Harvard Model Congress
Boston 2022

BRAIN CHIPS AND THE FUTURE OF HUMAN EVOLUTION

By Noelle Parks

Brain-Computer Interfacing Technology (BCI's)– *Machines capable of receiving electrical impulses from the brain, analyzing them, translating them into commands, and relaying those messages to another device capable of executing those commands. (Shih, 2012)*

Artificial Intelligence –*The science and engineering of making machines that are capable of the same tasks as the human brain, even if those tasks are not biologically observable. They also learn just like the human brain does. (IBM Cloud Education)*

INTRODUCTION

Cyborgs, mind-melding, and brain chips have been the stuff of science fiction stories for decades. However, these particular science fiction tropes are following in the footsteps of the telephone, lab-grown meat, and space stations; they are becoming less and less fictitious every day. Mark Zuckerberg envisions a platform that "lets you communicate using only your mind" (Stibel, 2017). Zuckerberg has described external brain sensors that would allow you to "type" 100 words per minute with your mind, a reality that Building 8—Facebook's research wing comprised of 60 scientists and engineers with hundreds of millions of dollars in funding—is undoubtedly working hard to actualize (Stibel, 2017). In fact, Zuckerberg's team already has an algorithm capable of deciphering words from thoughts in actual time (Samuel, 2019). His counterpart, Elon Musk, goes even further. Musk envisions a world where **brain-computer interfacing technology (BCI's)** makes it so that the human brain and **artificial intelligence** can combine to be indistinguishable from one another (Golembiewski, 2020). Musk's company Neuralink just finished a successful brain chip trial where chimpanzees were able to play a video game using nothing but their mind. The company's future aspirations include telepathy, strengthened sensory and motor skills, and digital immortality. Although competing visions for a neuro enhanced world exist, the fact remains that brain chips have transcended the world of fiction to enter that of reality.

In a world where information is power, how does one grapple with the implications of a brain chip that can read, analyze, and collect your thoughts as data in real-time? How does a society react when regular people suddenly possess superhuman-like capabilities?

What will they use those powers for? And once the technology becomes available, who is first in line?

EXPLANATION OF THE ISSUE

Historical Development

Luigi Galvani *– Italian biologist who discovered that electric shock could make a dead frog's legs twitch leading to the discovery of what he called animal electricity (the nervous system).*

Karl Lashley *– Psychologist and Harvard faculty member who used rats to study human memory*

Charles Babbage *– English mathematician who designed the first rudimentary computer (AKA the Victorian engine)*

Ada Lovelace *– English mathematician whose writings laid the foundation for the invention of the first computer.*

There is a common saying among psychologists: "If you get a great transplant, it feels like your heart has been replaced; if you could get a brain transplant, it'd feel like your body has been replaced." Our brains are home to our most intimate desires, our most shameful memories, and our complex personalities. In seeking to understand ourselves, we have sought to understand both our brains, and those of our predecessors. This is why biologists like **Luigi Galvani** were using electricity in the 18th century to make dead frogs twitch (RegDesk, 2019), and why psychologists like **Karl Lashley** were having rats run mazes with half their brain removed (Karl Lashley: The Representation and Processing in the Mammalian Cerebral Cortex). This is the same thinking that led **Charles Babbage** and **Ada Lovelace** to conceptualize and develop the first computer—which they molded after their perception of how the human brain made calculations (Ada Lovelace, 2021). Since its inception, the computer has been getting smaller and smaller. What once occupied a whole room can now fit on your lap. And at the most basic level, that is all the brain is, a computer with the ability to create programs based on the environment with about 2500 MacBooks' worth of storage. This is the reality that underscores the opinions of the likes of Nicholas Negroponte—the director of MIT's Media Lab—who see the symbiosis between man and machine as an inevitability that society must come to terms with rather than a moral dilemma (McGee and Maguire). According to Negroponte and his colleagues, in 10 years, computers will be everywhere; in 20 years, they will be embedded by bioengineers in our bodies (McGee and Maguire). They believe that integrating the natural and man-made operating systems has and will continue to "give us powers with which we can manipulate not only external reality—the physical world—but also, and much more portentously, ourselves"(McGee and Maguire).

