↘The **PCFormat** interview

STEVE GRAND

Terminator 3 aside, what do researchers into sentient machines really think? Steve Grand, an authority on artificial life and the founder of Cyberlife Research, talks to *PCFormat* about virtual worlds, AI and his home–made orangutan.

PCF What were your earliest experiences with computers?
Steve The first time I ever touched a computer I crashed it. It was a PDP8 and at one point I made a mistake and pressed [DELETE]. It seemed the logical thing to do, but in fact it caused the program to drop back to the operating system. I carried on typing numbers, utterly oblivious to the fact that each number was now actually deleting or inserting a line of BASIC code. I wasn't popular with the person who had to type in the whole program again. You couldn't just pop out and buy a PC back in 1977 so I spent months designing a computer of my own. I was just about to build it when manna fell from heaven in the form of the Nascom 1 – 4MHz of blistering speed and one whole kilobyte of RAM for a mere £199.

PCF Did the Nascom1 and Sinclair ZX help create the

profusion of good UK programmers in the eighties?
Steve I think so. It seems to me that programming skills develop in inverse proportion to the amount of computer power available. Because the Americans were rich enough to afford 16K Apples and could use Assembler or BASIC instead of hex machine code, I don't think they learned all the clever tricks that we poor cousins in the UK did. The first full–blown program I ever wrote was one that

called *Rome AD92*, which flopped nicely. Despite this, the CEO of the publisher Maxis, Geoff Braun, wanted to work with me again and asked for a proposal. So I pitched *Creatures* to him. I'd wanted to do it for some years, having been inspired by a lovely little book called *The Planiverse*, available on Amazon, written by computer scientist AK Dewdney, but nobody had shown any interest. Maxis was reading off the same page, so it seemed a natural choice.

(**www.eidolons-inn.de/lcp/lcp.html**) and others. Both Will and I came up with the ideas and the underlying philosophy independently and for much the same reasons – computers had triggered new ways of looking at the whole world, not just computer games. Artificial life and complexity theory were parts of a major shift in worldview that was beginning to bubble up inside many people's heads during the eighties. In our case, we expressed those ideas first as games.

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learned to play draughts. I wrote it in hex and it fitted into less than 768 bytes of RAM. Now, I'd be hard–pushed to fit it into 768Mb: they don't build memory like they used to.

PCF How did you gravitate into creating the architecture for the *Creatures* software?
Steve I began by writing an isometric game called *Robin Hood*, and then used the same engine for a game

PCF Do you see software such as *The Sims* as a logical descendant of *Creatures*?
Steve Actually, Will Wright was working on a prototype version of *The Sims* way back in 1991, when I was over at Maxis. *Creatures* slipped past its nine–month deadline by a mere four years – but *The Sims* managed to beat that record hands down! Both products have their origins in Activision's *Little Computer People*

PCF Do you think we'll ever have sentient machines?
Steve Obviously (to me anyway) the digital computer is a hopeless device for building intelligent machines – computers do one complex operation at a time, while brains do trillions of simple things simultaneously. Making neural networks in silicon will help a lot, but the best materials for making such complex parallel machines are likely to be proteins and other biological substances. The easiest way to make such nanotechnology materials is to grow them, and this begins to blur the distinction between the made and the born.

Meanwhile, we are starting to turn into cyborgs ourselves as we fuse technology with our bodies (this process started years ago with hearing aids and is rapidly moving through cochlear implants towards brain implants). Technology and biology are starting to merge on several fronts, and so who knows what we will consider to be sentient in a few decades' time?

PCF What's the thinking behind Lucy, the robotic orang-utan you're developing?

Growing Up With Lucy, Grand's latest book, will be out later this year. His first was called *Creation*.

GRAND DESIGNS

After initially applying his formative programming skills to educational software and the virtual world of text adventures, Steve Grand created the thoroughly immersive *Creatures* computer game environment, which enables the user to evolve creatures called Norns. With the help of a NESTA fellowship, his current work in the AI field focuses on the relationship between computer science and neural networks, culminating in his pioneering creation of Lucy – a robotic orang-utan. Grand charts Lucy's development in his forthcoming book *Growing up with Lucy – How to Build An Android in Twenty Easy Steps*, which is published later this year by Weidenfeld & Nicolson.
www.cyberlife-research.com
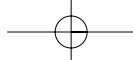
When the cyborgs write the history of humanity, there may well be a chapter on Lucy.

Soldering on: Grand at work.

Steve I'm trying to understand what basic principles enable the cerebral cortex of our brains to wire itself up in response to experience, until it becomes a very complex and specialised array of computing machines. So far, things have been going very well, and I think I'm starting to get a feel for these basic operating principles but, unfortunately, Lucy MkI (like my Nascom 1 before her) is a bit limited. So after three years of funding this work from my rapidly dwindling life savings, the very nice people at the National Endowment for Science, Technology and the Arts (**www.nesta.org.uk**) made me a Fellow, and gave me some cash to build Lucy MkII. For the next few months I'm not being a cognitive scientist, but have returned to the drawing board and the soldering iron. Lucy II will be a lot more powerful and 'biological' than Lucy I – she'll contain about 50 small 8-bit micro controllers, a couple of 8-way parallel

32-bit DSP boards and a network of off-board PCs. When you make complex biological systems, 1K of RAM just won't cut it any more!

PCF What's your opinion of Ray Kurzweil and other AI pioneers?
Steve In some ways I agree with the way Kurzweil thinks about AI. Where we differ most is in where we think it's leading. Kurzweil and others are fond of quoting Moore's Law and extrapolating future artificial intelligence on the assumption that IQ is somehow proportional to clock speed. I think that's a fallacy – I don't even think that computers are the right medium for creating intelligent artefacts in the long-run. What we'll need is massively parallel arrays of simple processors, not ever faster serial ones. And who says that a brain gets cleverer the bigger it is? In evolutionary terms that is true, but it's not as simple as it looks – otherwise sperm whales would be far smarter

than humans, because they have bigger brains. I think there are limits to intelligence and see no justification for the idea that machines will want to take over the world. I think that sort of scaremongering is irrational, poorly thought out and counterproductive.

PCF Is speech recognition an imminent possibility?
Steve Speech recognition is relatively

easy. Speech understanding, on the other hand, is extremely difficult. Speech recognition interfaces will never support genuine speech understanding while computers remain on the desktop.

Plus we don't even know enough about how brains deal with language. I bet you have no trouble at all using the simple word 'as', but just you try defining it! **PCF**