SMALL TECH, BIG OPPORTUNITIES: MICROTECHNOLOGY IN THE HUMAN BODY

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Abstract. *Microtechnology is ubiquitous and has become an integral part of our daily lives, impacting healthcare, consumer electronics, automotive safety, environment monitoring, and aerospace. The field of human implants benefits considerably from microprocessors, as it allows scientists to develop new methods to treat conditions or upgrade the human body with the help of electronics. Recent innovations in this area have completely revolutionized the way we can use microchips for the betterment of humanity, in terms of improved prosthetics, increased productivity, and treating disability. The new implementations have the potential to make a radical impact on the healthcare landscape and might bring legitimacy to the notion of transhumanism, the theory promoting the enhancement of the human body with the use of implanted technologies that can greatly enhance one's intellect, longevity and overall well-being. Thus, the scope of this paper is to investigate those innovative implementations in order to deduct where this technology is headed, and what we can expect from such tech in the future.*

Keywords: *implants, microchips, artificial intelligence, prosthetics, transhumanism.*

Introduction

Microtechnology is a general term referring to technology with features at the size of approximatively a micrometer, often used in electronics. The development of such concepts started in the early 70's with the introduction of microscopic transistors, and has evolved to be a component in most of the devices we use in our daily lives, such as wires, sensors and resistors. Microchips are often associated with computers or phones, although they also have a wide array of unorthodox applications, such as the use of microtechnology in the medical field for enhancing the human body and curing or treating certain conditions, which will be explored in the given paper.

The potential of microscopic electronics in medical fields

Healthcare isn't the first thing people think of when the topic of electronic technology is brought up, but advancements in computers and microchips have allowed researchers and doctors to diagnose patients with increased quickness and come up with more effective treatments, especially in surgical contexts.

One problem many people in the world have to deal with is a permanent loss of mobility, necessitating the use of assistance such as wheelchairs. In this situation there is nothing that can be done other than adapting to a low-mobility lifestyle. Microtechnology has the potential to change the life of people affected by physical disabilities permanently, with the help of brain and spinal implants, which can restore movement from the waist down.

A breakthrough like this occurred as recent as May 2023, where a pair of implants has enabled a patient to stand up properly and walk again, via a digital bridge between the brain and the spinal cord, showing potential for what could one day transform the lives of individuals with paralysis. One of the implants, situated above the patient's brain, decoded electrical signals which allowed for improved movement. This top microchip communicated with the one connected to the

spinal cord, enabling responses that triggered motion in the patient's legs. These implants wirelessly reestablish a link between the brain and body, thus allowing a bypass on the injured section of the spinal cord.

The implants have not only restored some of the damaged connectivity in the central nervous system, as the walking ability of the patient had improved to the point where they could walk with crutches even when the devices were disabled [1].

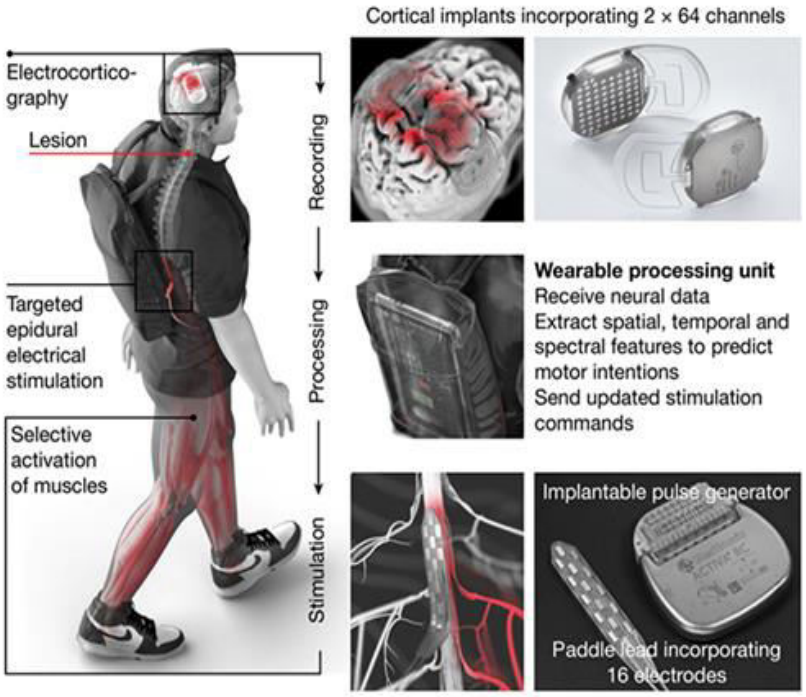

Figure 1. Setup of the digital bridge implants [2]

While methods that enhance limb control after paralysis have seen development, it leaves us with the question: what are people with completely missing limbs supposed to do, as you cannot connect an implant on a body part that isn't there. For years the solution was prosthetics, which are artificial devices that are meant to replace missing body parts and restore normal functions, usually through implants.

Prosthetics are still the main and best method through which one is able to return to a relatively normal lifestyle, but, recently, startup company Atom Limbs has revealed their work on Atom Touch, a next-generation prosthesis which uses artificial intelligence and does not require an implant or any invasive surgery for it to function. It would only require a direct link to your nervous system in order to restore sensation and regain the ability to feel touch again, which is one of the features planned down the road.

