In this essay, Chen moves from the problem of how and why AI challenges our understandings of innovation to the idea that intelligence and human identity are inextricably linked. (Instructor: Courtney Chatellier)

THE DUALITY OF INTELLIGENCE

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A curious question of identity arises in a well-known paradox called "The Ship of Theseus," originally reported in a Greek legend. When the mythic hero Theseus returned to Athens after one of his adventures, the Athenians decided to preserve the ship that he had used. As time passed, the ship's wooden planks started to decay. When one plank began to break down, it was promptly replaced, and the Athenians agreed thereafter to replace each rotting plank with a newer, sturdier one. Not long after the first plank was replaced, a second one started to break down as well. And then a third. In due time, all of the original planks eventually rotted and were replaced. Not a single plank that had belonged to the original remained. Was it still the same ship? Or did the replacement of all of its constituent parts turn it into a different one?

It doesn't seem like this thought experiment would have anything noteworthy to offer outside of a philosophical debate, but recent innovations have given this discussion a new relevance within the field of artificial intelligence, or AI. The questions previously posed are analogous to potential questions that could also arise from the study and research of AI. Is artificial intelligence the same as human intelligence? If a human mind were replaced with a machine capable of completing the same tasks, would our definition of intelligence change? Would machines be able to process meaning in the same way that we do, or would such a process be purely syntactic? In many cases, the resolutions to these complicated questions will depend on our interpretation of what 'the same' means.

Out of all our technological innovations, AI is one of the most peculiar. In contrast to traditional processing algorithms, which use explicitly defined inputs and outputs, a computer with AI capabilities leverages machine learning, the process through which machines recognize errors and correct them in the future. Machine learning can be viewed as the main enabler of AI, allowing it to be defined as 'intelligent.' Although 'artificial intelligence' may have a futuristic connotation to it, it already plays a substantial part in our lives today. In "The Great A.I. Awakening," Gideon Lewis-Kraus describes how Jun Rekimoto, a University of Tokyo professor of human-computer interaction, heard that "Google Translate, the company's popular machine-translation service, had suddenly and almost immeasurably improved." Rekimoto decided to test these newfound capabilities. He selected an English passage from Hemingway and fed his own Japanese translation of the passage back into the service. As far as meaning went, Google's English translation was nearly identical to the original passage, only missing a single grammatical article. Lewis-Kraus attributes this improvement to the service's conversion to an AI-based system. By implementing new machine learning algorithms, the system was able to 'learn' much faster than it did previously. Lewis-Kraus also mentions that we take current AI-enhanced systems such as this one "as a push-button given—a frictionless, natural part of our digital commerce." In doing so, he suggests, we may already be relying on AI to a greater extent than we thought.

Google Translate, as a flagship case, shows the extent of AI's potential. The development of machine learning in consumer products has resulted in systems with "overnight improvements roughly equal to the total gains the old one[s] had accrued over [their] entire lifetime[s]" (Lewis-Kraus). These improvements have allowed us to tackle old problems with ease and start working on solutions to new ones. Examples include autonomous vehicles, speech recognition software, and digital assistants such as Apple's Siri or Amazon's Alexa. All of these innovations rely primarily on machine learning to 'learn' and improve their level of intelligence, yet they are nonetheless classed as 'weak AI': they are capable of focusing only within a narrow set of boundaries ("Weak"). A self-driving car would be at a loss as to

what to do off the road, and a digital assistant eventually repeats or rephrases the same syntax over and over in a conversation.

