

The Potential Risks and Concerns of Neuralink

Samuel Woodruff

Abstract— Technology has been rapidly advancing with the turn of the century. These advances in technology have brought several wondrous inventions that have propelled mankind's ability to become more efficient, knowledgeable, and healthier. While this is the intended goal of these technologies, there are also unforeseen risks that cannot be predicted using current predictive technology. With every new technological invention, individuals will find a way to exploit and manipulate it. This is particularly dangerous in the field of cyberbiosecurity as it deals with human biological information that is paramount to keep private. The technology Neuralink is still relatively in its infancy, but has already brought up ethical and security concerns. In this paper, I will seek to explore the potential risks of Neuralink.

I. INTRODUCTION

What exactly is Neuralink? Neuralink is a Brain Computer Interface (BCI) device that is inserted and integrated into a person's brain to both stimulate and monitor. The goal of this device is to initially aid those who may be afflicted with disabilities like blindness, quadriplegia, and certain brain disorders/diseases. It helps to restore function for these individuals by allowing them to control devices like a computer by just using their thoughts, removing the need to physically interact with it. In the future, this device could potentially be expanded to more users and become a way for humans to directly interface with the internet, almost creating a sort of hive-mind [1]. The intended use of this device sounds miraculous, but unfortunately there is bound to be unforeseen consequences and individuals that will seek to exploit such a technology.

II. NEURALINK DEVICE AND INTENDED USE

A. Neuralink Design and Insertion into the Brain

The device is relatively small in design and is composed of many parts. First, there are 64 tiny threads that are inserted across the brain in order to receive electrical brain signals [2]. Then, there are small chips that collect and interpret these brain signals, turning them into action. [2]. Following that, the device is powered by a wirelessly-chargeable battery. [2]. Finally, the device is enclosed in a casing that is suited for survival within the skull, ensuring that the device will not break down due to its environment.

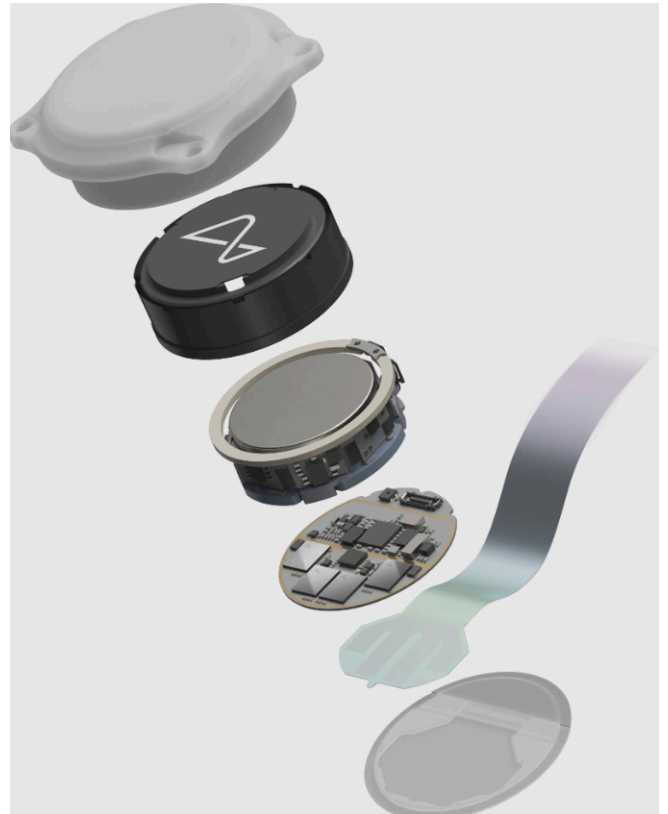


Figure 1: A graphic showing the overall design of the Neuralink device, piece by piece. Courtesy of Neuralink [2].

B. Neuralink Intended Use

As previously mentioned, the device's intended use as of right now is for those who are suffering from severe impairments and brain diseases/disorders. It has the ability to enable those who are paralyzed to use other devices using their brain and potentially control and operate prosthetic devices. [3]. The device is also targeted for users who are unable to speak. It has the ability to help these individuals by allowing their thoughts to convert text or control a text-to-speech program. [3]. Neuralink may also be used to help aid users suffering from brain diseases/disorders like Parkinson's disease by stabilizing their tremors. [3]. In the future, the device may be opened up for more individuals to use. Recreational use would look like having access to the internet through your brain.