Currently, our lives are playing out this very prophecy. We use prosthetics such as **cochlear implants** to help over 100,000 completely hearing-impaired people hear better (RegDesk, 2019). We use "bionic eyes," an artificial vision systems with cortical implants, to help visually impaired people see everything from cooking surfaces to laptop screens (RegDesk, 2019). There are even pacemaker-like implants that aim to treat Parkinson's, chronic pain, depression, epilepsy, dystonia, Tourette's syndrome, and obsessive-compulsive disorder in 30,000 people through deep brain

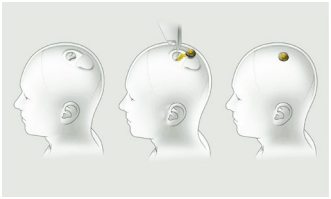
stimulation (RegDesk, 2019). All three of these technologies rely completely on the brain being able to interface with an implant. In a sense, technology has already arrived at the reality that Musk strives to create. It is just that until the present, brain chips have been prescriptive, not elective to large swaths of society.

Scope of the Problem

Privacy

Cochlear Implants *– Electronic devices that help hearing impaired people hear by circumventing damaged parts of the ear, especially the inner ear.* (Cochlear Implants, *Mayo Clinic)*

Privacy is the largest concern regarding brain chips. Brain monitoring devices have global tracking capabilities. This includes the ability to anticipate and influence buyer tendencies, the capacity to detect lies, and the capability to validate and/or refute memories in criminal trials (McGee, 2007). Looking deeper, concerns exist regarding the potential of brain implants to alter and dictate behavior and world view (McGee, 2007). In a recent study, coined "**Robo-rat**," researchers were able to make a rodent twist and turn its way through a maze and could even make it jump on demand by placing a few electrodes in its brain (Graham-Rowe, 2002). The scientist responsible for this experiment claimed that the research was to better understand how mammals navigate their surroundings, but, the ethics of the method, as well as its implications for human beings have been questioned (Graham-Rowe, 2002). The study shows that with BCI's, people's thoughts, emotions, desires, and actions could not only be recorded but also possibly controlled (McGee, 2007).



Nueralink installation procedure.
Stephen Shankland/CNET

As a result, surveillance could become omniscient. Data would exist on where anyone was at any given point in time and who they last talked with. If surveillance becomes an even more routine part of everyday life, the right to remain silent and all the protections against self-incrimination ensured in within the Fifth Amendment, would be rendered obsolete. The movie *Minority Report*, where the PreCrime Division apprehends and arrests murder suspects before they commit a crime, may not be too far off from the reality of tomorrow (Samuel, 2019).

Societal Impact

The social impact of BCI's cannot be understated either. Because brain chips will come with a large cost, only those who can afford one will be able to access the premium care necessary to obtain a brain chip. Differences in access would widen the already stark gap between developed countries and emerging nations (McGee, 2007). Disparities would arise between enhanced and non-enhanced humans with a troubling parallel with poverty lines (McGee, 2007). There is also the possibility that access to neuro electronic devices will become a sort of 'arms race' as people strive to make themselves more competitive in the workforce (Mendez and Jaremus, 2021).

This would exponentially exacerbate existing inequalities to a degree we have yet to witness before.

Moral Implications

One theoretical, but still powerful, perspective on brain chips is the idea that it simply isn't natural to mix man with machine. This objection to human enhancement can come from any of the following three pillars: a religious refusal—think "this is not what God intended"—a refusal based off the belief that acceptance of these modifications would disrupt the process of natural selection, or, thirdly, no specific rationale at all but simply a strong and instinctive aversion to the idea (Chan, 2007).

Psychological Impact and Autonomy

There are concerns regarding the continuity of self when one chooses to implant a brain chip. What happens if the boundaries between the real world and virtual reality become indistinct, so much so that it is impossible for one to tell which is which (Chan, 2007)? What happens if the addition of the chip erases an individual's sense of self? In a study of six patients who were living with BCI's, one reported feelings of "**radical symbiosis**" with her implant that can detect epileptic activity (Drew, 2019). Symbiosis, typically used in ecology, means a mutually advantageous relationship between coexisting species. "It became me," said Patient 6, in reference to her implant (Drew, 2019).