A stronger artificial intelligence may be better understood by looking at how innovation has functioned historically. Steven Johnson examines such chance connections and great discoveries in "Platforms," the final chapter of his book *Where Good Ideas Come From: The Natural History of Innovation*. Johnson says that in one such discovery, two physicists were discussing the signals that were coming from Sputnik I, the first human-made satellite to orbit the Earth, and, "[a]s they listened and recorded, the two men realized that they could use the Doppler effect to calculate the speed at which the satellite was moving through space" (184). They deduced that they could use this same information to pinpoint the location of objects on the surface by tracking known satellites, thus creating the beginnings of the modern GPS system. This discovery acted like a platform, because the duo had "created an entire ecosystem of unexpected utility" (Johnson 187). Such utilities, like Lewis-Klaus's observation about Google Translate, are taken for granted today; GPS provides guidance "for everything from mobile phones to digital cameras to Airbus A380s" (Johnson 187). In another instance, Johnson reflects on how something like a coral reef, built on dormant atolls, "is a platform in a much more profound sense. The mounds and crevices of the reef create a habitat for millions of other species" (Johnson 181). Such reefs form a symbiotic relationship with many of their inhabitants, who provide it with nutrients in exchange for protection from predators. Johnson's platforms "come in stacks," in this case both figuratively and literally (189). He uses the Internet as a modern case, imagining it as "a kind of archaeological site" (189). Web sites can be made "on top of the open protocols of the Internet," a platform that has become entrenched in many people's lives. Johnson's takeaway is that "the real benefit of stacked platforms lies in the knowledge you no longer need to have," very much like the original planks of Theseus' ship that were no longer needed (210). Nobody needs to understand the physics behind GPS in order to use it. The Internet offers a similar benefit; it is home to over three billion users, all of whom can enjoy the spread of information and connectivity that it offers without necessarily understanding the mechanics

behind it. When we extend this concept to AI, we see that it relies on the same principles. It's a new innovation, resting on the platform of the computer.

Johnson contends that as we move on to new platforms, the previous ones become less relevant to our experiences. We expect AI to eventually evolve into this as-of-yet hypothetical 'strong' phase, in which its intellectual capabilities and functions will "mimic" cognition in the human brain ("Strong"). However, the difference is that while the platforms leading up to weak AI can be considered an extension of our intelligence, the capabilities that strong AI will have could leave our own intelligence, and thus ourselves, behind. The intelligent capabilities of AI could render our intelligence platform—our minds—useless, like the old planks in the ship. We have always been complacent in the knowledge that we are the only bastions of "intelligence," defined by the *Oxford English Dictionary* as "the ability to acquire and apply knowledge and skills" ("intelligence, *n.*"). But the potential for AI to rival human intelligence brings up some complex existential considerations with regard to how we interact with it. Would we treat an AI with equivalent intelligence to ours the way we treat one another? Would its level of intelligence give it rights? Or would those rights only be conferred onto biological intelligence? The answers to these questions must take into account what such a capability would represent. It would be the first time a creation made in our image would be able to compete directly with us; strong AI could exhibit the potential to match or even exceed our own thinking. Despite the unpredictability that strong AI would have, our role as its creator would mean that we would have to come to terms with how to approach this new platform. It also means that we would be responsible for dictating the first move.

One potential path to strong AI lies in the research and development of brain-machine interfaces (BMIs), which allow communication "between a human or animal brain and an external technology" ("Brain-Machine"). The brain exhibits a unique feature known as cortical plasticity, allowing it to 'remap' important synapses in the event of biological damage. This feature also gives it the remarkable ability to adapt to the point of being able to handle implanted prosthetics and sensors as if they were natural components of the brain. In

"Dreaming in Code," a review of Michio Kaku's *Future of the Mind*, Adam Frank recalls the circumstances of the 2014 World Cup's ceremonial first kick, which was made by a paralyzed teenager using a BMI. Frank believes that such feats, already regular occurrences, may be our first foray "into our post-human future." Frank brings us up to speed on current progress, writing that "researchers are studying the microscopic dynamics of the brain's wiring." He explains that by tracking neural activity with an MRI, "researchers have recorded how the brain lights up when shown fragments of a video . . . they can then determine a subject's neural responses to the patterns" (Frank). The immediate applications of this research are currently being used in the medical field, allowing disabled or paralyzed individuals to regain some level of mobility. Frank's comment on how "it may even be possible for scientists to crudely identify what people hooked up to MRI machines are dreaming about" (emphasis on "crudely") shows that we have yet to grasp the full capabilities of cortical plasticity. Frank concedes that "on the ethical front . . . there are troubling issues inherent in the technologies." If prosthetics and even augmentations are no problem, it seems that it is only a matter of time before chips that could potentially enhance our intelligence or cognition will be made possible.