III. NEURALINK STATUS

Neuralink is currently in relative infancy for its release to its intended users and even more so in regards to the widespread population. It has progressed through multiple different trials in order to finally be experimented with human-use. The first ever human-trial began on January 28, 2024. A 29-year old man named Noland Arbaugh received the implant becoming the first ever person to use the device. After some time, it was reported that Arbaugh had been using the device successfully to "...control his laptop while lying down in bed" [3]. Since January 2024, a second patient has been approved for the device and has been using it successfully. A man named Alex received a Neuralink device and has been successfully using it to play video games online. [3]. These two initial cases of human-use have proved that Neuralink can be successfully used and integrated into the human brain. As the device advances and successes continue to mount, it's entirely likely that its use will be expanded to wider populations.

IV. SECURITY CONCERNS OF NEURALINK

Every new technology will have flaws that need to be corrected and security concerns that must be addressed. If there is a way to exploit technology, people will find it and use it. While regular cyberattacks on other forms of technology are extremely damaging, there is no telling how dangerous and consequential a cyberattack on a user's Neuralink implant could be. For one, since the device is implanted directly into the brain, what would happen if a hacker was able to overwhelm the device and cause physical damage to it? There is concern that future hacks of the device could potentially prove to be fatal for the user [4]. The device, while not currently listed as having direct internet access, may obtain it in the future. [4]. If the implant is directly connected to the internet, it opens the door for a multitude of security risks. As a whole, the device currently has many concerns in regards to the safety and security of the user that have both yet to be seen/addressed due to the infancy of the technology.

V. ADDITIONAL CONCERNS OF NEURALINK

A. ETHICAL CONCERNS OF NEURALINK

In addition to the security risks and concerns that Neuralink has, it also has several ethical concerns. Before clinical trials on humans began, the Neuralink company had to start by conducting experimentation on animals with the device. It's been reported since 2018 when the company began experimentation, it had "...killed about 1,500 animals, including more than 280 sheep, pigs and monkeys..." [5]. Experimentation using animals for products is highly controversial and raises valid ethical concerns surrounding whether it's moral to conduct deadly experimentation. Another ethical concern is whether or not the device should be used in a militarized capacity [6]. Neuralink could prove useful for a military to use in transferring information, cyber warfare, psychological warfare, and more. Before that becomes a reality, it's important to address the ethical concern associated with it. In order to properly implement a BCI such as Neuralink, it's important that care is given towards ethical concerns. Likewise, it's important to ensure

there are proper policies and other resources in place to keep up with the technology's advances.

B. Privacy Concerns of Neuralink

There are several concerns regarding the privacy of users that have the Neuralink implant. As the implant collects and uses data sourced from the user's own biology, it's important that this data is safeguarded and private. Biological information is perhaps one of the most important kinds of data to keep private as it's unique to the individual. The device's use also raises the concern of illegal or immoral surveillance of the user. It gives way for concern of multiple potentialities such as government surveillance on users, improper use of the device in police-interrogations, and more. Having access to a device connected to the brain could lead to a disastrous drop in personal privacy for users. In order to address valid privacy concerns of the device, there must be policies in place to protect user data, personal information, and biological data from being accessed by the wrong person.

VI. CONCLUSION

Technology has been rapidly advancing over the past one hundred years and even more so after the turn of the century. New technologies have greatly enhanced the quality of life, efficiency, and knowledge for all of humanity. Neuralink, a relatively new technology, has been striving over the past few years to accomplish this goal as well. Its purpose is to help those who are suffering from disabilities and brain diseases. Through the design of Neuralink, it's able to fit inside of a person's skull and be integrated into their brain. Users with the device are able to control devices like computers by using their thoughts as the device interprets their brain activity and transforms them into action. Since the device is integrated into the human anatomy, it brings several security, ethical, and privacy concerns along with it. Technology like BCIs are relatively new and there may be unforeseen consequences that come with them. All technology is flawed in some way that can be exploited and with a device like Neuralink the stakes could not be higher. Likewise, there have been several ethical concerns brought up in regards to the technology. Through Neuralink's development, hundreds of animals have been reported to have died from experimentation. Concerns over whether or not the device would be used in a militarized way have also been raised. Lastly, since the device is implanted into the brain and uses data sourced from it, substantial privacy concerns have been raised. It's important that users' data and other information is protected from bad actors. In order to satisfy the aforementioned concerns surrounding Neuralink, it's important that policies are put in place to responsibly moderate the new technology to protect the user.

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