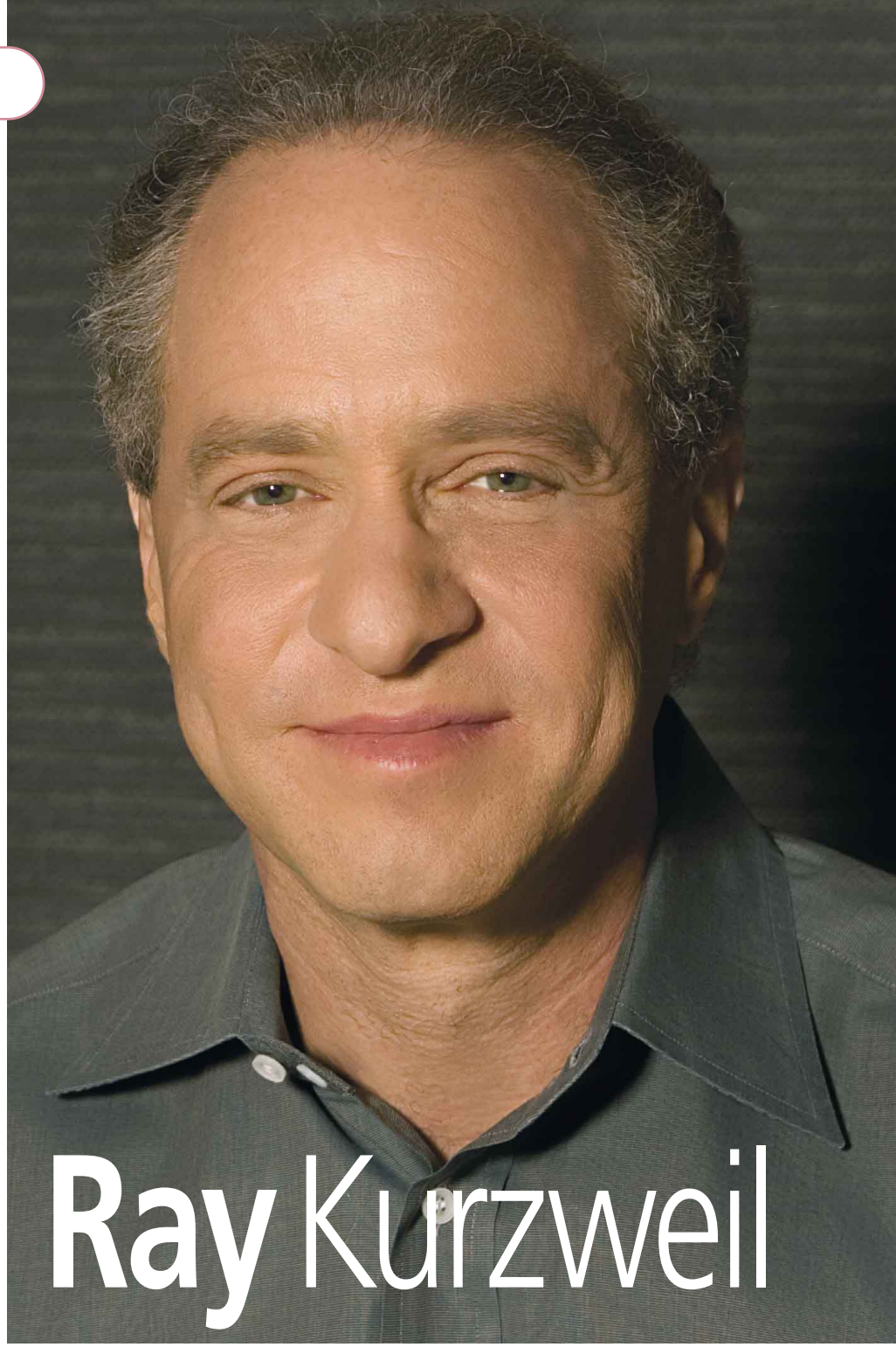

Ray Kurzweil

Photo courtesy of Kurzweil Technologies, Inc.

The Synth Designer Who Wants To Live Forever

Ray Kurzweil brought human feeling to digital synthesis, and his ultimate goal is to achieve immortality by fusing human and artificial intelligence. In the meantime, he's returned to Kurzweil Music Systems to oversee the next generation of music technology...