The exact direction that we are taking with AI and its integration into our lives is uncharted. However, at least one effort seems to lead the way through such a future. Neuralink, a company founded by Elon Musk in 2016, aims to alleviate concerns about keeping up with the potential intellectual capabilities of AI by "working to link the human brain with a machine interface by creating micron-sized devices" (Vijayaraghaven). While this doesn't seem too different from what our brains already do with artificial devices and prosthetics, Musk intends for his work to go beyond that capability. He explains that "there are a bunch of concepts in your head that your brain has to compress into this low data rate called speech or typing" (qtd. in Vijayaraghaven). All of our brains have a multitude of complex thoughts and concepts going on at the same time, and we exert effort to convey this amalgam as coherent expressions. In Musk's view, this process will be inadequate sometime in the future, because "[a]rtificial intelligence and machine learning will create computers so sophisti-

cated and godlike that humans will need to implant 'neural laces' in their brains to keep up" (qtd. in Vijayaraghaven). The ability of the brain to incorporate prosthetic electric inputs naturally suggests that it would be receptive to more complicated electronics. A role reversal might also be possible: our brains could perhaps be controlled or augmented by these "neural laces." But we can expect that an embrace of AI should meet two developmental goals: the assurance that we will be able to keep up with it and an opportunity for a safe path towards such a coexistence.

Looking beyond these feats, we could have the same intelligence as AI yet differ from it. Even so, we might have reason to reconsider our earlier concept of 'sameness.' Siding with the interpretation that the ship discussed earlier is indeed the same one, with the same purpose and the same existence, would allow us to view the purpose of strong AI in a similar vein: as a representation of ourselves in a classical sense. Just as there are countless components and parts that make up the human body, our minds are made up of a mixture of unique thoughts and memories. It is this complex blend that gives rise to our individuality. But would AI be capable of exhibiting such individuality? If we approach this question from the other side, we can see that the ship is unoriginal, and no longer exists as the same. Can such a comparison even be made when the difference between human and machine cognition will become more philosophical than physical? Johnson's concept of stacked platforms suggests that we often take the technology around us for granted, but if an AI were to make a hypothetical demand for a right to live, what right do we have to say yes or no? We extend to individuals, almost universally, the right to a free mind, but what of AI?

Take, for example, a fictitious robot AI, physically indistinguishable from a human, interacting with someone. Said person would have little reason to treat it as anything other than human. But would the person's perception change if they found out that the conversation they were having was not with a real person, but with a collection of code and machinery? In *Reclaiming Conversation: The Power of Talk in a Digital Age*, Sherry Turkle says, "What do we forget when we talk to machines? We forget what is special about being human . . . Machines are programmed to have conversations 'as if' they

understood what the conversation is about. So when we talk to them, we, too, are reduced and confined to the 'as if'" (339). In her book, Turkle frames conversation as something that makes us human. We treasure genuine interaction, so does an artificial conversation devalue our nature?

We might not be ready to answer such questions, only ponder them. To call AI an innovation in the classical sense would mean taking innovation for granted, and it's becoming more and more apparent that doing so might not be the best course of action. AI seems poised to transform the way we think about innovation by putting us in the spotlight. These transformations will not resemble a Skynet-esque 'AI takeover,' but an intellectual one. The question of what we do in this scenario will most likely be worth looking into. The word 'better' is used several times to describe the general trend that innovation has taken, but nobody could have predicted AI's perpetuity. We might find ourselves going down a path of bifurcation, struggling to come to terms with this new platform, or seeing in it a potential to enhance ourselves. Every innovation thus far has been built with the perspective of our cultural and intellectual achievements. Perhaps only time will tell whether that same perspective is ready to handle AI, a radical, if not profound, departure from ourselves.

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