Are our heads in the cloud? Science fiction or fact?

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Just as great novels are thought to illuminate the human condition, science-fiction can inspire real science. Many people know that the communication satellite was invented by Arthur C Clarke, who rivals Isaac Asimov as the greatest of science fiction novelists. Clarke announced it in a non-fiction journal[1] and, surprisingly, he over-estimated the delay before his idea would be implemented (2001 A Space Odyssey, his best-known work, erred in the other direction). Fred Hoyle's *The Black Cloud*, despite its rebarbative hero, is replete with scientific lessons, some of which, notably those on Information Theory, I listed in my Foreword to the Penguin paperback edition. Daniel F Galouye's name is less well known. His first full-length novel, *Dark Universe* (1961) contains inspiring intuitions about anthropology and religion as well as science. Again, I named some of these in my Foreword to the audio edition. In an underground world of pitch darkness where humans evolve echo-location, they intriguingly worship Light as a folk memory lingering on from a lost Paradise. "Great Light Almighty! "Oh, for Light's sake!" "Light only knows! "The cause of the Fall from Paradise and of humanity's underground exile is hinted in the demonology of their religion. The twin devils chillingly named Strontium and Cobalt are presided over by the arch demon, Hydrogen Himself.

But it is Galouye's third novel (1964) that prompted this brief speculative essay. I read it in the British edition as *Counterfeit World* but it was first published in America as *Simulacron-3* (Why do publishers so adore changing the titles of books as they cross the Atlantic? Is it because, as Matt Ridley suggests, it makes them feel useful and important?). The premise of *Counterfeit World* is that we are living in a computer simulation constructed by a superior civilisation with computing power to match. If this were true, we would have no way to disprove it. The idea was revived in a silly but mysteriously popular film called *The Matrix*.

It has also been taken up by serious philosophers such as Oxford's Nick Bostrom. Bostrom regards it as actively plausible on logical grounds, rather than merely unfalsifiable but still way-out and crazy. The likely simulating agents, for Bostrom, are not extra-terrestrials and not artificial intelligence robots but future humans. Humans, evolved on this planet, continue into the distant future to develop computational power to the point where they become capable of simulating the entire world, including us and our brains and mental capacities. Perhaps they think it an interesting research project, to simulate their own past.

Bostrom's logical point is this. If you wish to strongly deny that we are in a simulation you must deny one or both of the following propositions. First, humans will develop the necessary computational skill. And, second, they will want to put it into practice. It's up to you whether you

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[1] http://lakdiva.org/clarke/1945ww/

deny these two. Moore's Law (computational power increases exponentially, with a doubling time of two years or less) leaves me far from ready to reject the first. As for the second, I follow Arthur C Clarke again in suspecting that, if humans can do something in science, they will. If I had the computational and economic power to simulate the entire evolutionary process, wild horses wouldn't stop me. Per Bostrom, I conclude that we could very probably be part of a simulation by future humans. Alternative versions of the speculation, such as that we are being simulated by extra-terrestrials, merely add to the overall likelihood. In all the preceding, by the way, the problematic nature of what "extra-terrestrial" and "future humans" might mean in the context has not escaped me. It doesn't affect the argument.

The purpose of this essay is to add a further speculation of my own. An avowed opponent of dualism, I yet confess a worry about the astonishing capabilities of the human brain. How can so small a computational device achieve so much? Although today's computers far outstrip us in raw processing power and memory capacity, there are many respects in which our brains are still superior. Remarkable as Google Translate is, it is still instantly betrayed by its tell-tale mistakes, mistakes that no human translator would make. A robot card player may score brilliantly at bridge. But try asking it to hold a hand of cards in an elegant fan! In chess, the best computer programs are in the same league as our Grand Masters. But as soon as we leave the limited domain of the chess board, and go the bar to order a round of drinks, or go for a swim, or a bicycle ride, or to play tennis, or gossip at a party, we are far superior. And that says nothing about our deeply mysterious subjective consciousness – the "hard problem."

Yet our skulls are tiny. Whatever goes on inside them must be very very different from the ones and zeroes shuttling through silicon chips. Philosophers imagine replacing each neurone with a transistorised equivalent. It would be huge, and unworkable if only because of overheating. What clever trick has evolution discovered? Such considerations led the Oxford mathematician Roger Penrose to propose his quantum theory of brain function (*The Emperor's New Mind)*. The idea has not met with much support, but the need he perceived for some such measure of desperation is more widely regarded. My suggestion is that the *Counterfeit World* hypothesis might provide a solution to the riddle of how much can be achieved by so small a brain.

Just as the human skull seems too small to accommodate all the computational power of which the brain is capable, much the same could be said of a smartphone. It's tiny, yet it appears to be filled with, and capable of manipulating, all the knowledge in the world's most comprehensive encyclopedia. This is regularly brought home to me when I bring out my iPhone to look up something for my 101-year-old mother. I show her Google Maps and we fly virtually to each one of her childhood homes, using Street View to show her the house itself. Or I ask Siri to play a nostalgic tune from her adolescence and it instantly finds it and plays it for her. She shakes her head in bewilderment. How can so much knowledge, so much thinking power, so much stuff, be crammed into that tiny phone in her son's hand? I try to explain to her. It isn't there, it's somewhere out there. On a server in California, perhaps. Or in a "cloud." The smart phone is a portal to massive, shared knowledge and computer power.

My mother's puzzlement at the power of my tiny iPhone exactly parallels my own puzzlement at the power of the brain inside our tiny skull. Is it conceivable that the same answer fits both puzzles? If, following the Bostrom logic, we really are part of a gigantic simulation, a *Counterfeit World,* could it be that much of the computational power is not in our skulls at all. Just like the iPhone? Could data or software be switched in and out of some equivalent to what we, in our present paltry stage of development, call "the Cloud"?

I am sensitive to a criticism I have myself often made of creationists. Am I falling for "The Argument from Personal Incredulity"? How often do we hear something like this? "The human eye [substitute, to choice] is so complex, I simply cannot believe it came about by chance. Therefore God did it"? But there are two differences. First, in the case of the complexity of life, we already know the answer. Evolution by natural selection, which is the very opposite of chance. Second, the alternative I am offering as an answer to my personal incredulity is not something nebulously supernatural and devoid of its own coherent rationale. The *Counterfeit World* hypothesis is a real scientific possibility which enjoys some philosophical support. And the predictable temptation to say "The future humans of the Bostrom theory might as well be gods" should be vigorously resisted. Bostrom's future programmers are not magicked out of thin air, without any explanation, like gods. They evolved by slow, gradual, Darwinian steps from primordial simplicity. They may be superhuman but they are emphatically not supernatural. And they may be science fiction but – it requires a leap of intellectual daring to see this – there is a powerful logical argument to suggest that they could very possibly be science fact.