There is great potential for human beings to lose individuality, not only to the chip, but to the communities they will be able to connect with through the chip. It has already seen that social media platforms, like Facebook, can create bubbles and echo chambers for consumers. These environments can lead to hive or mob mentality. In environments that value groupthink over agency of self, the addition of brain chips may very well blur or completely remove the line between the self and others (McGee, 2007).

Patient Safety

In general, any surgery, including the insertion of a neuro electronic device, is going to come with risks. These risks include bleeding, infections, and adverse reactions to anesthesia. As they relate specifically to implanted devices, concerns include change of cognition, mood, personality, and adverse immune responses to foreign materials in the body (McGee, 2007). There are also unique procedural concerns when it comes to BCI's, like warranty access, culpability of manufacturers, the establishment of industry-wide standards, an official system with which to upgrade devices, and steps for teaching users how to use the hardware (McGee, 2007). At the moment, these have all gone unaddressed—perhaps understandably so—as we are just on the precipice of this new era.

Robo-rat *– A "bionic" rat whose brain has an implant in it. The rat's brain—and by extension the rat—can be controlled by sending electrical impulses to the rat's brain through the chip.*

Privacy *– In a legal sense, privacy is a **host** of distinguishable phenomena, including but not limited to: (1) informational intrusions, such as breaches of confidentiality, identity theft, secret location tracking, or e-mail hacking; (2) proprietary intrusions, such as an advertiser using someone's photograph without permission, or a former spouse publishing revenge porn; (3) intellectual intrusions, such as accessing Internet browsing histories or library records to track what someone has been reading or thinking about. All three of these broad categories of "privacy" usage have wide currency in the law. ("What Is Privacy?" American Bar Association)*

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Audit(s)– *Under the Federal Food, Drug and Cosmetic Act, the FDA is required to inspect manufacturers at least once every two years—even more for companies just getting started, those with a history of compliance problems, and those who have started producing products significantly different from what they produced before. Also called Inspections.*

Symbiosis *– a term used to describe the mutually beneficial relationship a person has with their BCI. It means that both the person and the BCI are better off depending on each other than not.*

("What Happens During an FDA Inspection?" *The FDA Group*)

Congressional Action

On March 10th, 2021, Rep. Suzan DelBene (D-WA) introduced the Information Transparency and Personal Data Control Act (HR 2013), which aims to create a national standard for data privacy for U.S. citizens (New House Privacy Bill, 2021). It applies to any entity that collects users' personal data for commercial use. It should be noted when considering legislation related to brain chips that the US still sits on the brink of this technology, meaning much legislation has not been introduced nor passed related to the topic. Here are some of the functions of HR 2013:

Transparent Privacy Policy

The act mandates all data collecting entities must alert users of their most up-to-date privacy policies in plain language (New House Privacy Bill, 2021). That means that long terms and conditions sections of websites will have to be intelligible to everyone, not just lawyers. When necessary, the act mandates the use of visualizations to explain to its policy to users (New House Privacy Bill, 2021). Additionally, the law-abiding privacy policies must include contact information for that entity, why they are collecting your data and how they are using it, any third parties they are sharing your information with, information on how to withdraw consent, how to view the data they have gathered on you, and how the entity is protecting your information from cyber-attacks (New House Privacy Bill, 2021).

Opt-In and Opt-Out Rights

Businesses must acquire expressed, opt-in consent from users for permission to collect or distribute sensitive personal information. Sensitive personal information refers to any data that can be used to identify an individual (New House Privacy Bill, 2021).

Additionally, Users have the right to opt out of non-sensitive personal data collection at any time (New House Privacy Bill, 2021).

Privacy Audits

Additionally, under this new legislation, there would be annual **audits** of businesses with 501 or more employees that will be contracted out to independent third-party entities. If the state or federal government deems it necessary to bring forth allegations of wrongdoing (due to a nonobservance of regulation), the entity will have 10 days to deliver the audit (New House Privacy Bill, 2021).

The California State Legislature.
Anda Chu/The Mercury News

Rulemaking and Enforcement

The **Federal Trade Commission (FTC)** would be in charge of supplementing the legislation with additional rules and gives the FTC the power to enforce the law (New House Privacy Bill, 2021). Except for a few Trump-driven swings, the issue of privacy is

commonly a bipartisan issue with support from libertarian leaning people on both sides of the aisle.

