The issue of the future conveniences and complications presented by computer-brain interfaces

What is a brain-computer interface?

Brain-computer interfaces (BCIs), also known as brain-machine interfaces, are systems that enable a person to use their brain signals to control an external device; they analyse brain activity, and then translate it into usable commands, for an external device to complete. There are different types of BCI's, categorised by how they interact with the brain, and they can be broadly classified as invasive, semi-invasive, or non-invasive.

An Invasive BCI is directly connected to a patient's brain tissue, and they are inserted via a surgical procedure. Due to the possible complications of an invasive surgery (blood loss, infection, body's rejection of the implant), these BCI's are reserved for people with higher level injuries, such as paralysis, or neuromuscular disorders. A non-invasive BCI, is a wearable device with electrical sensors, which serves as a middleman between a patient's brain, and a machine. They produce weaker signals since they are not directly connected to tissue, and they are therefore better suited for guiding the actions of robots, or augmented reality purposes.

Although they have become very popular in recent media, they have been around since the 1960s and 1970s, when researchers trained monkey's to be willing experiments in non-invasive BCI procedures. Jonathan Wolpaw and his team proved in the 1990s that brain waves can be utilised to control a cursor on the screen, and developments have only progressed since. One of the most exciting developments of BCI's in the 21st century, was the BrainGate project, led by John Donoghue at Brown University. This invasive BCI involved the implantation of a tiny device in the brain, that could record the activity of neurons in the motor cortex. When translated into binary, the BrainGate allowed users to control external devices, like a robotic arm. One of the first users, a man named Matt Nagle, was able to use the system to perform everyday tasks, like opening doors.

A case study

A fascinating example of how computer-brain interfaces can revolutionise people's lives, is the first human patient who was implanted with Elon Musk's 'Neuralink'. Noland Arbaugh, an American quadriplegic who suffered a severe spinal cord injury in 2016, received his implantation in January 2024. After eight years of being completely paralysed from the waist down, unable to do simple tasks for himself, he was able to control a computer mouse using his thoughts. His progress after the implantation is good, and he mad e a full recovery after, with no ill side effects. The

core ambition of Neuralink, is to develop, and deploy, brain-computer interfaces, to restore autonomy, and unlock the extent of human potential. The future for Neuralink following their ambitions, is thought to be big and bright, with Musk saying it would 'facilitate speedy surgical insertions of its chip devices to treat conditions', conditions such as: Obesity, Autism, Depression, and Schizophrenia.

The device itself, being approximately the size of a coin, is implanted beneath the skull, and can both connect to a smartphone, and interpret brain activity. However, despite the great progress pioneered by Noland, the possibility existed that he may have to have the device removed. In one instance, many of the gadgets 64 tiny wires become loose from his brain, causing performance issue. Fortunately, Neuralink was able to resolve this issue, and develop their product so there would not be a similar instance in the future. He has addressed the public, maintaining positivity surrounding the device, and he is excited to see what the future holds.

Questions to consider

1. Should international regulations regarding BCI's be released, before it is too late?
2. What good can come of BCI's?
3. Should the use of humans for testing be allowed while products are in their elementary stages?
4. Ought we instead focus time, and resources, on biological solutions to these disorders?
5. Must the industry be made public, and cheap for the majority of people to enjoy?

Useful links

1. What is a brain-computer interface
2. 7 leading brain-computer interface companies and their current prospective products?
3. The brain-computer interface market is growing – but what are the risks?
4. What is it like to use a BCI? Insights from an interview study with brain-computer interface users.
5. Hacking the brain – Innovations and Implications of BCI's