The prosthetic uses microchips and artificial intelligence to fully restore limb function, as company CEO Tyler Hayes puts it: "The Atom Touch is what we call an artificial arm. It will act much like a regular arm, restore a near-full range of motion, enable individual finger control, be comfortable to wear all day, restore a basic sense of touch, and be considerably more affordable than leading prosthetics today" [3]. This kind of technology could popularize transhumanism, the philosophical movement that advocates for the enhancement of the human condition through sophisticated technologies that can improve longevity, cognition, and overall well-being.

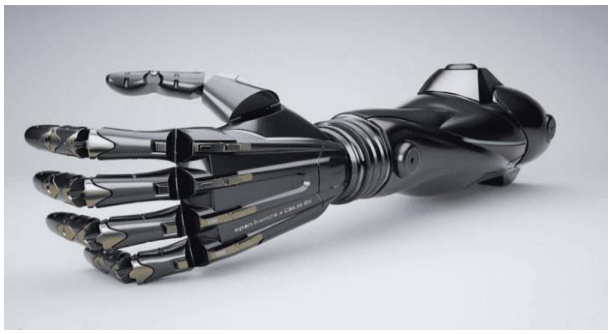

Figure 2. Concept render of Atom Limbs' prosthetic arm project [3]

Using microtechnology for human enhancement & transhumanism

The idea of injecting microchips inside your body, let alone your brain, is something that sounds like it was taken straight from a science fiction movie, however there have been developments towards the implementation of microchips for the purpose of increased security or general enhancement, as opposed to saving lives or making life easier for the disadvantaged.

One clear example of such piece of technology is the Neuralink, a recent business venture that intends to convert information obtained from neurons from our body into binary code which can be interpreted and turned into external commands, such as moving a cursor without the help of any peripheral devices. This tech is similar to the aforementioned brain-spine implants, though it differs in its goal. The general notion of most implants is to heal people of physical disabilities, whereas Neuralink technology aims to further evolve the human body and potentially bring transhumanism from fiction into the real world. Additionally, it can help researchers achieve a better insight into how the human brain operates and how they can use this understanding to our advantage.

While experiments on humans have been delayed and its previous animal tests have been unsatisfactory, as recent as the 29th of January, 2024, a Neuralink device has been successfully implanted into a human brain [4], which shows that this technology can work in practice and has potential in the future once it gets perfected.

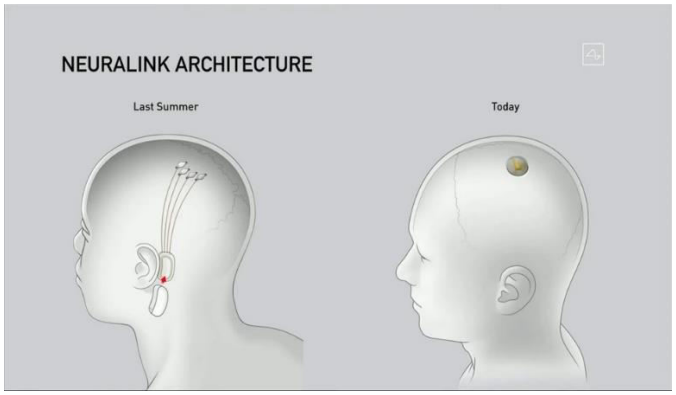

Figure 3. Mock-up of the current architecture design compared to the old one [5]

The essence of brain-computer interfaces is to allow for communication between the brain and electronic devices, which implies the ability to use your thoughts instead of a peripheral for the sake of convenience or productivity. With that being said, the concept of microchip implants is not new, as they have been utilized before, albeit for limited purposes or in other parts of the body, usually the arm. Older examples of microchip implementations include, but are not limited to:

- A radio-frequency identification (RFID) implant by Kevin Warwick in 1998, which could carry information about the patient or be used with electronic devices [6];
- The first 'bio-payment' done by Patric Lanhed in 2015, using a chip embedded in his hand to pay with a euro's worth of Bitcoin [7];

- A chip implant done by Mikey Sklar into his left hand in 2006, the procedure was filmed and an interview was later held on Fox News [8];
- In 2015, computer programmer Jonathan Oxer implanted an RFID chip in his arm by himself using a veterinary implantation tool [9].

As new iterations of RFID implants are developed, there could be a future where physical cards and mobile e-wallets will become redundant, due to the fact that people could have their bank account information at the literal tip of their fingers. It is uncertain if it's feasible to implement microchips of this fashion on a large scale, though the possibility is there and it is something that would change the way financial transactions are completed.

Conclusions

To summarize, microchips, and microtechnology in general, can be of use in various facets of human life. On one hand, in the medical field it can be utilized to regain control of previously paralyzed limbs, enhance prosthetics by improving control and potentially even recover the sense of touch. Alternatively, microtechnology is applicable in the field of human advancement, especially when paired with other innovations, such as artificial intelligence, to transform the mundane life into a more productive and enjoyable endeavor. This technology is still in early development stages despite the few decades of progress, but inevitably we'll reach a stage where chip implants will become a reliable upgrade or a life-saving measure, rather than just an eccentric business idea for Silicon Valley.

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