Gordon Reid

Although the music industry thinks of Ray Kurzweil as synonymous with the keyboards that bear his name, these are only a tiny fraction of his creative output, which started in 1964 when, as a high-school student, he wrote software that (ostensibly) could be instructed to compose in the style of the great composers. This won him seven national awards, one of which was presented to him by then President of the USA, Lyndon Johnson. In 1970 he graduated from MIT with a degree in Computer Science and Literature and, over the next few years, he invented the CCD flatbed scanner (1975) and the speech synthesizer (1975), and contributed mightily to OCR (optical character recognition) technology by making it capable of reading almost any font (1976). Putting the three together, he found that he had all the elements needed for a text-to-speech system or, to put it crudely, a computer that could read books to blind people.

The Birth Of Kurzweil Music Systems

Having developed the technology, Kurzweil founded Kurzweil Computer Products in 1976, and his reading machines attracted a great deal of interest from the press and on TV. The turning point for the music industry came in the same year, when none other than Stevie Wonder bought Kurzweil's first unit. I'll let Kurzweil take up the story. "When he came by in 1976 and we gave him the first Kurzweil Reading Machine For The Blind, it began what is now a 30-year friendship. Our conversations over the years culminated in his challenge to build a bridge between the acoustic world and the computer world of music, so we decided to work together and founded Kurzweil Music Systems."

The *raison d'être* for the company was, to use Kurzweil's own words, to marry "the extraordinarily flexible computer control methods with the beautiful sounds of acoustic instruments", and the result, introduced in 1984, was the K250. Nowadays, many players might feel that a 12-bit ROM-based sample player was far from a step forward in a world populated by revered CS80s, Prophets, OBXs and Memorymoogs, let alone Fairlights and Synclaviers. Nevertheless, the K250 was an instant sensation. The company's claim that it was "the first music synthesizer able to fool professional musicians into thinking they were listening to real instruments" is hyperbole, but it had a sound and character that remains respected and sought-after to this day.

"My primary interest is information technology, especially pattern recognition. All my computer-related projects involve pattern recognition, whether recognition of printed letters (OCR), spoken language (speech

recognition) or other patterns. There were a lot of problems in trying to get a conventional sampler to sound like a piano back in 1982. When a sampler looped the last waveform, as it needed to do to conserve memory, all of the overtones became perfect multiples of the fundamental frequency, thereby lost their 'enharmonicity' and therefore sounded like an organ, not a piano. Samplers did not accurately reflect the effect of touch on the time-varying timbre, and there were other problems. We used insights derived from pattern recognition and the closely related field of signal processing to model the piano and other orchestral instruments, and developed an advanced signal processing approach that accurately modelled a piano's response." I suspect that there's more than a little artistic licence in this description, but there's little doubt that the K250 sounded warmer and more organic than any other digital synthesizer of its era.

Throughout the '80s, things appeared to be going well for KMS. The K250, which cost approximately £12,000 for an unexpanded version, was never going to sell in huge numbers, but it was highly regarded throughout the industry, and soon spawned a range of much more affordable keyboards and 2U rackmount products based upon its technology. Offering up to 24-note polyphony and 16-part multitimbrality, as well as superb sound quality and expandability, the K1000 series — despite lacking conventional filters and some other, seemingly standard facilities — soon became staples on the keyboard stands and in the racks of high-profile players after their release in 1988. The reason? They sounded great.

Promise Unfulfilled?

Ray Kurzweil split his time between KMS and his other ventures. He had sold Kurzweil Computer Products to the Xerox Corporation in 1980, but had been retained as a consultant, a position he held until 1995. (The company is now known as Nuance, and has a market capitalisation of $2.6 billion.) The rest of his time he split roughly equally between KMS and Kurzweil Applied Intelligence, which was also founded in 1982 and which, in 1987, became the first company to market large-vocabulary speech-recognition software, called Kurzweil *Voice Report*. He also had many other positions and activities, all of which drew upon his time.

Kurzweil, The Fat Kat

In addition to everything else, Ray Kurzweil is the founder of Fat Kat, a company that claims to use pattern-recognition techniques to predict, recognise and create strategies for investment opportunities, and to apply "evolutionary algorithms to stock market decisions, with the goal of creating an artificially intelligent financial analyst". The company's web site makes remarkable claims about the provenance of their techniques, and the techniques themselves, which apparently employ fuzzy logic, neural nets, genetic algorithms, Markov models, fractal methods and clustering techniques. If these claims are true, Kurzweil doesn't only want to live forever, he must expect to be quite wealthy while he does so!

