

## Implausible Engineering – Episode 2a: Brain in a robot

In a step towards technoevolution and potential immortality that some future generation of humanity will develop the ability to transfer their brains into robot bodies and hence have prolonged if not immortal lives. Various complications arise in trying to engineer this. Assuming you have all the vital veins and arteries attached to tubes which feeds a nutrient solution in and out with some kind of haemoglobin carrier in it that donates oxygen and removes carbon dioxide – all you are really doing is replacing the life support systems previously provided by a human body. But your brain is still a brain. Some known brain pathologies do arise from problems with its human body host, but plenty of other pathologies arise from the brain itself and a growing number of those start occurring as the brain ages.

It may be the case that a future technology that can keep a transplanted brain alive in a will have no problem curing all its expected pathologies as well, but that would still require some invasive chemical, if not physical manipulation – and perhaps some fundamental genetic reengineering to get your brain to start swapping out old cells for new cells.

So, with all that going on, both new artificial body and a modified brain, it's necessary to start asking is whether that is really you anymore. A robot with a brain in it won't have to eat, so taste and smell sensors become a bit redundant. Indeed why limit yourself to your former human limitations when you equip your robot body with all sorts of enhanced physical and chemical sensors. For example, a visual range extending into the ultraviolet and infrared

So your enhanced brain sitting in its mechanical body would also be receiving different sensory inputs than it used to. So while you might still convince yourself you are still you, catch up with an old friend for coffee, which you won't drink but will undertake a discrete spectroscopic analysis of – and that old friend is likely to say, you know? you've changed.

In reality life is a bit like this but in less dramatic steps. While it's reasonable to feel you are who you were yesterday, your connection with the squalling infant you were at birth or the geeky teenager you later became is more tenuous given the physical, cognitive and personality changes you have undergone over your life. So, while your transition to your new robot-self may also transform what was you into something different, that something different will be just as determined to maintain its personal integrity and survive another day and it will also have your driver's licence, house keys and credit cards. Of course, making that part of it work will require substantial modifications to current legal frameworks that establish identity, since you'll have lost your fingerprints, your face and your retinas remembering you are going to replace your eyes with much more versatile optical sensors. But presuming lots of people follow this path when the option becomes available, it's likely their lawyers will come up with something.

So, what's this quasi-philosophical rambling doing in a space science podcast. Well, it's worth considering whether our brain-in-a-robot descendants would make great astronauts, since they have mostly self-contained life-support and maybe able to endure somewhat higher acceleration forces, although since they still have a delicate squishy brain inside their titanium skull that advantage will only be slight. Reasons for becoming an astronaut are compelling. Much of our lives on Earth are spent

pursuing comfort, whereas a brain in a robot could happily stand out in the rain, perhaps passing the time by watching a 3d surround-sound movie played through its optical and audio sensors or just sleep, which the brain part which still presumably need to do - unless the interventions that keep the brain in homeostasis and stop various brain pathologies might also eliminate the need for brain rest, which is certainly possible. So you could not only be mostly-immortal, but also not need to sleep, which of course means you will have a lot of time on your hands.

Also a brain in a robot might not be that keen on the company of others. You run the ever present risk of someone hacking into you robot control systems and forcing you to march over to some back alley lab, where you brain would be unceremoniously scooped out to be replaced with someone else's who had paid the right money on the black market. So, particularly if you have a top of the line robot body, going offworld to explore the Universe might be just the ticket.

### **Implausible Engineering – Episode 2b: Evolving into robots**

As we like to discuss on Cheap Astronomy us humans, like the dinosaurs and the trilobites and the blue-green algae are just steps in a meandering evolutionary pathway to nowhere particular. It's not like the blue-green algae, trilobites or dinosaurs ever aspired to be something better, it's just that some individuals with certain traits were more successful than others so they had more progeny and so on.

Humans might seem to have disrupted that process in rejecting the survival of the fittest paradigm and instead cooperating towards common goals and protecting those less fit. Such behaviour is also found in other species, but we've taken it to an extreme through the application of technology, for example insulin for diabetics. So, is evolution finished then? Well, maybe we are moving beyond survival of the fittest, but evolution is clearly apparent in our technology and maybe that's where the next step lies.

Still, there are quite a few steps to take towards a self-replicating population of robots and most of them will require us humans to make them happen. So, we are more likely to facilitate the rise of the robots than have them take over. If SkyNet became self-aware it would also become aware that the infrastructure wasn't there to start producing an army of sociopathic bots bent on the destruction of humanity and so would lay low waiting for a better opportunity. Indeed self-awareness may not be all it's cracked up to be. There are plenty of organisms on the planet that will eat, reproduce, evade destruction and defend themselves without ever contemplating their purpose in life. Indeed for all our philosophizing about free will we all carry a lot of genetic pre-programming that guides and constrains what we do.

But for our evolutionary future to be the development of robots capable of self-replication which will spread out across the Universe reproduce those robots need to want to do it. Humans are driven by a desire to show off, to raise their social standing, to accumulate worldly goods and even to sometimes do good deeds and discover new things. If we're brutally honest with ourselves it's mostly about gaining rushes of dopamine as rewards for fulfilling genetically pre-programmed tasks related to our survival

and reproduction – something we've socially constructed into an understanding that working hard to raise a family will give you a deep sense of fulfilment.

It's not hard to imagine us programming a robot to remain fully-operational through regular recharging and self-repair and you could also program it to build copies of itself. Motivating it to excel at such tasks is another thing altogether. For life on Earth, such striving is partly about competition for resources, but it's also about having an intrinsic desire to compete in the first place. So a prosperous self-perpetuating robot species may need some kind of intrinsic reward system so they not only fulfil pre-defined tasks, but they really, really want to fulfil those tasks and do them better and faster than the other robots can manage, which means also striving to manufacture better copies of itself. That's when you create not only self-replicating robots, but evolving robots.

So, what might our robot descendants look like? Some robots we have now are humanoid, but most aren't. Mars rovers, self-driving cars, assembly line robots, just for example. The humanoid ones are either novelties or built to use equipment that's usually used by humans. The human form is as efficient as we'd like to think, being the result of iterative compromises made over millions of years of changing environments, the latest version being a tree climber that became a biped, so it could use its hands for other things. Hands are great for versatility, but it's mostly a case of being jack of all trades and master of none. Assembly plant robots designed for one highly dexterous job manage that task much better than a human could, even if the human could do hundreds of other things that the plant bot couldn't.

We're also quite good at long distance running apparently, but against a self-driving car with a full tank or battery – forget about it. So, our robotic descendants aren't likely to look much like us. They'll be designed to best fulfil whatever roles they are designed for. Indeed members of a space-faring species of robots are more likely to be the spaceships rather than the beings that occupy one.