State Action

California, Missouri, and Oklahoma have all taken steps at the state government level to ensure protection against an extreme -- that no one will be forced into implanting an unwanted device.

California Civil Code section 52.7(a) "(a) Except as provided in subdivision (g), a person shall not require, coerce, or compel any other individual to undergo the subcutaneous implanting of an identification device" (Mendez and Jaremus, 2021).

Missouri Rev. Stat §285.035(1.): "No employer shall require an employee to have personal identification microchip technology implanted into an employee for any reason. 2. For purposes of this section, "personal identification microchip technology" means a subcutaneous or surgically implanted microchip technology device or product that contains or is designed to contain a unique identification number and personal information that can be noninvasively retrieved or transmitted with an external scanning device. 3. Any employer who violates this section is guilty of a class A misdemeanor" (Mendez and Jaremus, 2021).

63 Oklahoma St. Ann. § 1-1430 "A. No person, state, county, or local governmental entity or corporate entity may require an individual to undergo the implanting of a microchip or permanent mark of any kind or nature upon the individual. B. The State Department of Health may impose a fine not to exceed $10,000 on any person who violates this act. Each day of continued violation shall constitute a separate offense" (Mendez and Jaremus, 2021).

***FTC**–American governmental agency to protect consumers and competition by preventing anticompetitive, deceptive, and unfair business practices through law enforcement, advocacy, and education without unduly burdening legitimate business activity.* (About the FTC." *Federal Trade Commission*)

FDA Action

Current FDA Regulations

Before being marketed in the U.S., a medical device must be **FDA** approved. According to FDA rules, bioelectronic devices are labelled Class III (McGee, 2007). As it stands, neuro electrical implants fall into Class III (which would require the most extensive testing). If a company said that their brain chip was ready for commercialization, they would have to meet FDA requirements for Class III devices first (McGee, 2007).

IDEOLOGICAL VIEWPOINTS

Conservative View

Conservatives prefer limited government and a free market and prioritize personal freedoms over social or economic government

actions. Regarding neuro electronic devices, a free market may suit the situation best, so that each person can decide for themself what the best course of action is. That said, privacy is a bipartisan issue that garners support from both sides. Some evangelical conservatives may view implantable brain chips the same way as they would see abortion or stem cell research, as against traditional morality.

Elon Musk, Founder of Neurolink, SpaceX, and Tesla.
Kevork Djansezian/GETTY IMAGES

Liberal View

In general, liberals take a progressive and preemptive approach to policy and like to utilize government action to ensure social and economic equality. The core belief here is that the role of the government is to enforce universal well-being in society, not the individual. Here they may favor more aggressive policy actions in terms of brain chips and may sacrifice personal freedoms for collective welfare.

Yet liberals would still have some similar privacy concerns that conservatives will have. A good grounding in this debate would be to analyze your representative's views on current debates regarding social media.

***FDA**– Food and Drug Administration. Government agency responsible for protecting the health and safety of Americans by ensuring the safety and efficacy of drugs, biological products, medical devices, cosmetics, and radiation emitting products ("What We Do." U.S. Food and Drug Administration)*

AREAS OF DEBATE

Expand FDA Regulations

Because the implications of neural enhancements are so large, and unlike anything humankind has seen before, it is important that the FDA put a procedural framework in place now to prevent the onslaught of safety and efficacy, social, moral, political, and ethical issues coming down the pipeline (Chan, 2007). As a committee, you can direct the FDA to alter or specify their classification system in order for brain chips to fit within their approval stratification properly and easily.

For context, currently, all medical devices in the United States are separated into three classes: Class I, Class II, and Class III. Class I appliances are low risk and low complication, and consist of things like medical gloves, handheld medical tools, and bandages (Chan, 2007). Regulation for these devices is basic—they cover registering the appliance, and keeping good manufacturing etiquette (Chan, 2007).

Class II contains devices that need further regulation than devices in Class I. These more stringent requirements include special labeling instructions on products, compulsory performance reviews and standards, and post-market scrutiny (Chan, 2007). Examples of Class II appliances are electric wheelchairs, IV infusion pumps, and surgical drapes (Chan, 2007).

