

## Explore – Impact of Computing Innovations

### Written Response Submission Template

Please see [Assessment Overview and Performance Task Directions for Student](#) for the task directions and recommended word counts.

#### Computational Artifact

2a)

The computational innovation that is represented by my computational artifact is Neuralink, a piece of technology designed by Elon Musk that will allow humans to access more of their brain functions [4].  
Neuralink's intended purpose is to serve as an interface that links the brain to a machine, interpreting complex commands from brain activity and using them to communicate with a computer [4].  
My computational artifact explains how Neuralink works within the brain to receive and send messages, describes the structure of the technology, and outlines Neuralink's intended purposes and how it might be used in the future.

2b)

I created my artifact by piecing together images and text on Microsoft Word. I found most of my images by taking screenshots of a youtube video of Neuralink's launch event [5] using Snipping Tool. I then used Photoshop to manipulate the image's size, shape, color, and other properties, before inserting the image into Microsoft Word along with text. Because all of my images were from one source, I cited them with [5], to indicate that they came from that video. I also cited the text on the artifact with the appropriate sources.

## Computing Innovation

2c)

One beneficial effect Neuralink can have on society is its ability to help those who have lost a limb [2]. This technology allows people to control and receive information from machines using their brains, as well as enable haptic feedback: Neuralink could record which areas of the brain are stimulated when we touch something, then use this information to stimulate these areas when people use robotic prostheses to touch something similar [2]. This will result in more accurate, advanced robotic limbs and prosthetics, allowing people who have lost limbs to gain more autonomy and access to the world.

One harmful effect Neuralink can have on society is lack of privacy. Neuralink uses Bluetooth to interface between the chip implant and machines, like keyboards, robotic limbs, etc. This makes it possible for wireless transmissions to be captured to track your geographical movements, even playing a role in surveillance programs [1].

2d)

This innovation uses data in the form of electrical signals sent into and received from the brain [5]. When the brain wants to send a message to another part of the body, neurotransmitters are sent between neurons to communicate with each other. When a neuron receives enough of a specific kind of neurotransmitter, an action potential gets fired, causing the neuron to continue passing on the message it received. These action potentials produce an electric field, which can be detected by electrodes, allowing the message to be recorded [5]. This electrical signal is then sent to a chip implanted behind the ear, which reads and interprets it in order to perform a command on a machine. Conversely, this process can also work in reverse. An action done by a machine, such as a robotic limb, can send electrical impulses through Neuralink to stimulate a certain part of the brain, mimicking what information the brain would receive from nerves in a flesh limb [2].

One data security concern about Neuralink is related to Bluetooth. The chip implant will be controlled by a phone app using Bluetooth, which has been known to have security problems [6]. By using Bluetooth to open up a channel

for two devices to communicate, there is a greater opportunity for man-in-the-middle attacks to occur, where a third party can access private data sent through bluetooth [7]. Especially considering that Neuralink hopes to both read from and write to the brain, this vulnerability can be dangerous [6].

## References

2e)

[1]

Bocetta, Sam. "What are the Security Implications of Elon Musk's Neuralink?" CSO, 1 Aug. 2019, <https://www.csoonline.com/article/3429361/what-are-the-security-implications-of-elon-musks-neuralink.html>

[2]

Hamilton, Isobel Asher. "We Spoke to 2 Neuroscientists About How Exciting Elon Musk's Neuralink Really Is." Business Insider, 6 Oct. 2019, <https://www.businessinsider.com/we-spoke-to-2-neuroscientists-about-how-exciting-elon-musks-neuralink-really-is-2019-9>

[3]

Lopatto, Elizabeth. "Elon Musk Unveils Neuralink's Plans For Brain-reading 'Threads' and a Robot to Insert Them." TheVerge, 16 Jul. 2019, <https://www.theverge.com/2019/7/16/20697123/elon-musk-neuralink-brain-reading-thread-robot>

[4]

Markman, Jon. "Elon Musk's Neuralink is Sci-Fi Made Real." Forbes, 30 Aug. 2019, <https://www.forbes.com/sites/jonmarkman/2019/08/30/elon-musks-neuralink-is-sci-fi-made-real/#3fed797c4e2f>

[5]

Neuralink. "NeuroLink Launch Event" YouTube, commentary by Elon Musk, Max Hodak, Matthew MacDougall, Vanessa Tolosa, DJ Seo, and Philip Sabes, 16 Jul. 2019, <https://www.youtube.com/watch?v=r-vbh3t7WVI&feature=youtu.be>.

[6]

Scammell, Robert. "Neuralink Security 'Has to be Solid' to Avoid Brain Hacking." Verdict, 24 Jul. 2019, <https://www.verdict.co.uk/neuralink-security-brain-hacking>

[7]

Stewart, Ryan. "Latest Bluetooth Hacking Techniques Expose New Attack Vectors For Hackers." Cyware, 6 Jan. 2019, <https://cyware.com/news/latest-bluetooth-hacking-techniques-expose-new-attack-vectors-for-hackers-a16cfb5e>