

Thinking Thematically

200,000 years and still champion: technology and the human brain



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Overview

- A long history of biomimicry in technology begs the question of how to best innovate using the human brain
- Neuralink, Elon Musk's start-up, implanted their first device into a human brain this year, drawing attention to the field of neurotechnology
- Other innovations are taking place in artificial intelligence, where researchers are trying to train their models the way humans train – as toddlers

The world of technology has long been fascinated with biomimicry, ideas that source their innovations from nature. As far back as Leonardo Da Vinci, scientists have been looking to birds for better wings, plants for better materials, and even coral for improved cement.¹ But what about the human brain? It's nature's version of a supercomputer, filled with 85 billion neurons, each of which boasts nearly 7,000 synapses connecting to the neurons around it.² It's a marvel of engineering even compared to other mammals, with a brain 5-7x larger than body size normally demands and an efficient use of energy to power those connections.² (After all, elephant and whale brains are *physically* bigger – a process called encephalization - but given differences in design, they still don't surpass the human brain's capacity).

So, how can we use the insights of the human brain for innovation? We could, of course, try to replicate it. Until now, computing power created limitations, though the race to build better and faster chips continues to push through many walls. Just two years ago, for example, China revealed a 'brain-scale' computer, Sunway, which was used to train an artificial intelligence (AI) model with 174 trillion parameters, rivaling the connections in the human brain.³

However, as the remarkable capabilities – and mysteries, mistakes, and imaginations – of generative AI have shown us this past year, we still have a lot to learn about the human brain. Fortunately, many innovators are focused on just that – harnessing human potential to move our technology forward. Today, we'll look at a few of the more recent examples and what it could mean for the world of thematic investing.

I'll have the brain – with a side of chips

One possibility in merging the brain and technology, of course, is to take the concept literally, adding new tech to the human body. Called neurotechnology, the field received a jolt this year from the news that Elon Musk's start-up, Neuralink, had implanted its first device into a human brain.⁴

Neuralink isn't the first brain technology. Since 2004, there have been startups working on implants, attempting to study brain signals and help with diseases like epilepsy and Parkinson's. However, Neuralink appears to be the most advanced yet, containing over 1,000 electrodes and connecting to individual neurons rather than groups of brain cells. After receiving US Food and Drug Administration approval for human trials in May, Musk's venture joins those ranks, looking to use the brain implants to help people with injuries to use phones and PCs with only their thoughts.⁴ Eventually, they hope to aid those with vision and hearing loss.

The technology – and Elon Musk himself – are not without controversy. The company is under fire for earlier trials using primates, and Musk's long-term goal is to expand the use of the chips from disabilities and into futuristic goals like merging humans with AI. However, the implant also drew attention to neurotechnology more generally, a more than \$8B vertical where nearly 300 companies have raised venture capital.⁵

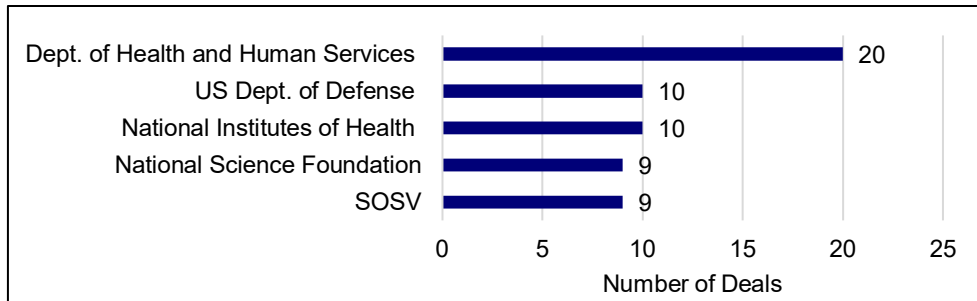
1. A-Planet, August 2022

2. Herculano-Houzel, August 2009

3. South China Morning Post, June 2022

4. Bloomberg L.P., January 2024

Top Venture Investors in Neurotechnology ⁵



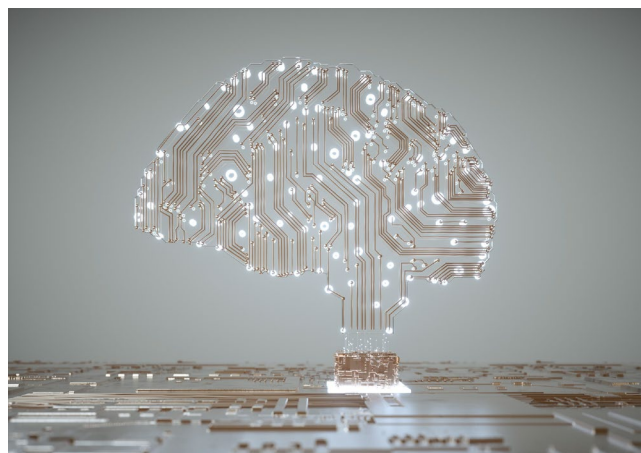
All agencies listed are US Agencies. SOSV is SOS Ventures

Training like a toddler

Part of what makes the human brain so incredible, of course, is time. And we’re not just talking about millions of years of hyper-competitive evolution gearing us toward survival! We’re talking about childhood – growing brains from scratch before training them for nearly two decades to get a finished product. While the work of babies might not seem like work at all (one of our nephews is particularly interested in bongos right now...), several years of tears, milk, and play end up building a remarkable brain. And in the world of AI, it’s something researchers want to replicate.

Current AI models are trained on troves of data but still trail behind toddlers in basic logic and reasoning – a feat accomplished with much less data, with most children not venturing further than the local playground. Toddlers also seem to have a working model of the universe, understanding basic physics and other complex concepts – like understanding, for example, that a dropped ball should fall.⁶ To harness this power, researchers are replicating these experiences. A team at New York University recently trained an AI model using 61 hours of footage from a camera strapped to a toddler’s helmet. They found the AI was able to make word associations, correctly naming objects the toddler had interacted with.⁶

Another example comes from Meta, where researchers worked with teams at McGill University and Northwestern to create a biomechanical model based on the movements of toddlers. Called MyoSuite 2.0, the model could help robots and avatars move more fluidly. In one experiment with a model of a human arm – complete with 39 digital muscles and 29 joints – MyoSuite worked on picking up a collection of toys and balls like a toddler might, training the model for future interaction.⁷



Neuro and technological elasticity

Even as the world was awed by artificial intelligence this past year, the secrets of the human brain could provide a path for improving them further. And while we’re seeing the technology go in different directions – from putting computers in brains to training computers to act like them – it’s clear the brain is a source of innovation.

While the path of technology is never completely clear, sometimes the direction is. After all, it was only 150 years ago that we discovered photography, and AI models have already created more digital photos than humans ever took – some 15 billion⁸. The most human thing of all is ingenuity, stretching ourselves to discover and improve. Perhaps with the help of the human brain, tech will take its own leaps next.

6. MIT, February 2024
 7. IEEE, August 2023
 8. Exerypixel, August 2023

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