Perhaps it was for this reason that KMS never capitalised fully on their reputation. Although successful in the USA, the company's products made little impact in the UK, and were all but invisible in many other markets. This must have had an effect on the company's profitability, and KMS clearly lacked the penetration of, say, Roland or Korg, even in their home market. When I mentioned ▶

this to Kurzweil, he was very open, agreeing that "It was very difficult for any of the American musical instrument manufacturers, or for any consumer electronics company for that matter, to compete with the quality and efficiency of Asian manufacturing capability. So we felt we needed to team up with a strong Asian company."

Consequently, Kurzweil sold KMS to the Korean piano manufacturer Young Chang in 1990. As far as the outside world was concerned, this seemed to make little difference to the company. Kurzweil resigned as CEO but stayed on as a consultant, and the K1000 line was further enhanced and marketed as the K1200 and 'Pro' series. Then, in 1992, KMS released the first of the K2000 series of synthesizers and modules, and shortly thereafter discontinued all its other 'K' products. Existing owners were not happy, because Young Chang also discontinued the expansions and upgrades. On the other hand, the K2000 was received warmly by reviewers and players alike, and was to go on to spawn a dynasty of synthesizer workstations that still exists today.

Three years later, in 1995, Kurzweil departed from KMS and, for whatever reasons, the company entered a decade-long decline. Sure, the K2500 was a superb instrument, but by the time that it arrived, in 1996, the Korg Trinity and the Roland JV/XP series dominated the market that the Kurzweil workstations addressed.

Unfortunately for the company, Kurzweil hadn't been the only person to leave in the mid-'90s. "Other key players also left shortly thereafter, such as YT Kwon (who is now back, heading up international marketing and sales) and President Nam. I'm not entirely sure as to the reasons, but I think one factor was that there began to be a downturn in the worldwide acoustic piano market and that affected Young Chang, which had been the largest acoustic piano company in the world."

Further upgrades and options appeared for both the K2000 and K2500, and the K2600 was launched, as were diverse products including master keyboards, small MIDI modules and a powerful multi-channel effects unit. But nails started to drop into place around the coffin lid when, in 2003 or thereabouts, Young Chang's distribution and servicing network appeared to be evaporating. By the time the K2661 — yet another revision of the K2000 series — arrived in 2004, it seemed that the company had little left to offer. Then the virtual analogue VA1, which created a considerable amount of excitement at the NAMM show in January 2004, failed to materialise. Rumours began to circulate: was this the end of Kurzweil Music Systems?

The K250 was revolutionary in being a digital synthesizer designed with the musician's needs in mind.

Hello Hyundai

Kurzweil had been far from quiescent since leaving KMS a decade earlier, registering numerous patents, winning awards, adding to his already extensive list of honorary degrees, and being inducted into numerous Halls of Fame. Even before leaving the company he had developed Kurzweil *Voice For Windows*, claimed to be the first speech-recognition system for Microsoft Windows, and he followed this with Kurzweil *Voice Commands* (1997), improved text-to-speech systems (Kurzweil 3000, also in 1997), a 'virtual' recording artist that performed 'live' in 2001, photo-realistic avatar software for the Web (2001), and a pocket-sized text-to-speech system (2006).

He had also sold Kurzweil AI in 1997, and founded numerous further companies. Faced with this huge list of achievements and activities outside the music industry, and the lethargy that appeared to overtake KMS's R&D after 1995, I suggested to Kurzweil that the company's deterioration coincided with his departure. "It is fair to say that it slowed down," he agrees, "but there was ongoing improvement in all layers of the software and a major effort continued to develop cutting-edge music synthesis chip technology. That is reflected now in the release of the Mara chip, which I believe is the most advanced in the industry."