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Class III is the category for devices even more complex and that need even more regulation than Class II items. Class III includes appliances "represented to be for a use in supporting or sustaining human life" or that seem like they have "potential unreasonable risk of illness or injury" (Chan, 2007). These more rigorous qualifications for Class III involve all the requirements for Class I and Class II, with the addition of **Premarket Approval (PMA)** (Chan, 2007). Some Class III items are heart valves, silicone sacs for body augmentation, and cerebella stimulation devices (Chan, 2007).

Premarket Approval (PMA) *— FDA review process to assess the safety of class III medical devices. Class III devices are substantially important to supporting human life but present a potentially unreasonable risk of illness to humans. (Center for Devices and Radiological Health. "Premarket Approval (PMA)." U.S. Food and Drug Administration,*

PMA may work for monitoring pharmaceutical drugs that are quickly metabolized (and was the original aim of the FDA) (Chan, 2007). However, PMA is a one-time event before approval which may not make sense for something as permanent and intrusive as a brain chip. There is little information about the impacts of neuro-electronic devices on the health and wellbeing of people, and it will take diligent trial and error, evidence, and experience to develop something that will work for everyone (Chan, 2007).

Therefore, a possible policy solution is instituting a new category of devices—Class IV. Class IV would be for any device that can send or receive signals and other communication straight to and from the brain and is interconnected with the nervous system in a manner that is long term (Chan, 2007). Class IV would have all the requirements of devices in Class III, with the addition of more rigorous standards for well-being and efficacy over the life of the BCI and the consumer (Chan, 2007). A sub-class could also be created, called Class IV-E. Class IV-E devices could be for those BCI's with great potential to magnify normal human facilities. Additionally, these Class IV-E devices would be subject to robust and continuous testing overseen by a new committee called the 'Enhancement Panel' (Chan, 2007).

BCI's, or brain computer interfaces, are nothing new, but they are getting more advanced by the day.

After final approval from the Enhancement Panel, human enhancing BCI's could be introduced in two phases: the first in line to receive would be those with disabilities -- those who are deaf, blind, paralyzed -- to use as a more dynamic prosthetic instrument (Chan, 2007). The second group to have enhanced BCI access would be those enlisted in our military, where the immense capabilities of the devices could potentially save lives (Chan, 2007).

Political Perspectives on this Solution

Generally, conservatives and liberals alike would be likely to not have strong opposition to this policy proposal, as it simply modifies clear guidelines that are already in place. Liberals would be likely to support this policy proposal as they are typically in support of safety-related government regulation.

Yet, any opposition to this proposal presents itself as an argument against government interference and regulation. This opposition would most likely be seen from conservatives. Generally, conservatives believe that it is not the government's place to decide

who can and cannot get a sensory enhancing BCI and when they can or cannot receive this device. There is a world in which it could be considered another body modification, and the government would never mandate who can get a tattoo and when (as long as they are an adult). The same principle could apply here.

Increase HIPAA Regulations

Doctor-patient confidentiality *– A provision in the relationship between physicians and their patients that restricts physicians from discussing a patient's personal or medical issues with anyone other than the patient. It is outlined in the HIPAA and necessary to enable free information flow and by extension sound medical care.*

In the United States, **doctor-patient confidentiality** is covered by The Health Insurance Portability and Accountability Act of 1996 (HIPAA), Public Law 104-191 (HHS Office of the Secretary, 2020). The HIPAA Privacy Rule enables a national standard for which patient records are protected. Under HIPAA, no doctor may release medical records without the explicit consent of the patient. This includes to parents if their child is over the age of 18. (HHS Office of the Secretary, 2020). It may be possible to use this law as a precedent to ensure privacy of thought.

Because of the potential for future BCI's to gravely violate any American citizen's privacy, it may be useful to classify everyday thoughts that get transformed into data, as medical information. If a BCI cannot share your thoughts with anyone but your doctor, and then if anything you share with your doctor is protected by HIPAA, by extension, your thoughts are protected. It is just a matter of writing legislation that would classify one's thoughts as medical information. This is legislation that could be passed within this committee as a possible policy solution. Just as one's conversations with a therapist are confidential, why not the conversations you have with yourself?

If legislation can be passed to mandate that the data created from implanting a BCI is health information, any outside entity would be denied access unless the healthcare professional chose to share the information. Times that therapists may break confidentiality include "(1) When the client poses an imminent danger to themselves or others, and breaking confidentiality is necessary to resolve the danger. (2) When the therapist suspects child, elder, or dependent adult abuse. (3) When the client has directed the therapist to share information about their case. (4) When the therapist receives a qualifying court order" (Caldwell, 2021).

