area of our lives or one discipline and see that it can apply to something completely different at a level that we can't even articulate.

"We're beginning to understand how that works, and machines can do that too. In fact machines can be much more methodical in looking for those kinds of cross-pollination opportunities."

While artificial intelligence will lead to numerous innovations, Kurzweil says the law of accelerating returns means that numerous industries are facing periods of rapid change. For instance, the advent of three-dimensional (3D) printers promises to revolutionise manufacturing, with many parts and objects effectively being able to be 'printed out' at the location where they are needed, using a combination of powders and resins to build up a part.

Kurzweil says these devices are becoming both cheaper and able to work at smaller and smaller scales.

"Right now it is in microns, but it will be in nanometres within 20 years, so we will be able to manufacture anything," he says.

"But already you can manufacture quite a bit. Already I could email you a violin if you had a 3D printer, and you could print it out. And it plays quite well.

"3D printers are not that expensive now. They are in the thousands of dollars they used to be in the tens of thousands. And if you go out ten years they will be in the hundreds of dollars."