Perhaps it was this that persuaded the huge Hyundai Corporation to buy KMS from Young Chang in 2006 and then reappoint Kurzweil as its Chief Strategy Officer (CSO). Nevertheless, a car manufacturer with multi-national divisions in fields as diverse as shipbuilding, heavy industrial manufacturing and worldwide shipping may seem a strange parent for a keyboard manufacturer. Kurzweil thinks otherwise. "Hyundai Management Company is a broadly diversified company and likes to invest in markets where there is substantial growth potential. They have very capable management and a lot of resources, so when they get involved in an area they do so to be a major player. When I was in Seoul in January, they took me to a mall they had opened only a few months earlier and it was already the biggest mall in Asia. They are impressed with the multi-billion dollar market for electronic musical instruments, and they felt that combining their management skills and resources with the Kurzweil Music technology and brand they can take a leadership share of this worldwide market. I agree, and intend to work with them to achieve this objective."

This is borne out by Hyundai's current corporate objectives and its pledge to "build Kurzweil Music Systems into one of the largest music instruments brands in the world". But why would Kurzweil himself — whose activities are painted on a far larger canvas — choose to return to the company that he left more than a dozen years ago? "I've always had a great deal of pride in the Kurzweil Music products," he insists. "That is what is exciting for an inventor: to see people use and benefit from your inventions. I'm always excited when a musician or musical group sends me an album that the Kurzweil musical instruments contributed to. Hyundai has a methodical plan to build up every aspect

Ray & Terry's

I doubt that there's anybody else who has been featured in the pages of *Sound On Sound* who also co-owns a company dedicated to food supplements and longevity programmes. Kurzweil's interest in these areas is not capricious; he suffered from type II diabetes for many years. "My health interest started out as an independent interest stimulated by my overcoming my own diabetes. However, today, health and medicine has become an information technology, in that we are modelling, simulating and reprogramming the biological processes in our bodies and brains as information processes."

The benefits of antioxidants and other wellness products are hotly debated, and some scientific journals have expressed concerns about their use. But, whether or not you believe the remarkable claims made by Ray and Terry, it's more evidence of Kurzweil's remarkable range of activities.

Some views of the Kurzweil factory in Korea.

of the company. Research and development has already quadrupled and will continue to grow. Some of the keys to Hyundai's success are quality, reliability, and service. That may seem mundane, but it is these sorts of issues that enable success on a large scale.

"I see one area of my new role as assisting with strategy. I recently conducted a review of the technology and product plans and wrote a detailed memo with suggestions that have been taken seriously. I will also play a role as a public spokesperson, as the founder of the company."

Of course, what we want to know is whether Hyundai's acquisition of KMS will result in exciting new toys. Inevitably, Kurzweil has to be rather circumspect on this point, and his comments read a little like something trotted out by the marketing department. "If you look at the new PC3 and SP2, you can see a major new level of price-performance. For relatively low cost, the PC3 [*below*] provides 128 digital channels, each with their own sophisticated signal processing, plus overall signal processing on each mixed channel, and lots of programmability. You'll see this kind of price-performance in a variety of configurations for different markets and price points. The technology will also be adapted for an attractive line of home products." Hmm... those last few words are more interesting than they first appear. I'm reminded of the evolution of Emu after its acquisition by Creative Labs; products such as Soundblaster AWE32 and Waveblaster II were based in large part on Emu's technology, reaching a customer base that would have been beyond the wildest dreams of the original company.

Who Wants To Live Forever?

But Kurzweil's view of the future is far wider than that. Liking to be perceived as "an inventor and futurist", he is the guru of the principle of Accelerating Returns, a belief that the rate of technological progress is not just increasing, but doing so in an exponential fashion. "Information technology doubles its price-performance and capacity in under a year," he says, "which represents a billion-fold improvement in 25 years. Consider how powerful information technology is already, and imagine multiplying that by a billion in just a quarter of a century. This will impact not just electronic devices but everything from our health to energy. By the 2040s, non-biological intelligence will be a billion times more capable than biological intelligence. But this is not an alien invasion of intelligent machines, rather it is extending the power of our civilisation. We are already a human-machine civilisation, and ultimately we will merge with the technology we are creating. We are the only species that extends our physical and mental horizons with our technology."

Not all scientists believe that Kurzweil's views bear close scrutiny. For example, the rate of increase in computer power has until now been driven by miniaturisation, but this cannot continue indefinitely, because quantum physics will get in the way of developing ever-smaller transistors. Kurzweil remains undeterred. "This is a complex topic, and I analyse it in detail in the first several chapters of my latest book, *The Singularity Is Near*. Moore's Law [*see box opposite*] is just one paradigm for extending computer capability, but it will continue until around 2020. At that time, we will go to the next paradigm, which is three-dimensional molecular computing. That will keep this acceleration going through the rest of the 21st Century."