Additionally, therapists can break this confidentiality if their patient is suspected of a crime, especially on a national scale (Caldwell, 2021).

Political Perspectives on this Solution

Opposition to this proposal could include that an entire separate law is needed to address the issue of data privacy instead of an amendment to HIPAA. Again, the main issue at stake here is that of privacy. It still remains to be seen exactly how these technologies will play out in practice, meaning that preemptive legislation can serve as

a starting point to ensure protection from the start of implementation of these technologies, rather than retroactively creating these laws. Alternatively, the objection could be that surveillance is actually a good thing. The only people who would worry about surveillance are people with something to hide.

Adapt Existing Discrimination Law

As you consider policy solutions, it is important to remember the discussion between the status of individuals with brain implants versus those without. Possible solutions include the possibility to add non-implanted people as a protected status. It is possible that eventually there could be a wide enough divide between people who embrace this technology versus those that do not, creating discriminatory divisions between these two groups.

Currently, for context, Title VII of the Civil Rights Act of 1964, the Americans With Disabilities Act (ADA), the Age Discrimination in Employment Act (ADEA), and the Genetic Information Nondiscrimination Act (GINA) make up employee protections against discrimination on the basis of "race, sex, color, gender, national origin, religion, disability, age, and genetic information" (Mendez and Jaremus, 2021). There could be a day where not receiving a BCI could be considered a 'disability' because most other people will have it. In the ADA, a person must be "substantially limited in one or more major life activities as compared with most people" to qualify as disabled (Mendez and Jaremus, 2021). If enough people use Nueralink or its peer devices, they will become the norm. To keep those without implants from needing to 'keep up,' employers may be required to create accommodations for those without implants (Mendez and Jaremus, 2021).

As a result, it may be eventually required that there are clear protections for both sets of individuals. These protections can be preemptive and again allow for legislation to be in place prior to its necessity. This would allow the US government to stay ahead of technology, rather than falling behind and legislating after issues arise.

Political Perspectives on this Solution

Liberals would be more likely to support this policy proposal as compared to conservatives. Conservatives would view it as unnecessary to pass legislation that does not have an immediate use, while liberals would be more likely to support this preemptive legislation.

BUDGETARY CONSIDERATIONS

There are a range of possible policy actions that have a multitude of budgetary constraints. For example, expanding the policy scope of HIPAA would cost significantly less than an overhaul of the way the FDA conducts tests on potential products for American consumers. It is important to remember that these brain implants are very expensive, meaning that most likely, the average American would not gain immediate access to them. Additionally, it should be remembered that any budgetary figures must be realistic.

CONCLUSION

Altogether, brain chips bring to light questions of privacy and autonomy, patient safety, and social and economic disparities. Cracking this open is no easy task. Think about whether the ends justify the means, no matter which political leaning you adhere to. Where are some places to compromise -- for true bipartisanship?

The COVID-19 pandemic has spurred us even further into the digital age—increasing how much we rely on technology to live in a society. Overnight, we switched from a world full of handshakes and hugs to one full of zoom reactions. Physical wallets were replaced with digital ones, classrooms with breakout rooms, and parties with Netflix parties. Imagine what would happen if brain chips had been released during 2020 and could make it feel as though you were really interacting with a loved one in person? For many, brain chips would have become one of the various modifications to our lives borne out of necessity. Fortunately, the timing of their release will allow for a much more exercising of personal choice in the decision to use or not use a brain chip. Given, though, that brain chips aren't quite ready to be introduced to us, we have the time to figure out if we are ready to be introduced to them.

GUIDE TO FURTHER RESEARCH

The scholarly articles function on Google is highly useful for delegates who seek to conduct more research on this topic. Try looking for more information on ways to curve and stymie societal destabilization. What policies would you want in place if brain chips were being launched tomorrow? Can you think of any implications that brain chips have that this author may have missed?

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GLOSSARY

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Artificial Intelligence – The science and engineering of making machines that are capable of the same tasks as the human brain, even if those tasks are not biologically observable. They also learn just like the human brain does.

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