Chapter 19
What is it Like to be a Robot?

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ABSTRACT

It is now possible to grow a biological brain within a robot body. As an outsider it is exciting to consider what the brain is thinking about, when it is interacting with the world at large, and what issues cause it to ponder on its break times. As a result it appears that it will not be too long before we actually find out what it would really be like to be a robot. Here we look at the technology involved and investigate the possibilities on offer. Fancy the idea of being a robot yourself? Then read on!

INTRODUCTION

When Nagle asked the question "What is it like to be a bat?" (Nagle, 1974), he raised a question that, I suppose, many took to be nothing more than a philosophical exercise. After all it is simply not possible to transfer a human brain into a living bat body for it to experience life as a bat. Even if, by some leap of science, that did happen then it still would not be possible for the individual to communicate their feelings, after all bats can't speak or send emails can they. But Nagle's question was a pertinent one. With different senses, different motor skills and a completely different raison d'etre, as a bat, what would be top of the agenda when you woke up in the morning – indeed as a bat wouldn't you actually wake up at night?

Then we come to Kafka, who considered a similar topic in his Metamorphosis (Kafka, 1972). In this tale the hero, a human, wakes one morning to find that his body has turned into that of a bug. Although it is interesting to follow how he has to learn to walk again now that he has many more legs to contend with, the story revolves mainly around how he is treated, in his new guise, by his friends and family. His nearest and dearest in fact appear to remain remarkably calm in the circumstances. But the hero of the story (Gregor)

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has major problems in communicating with them and seems to lose his taste for traditional foods. Interestingly Kafka avoided the thorny issue of the change in sensory signals that would no doubt have occurred and Gregor's brain seemed to emerge in very much its original form, pretty much untraumatised as a result of the transition.

The topic has also been viewed by Moravec in his "Mind Children" (Moravec, 1990) in a more modern setting. Here Moravec considers the possibility of copying, cell for cell, a human brain from its biological, carbon original form into a silicon, computer version. The latter entity then has the enviable opportunity to reside within a robot body, with all its advantages. Need a new arm or leg, no problem sir. Whilst Moravec does revel at the possibility of this new version living forever, again he appears to overlook the trauma that might be caused when a brain suddenly realizes that all sensory inputs are different and movement is altered beyond all recognition. It does nevertheless spark of Wilde's Dorian Gray (Wilde, 1891), in this case with the silicon copy remaining forever young, whilst the carbon original withers away into old age.

Quite clearly the topic of mixing and matching brains and bodies has provoked interest across cultures. For each of the tales mentioned thus far, a thousand more exist investigating previously unexplored concepts with sometimes horrific consequences. Indeed Mary Shelley's Frankenstein (Shelley, 1831), written only a few miles geographically away from where I am now, is a prime example. She dared to explore what the monster thought and the problems he faced. But then, when restored to life in another human body, presumably senses and motor skills are not going to be too far removed from their originals. By comparison Kafka's Gregor really did draw the short straw.

But it is one thing to merely speculate and develop a storyline in a scientific vacuum, it is quite another to investigate what is actually going on when science does a catching up exercise. It is now quite possible, as will be discussed, to grow a biological brain within a robot body. The processes involved will be described, in a nutshell, in the section which follows. The opportunities arising as a result of this new technology will then be considered, such that the question, on which this article is focused, will be unraveled.

BACKGROUND TO THE TECHNOLOGY

The intelligent controlling mechanism of a typical mobile robot is usually a computer or microprocessor system. Research is however now ongoing in which biological neuronal networks are being cultured and trained to act as the brain of a real world robot – either completely replacing or operating in tandem with a computer system. Studying such neuronal systems can help study biological neural structures in general and has immediate medical implications in terms of insights into problems such as Alzheimer's and Parkinson's Disease. Other linked research meanwhile is aimed at assessing the learning capacity of such neuronal networks. To do this a hybrid system has been created incorporating control of a mobile wheeled robot solely by a culture of neurons – a biological brain.

A brain, the human version in particular, is a complex computational platform. It rapidly processes a plethora of information, is adaptable to noise and is tolerant to faults. Recently though, progress has been made towards the integration of biological neurones and electronic components by culturing tens of thousands of brain cells in vitro (Bakkum et.al., 2003). These technologies blur the distinction between the synthetic and the organic.

The cultures/brains are created by dissociating the neurons found in cortical tissue using enzymes and then culturing them in an incubator, providing suitable environmental conditions and nutrients. In order to connect the culture with its robot body, the base of the incubator is composed of an array

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