First Person Singular

Kurzweil sees Accelerating Returns as only a stepping-off point for something that he calls The Singularity. This is the belief that, as technology continues to progress, it will become intelligent and, within a short time thereafter, billions of times *more* intelligent than even the brightest human genius.

If this sounds rather too close to *The Terminator* for your taste, you're not alone. Indeed, the notion of The Singularity has its roots not only in maths and astrophysics, but in science fiction, wherein intelligent computers design ever more intelligent computer offspring at an exponential rate. But Kurzweil doesn't fear this. Indeed, he embraces it passionately. "I have made hundreds of predictions that were criticised as being 'science fiction', but these predictions proved to be, if anything, conservative. There are always dangers to technology. It is a double-edged sword, although I do feel the benefits far outweigh the dangers, and history supports that view. Nevertheless, I've been very active in developing ideas and lobbying for resources to develop defences against the potential abuse of biotechnology."

In Kurzweil's future, the collision of Accelerating Returns and The Singularity lead to an inescapable conclusion: that it will be possible to enhance human intelligence using technology, or even host it and expand it within that technology. He

The new Kurzweil PC3 keyboard.

doesn't claim to know how it will do so, but he sees no end to the upward curve, and is sure that it will happen. To that end, he takes scores of food supplements per day, hoping to slow the ageing process so that he can live long enough for one of two technologies to evolve: nanobots that can repair the human body, or artificial intelligence so powerful that he will be able to upload his consciousness into a computer.

Inevitably, these ideas have attracted criticism. They've been described variously as science fiction and fairy tales, and his desire to prolong his life has been described as both selfish and narcissistic. Many doubt that computers will ever achieve consciousness, let alone the spirituality that Kurzweil claims, and he has been accused of preaching transcendence, propagating ignorance, and ignoring the ways in which technological development is bound by social development. At the same time, his views have been embraced by others in ways reminiscent of a religion, and some don't ask "whether?" but "when?". The result is a battle between sceptics and adherents fighting it out through the press. I asked Kurzweil how he felt about this. "One of the benefits of today's communication technology is that we can have these types of constructive debates. Death is a tragedy but the philosophies and religions that developed in pre-scientific times have rationalised it as a 'good thing', since we have had no alternative. But disease and death reflect a great loss of knowledge, of relationships, and of the potential to expand the human experience. Expanding human knowledge is, in my view, the purpose of human life, and staying healthy is a prerequisite for being able to do this. In my mind, people who ignore their health through unhealthy lifestyles and then become a burden to their loved ones and the rest of society are the ones being selfish and short-sighted."

People Power

Faced with these startling ideas, I asked Kurzweil what the future might hold if his views proved even to be approximately correct: "We are also the only species that creates knowledge, and that knowledge base is also doubling in size every year. Human knowledge includes all of the arts and sciences, so music is a major part of what humans do. Music will become ever-more amazing as technology increases its capabilities."

This leads us back to synthesizers and Kurzweil's role in the reborn Kurzweil Music Systems. Asked whether he anticipates evolution or revolution in music technology over the next few years, he replies "Evolution, but at an ever-accelerating pace. Music has always used the most advanced technologies available, whether the wood crafts of the 18th Century, the metal-working of the 19th Century, the analogue electronics of the 1960s or the digital electronics and advanced software of today. That will continue."

If Kurzweil's beliefs prove to be correct, it's possible that the technology hosting your music software will be the same as that hosting your consciousness. In Kurzweil's future, everybody could have every possible musical tool at his or her (or maybe 'its') disposal. The only differentiating factor will then be the talent of the human consciousness within. That will sort out the Zettabyte people from the Terabyte people! SOS

Moore's Law

Moore's Law, which isn't a law at all, was formulated in 1965 by Gordon Moore, one of the founders of the Intel Corporation. Originally, it stated that the number of transistors and resistors on a chip doubles every 18 months, but he revised this in 1975 from 18 months to 24 months. When the 'Law' was originally stated, the number of devices on a single chip could be counted in tens; today they are counted in billions.

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