1
From Myth to Reality: Artificial Intelligence in History

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In 1988, Robin Burgener invented the key software components of the handheld game 20Q, based on the spoken parlor game in which a player is asked to think of an object and is then asked a series of yes or no questions in order for the questioner to guess what they're thinking. The 20Q AI uses an artificial neural network to pick the questions and to guess. After the player has answered the twenty questions posed (sometimes fewer), 20Q makes a guess. If it is incorrect, it asks more questions, and then guesses again. It makes guesses based on what it has learned; it is not programmed with information or what the inventor thinks.

Creating Life: The Dream of Artificial Intelligence

In ancient Greek myth, the supernatural blacksmith Hephaestus was said to have created mechanical automatons—machines built to emulate humans—to act as servants to the gods of Olympus. These mythical beings ranged from metal handmaidens to a building-sized bronze guardian, Talos, built to defend a city from ravaging hordes. In the ancient epic poem the *Iliad*, the mythical author Homer wrote of Hephaestus's creations, describing two mechanical servant women built of gold: "There is intelligence in their hearts, and there is speech in them and strength, and from the immortal gods they have learned how to do things."[1]

An automaton is a machine designed to perform a function typically associated with humans. This could be a mechanical action, like holding a comb and brushing one's hair, or an intellectual process. Robots, by contrast, are self-governed, programmable machines built for a specific function and are not necessarily designed to mimic human actions or abilities. In myth, Hephaestus created robots that were also automatons, having human shape and function and so, capable of handling many of the same tasks as a human, but independent and mechanical. The concept of robotics and artificial intelligence was thus born out of myth in antiquity, but the allure of this idea, of creating mechanical servants and guardians, became an enduring fantasy throughout history. Over the ensuing centuries, a whole host of brilliant mathematicians, engineers, and scientists from a variety of fields worked to turn Homer's fantasies into reality.

From Logic to Programming

The number of steps between the earliest dream of thinking machines and the modern field of artificial intelligence is also the history of science itself. This is a path that saw the introduction of syllogistic logic by the famed intellectual Aristotle in the fourth century BCE and many other key developments in mathematics and logic that ultimately resulted in the ability to encode information in mathematical form. On the mechanical side of the equation, the invention of clockwork systems in the fifteenth and sixteenth centuries was one of the key steps towards the field of robotics. From there, inventors used clockwork gears, levers, and springs to create moving statues and figures, including a now famous "walking lion" built of metal by the inventor Leonardo DaVinci for the King of France.[2]

In 1801, French weaver, merchant, and inventor Joseph Marie Jacquard debuted an automated weaving loom that could be "programmed" to create different designs. The machine, typically called the "Jacquard Loom," was able to read a punch card containing a formula for a certain pattern and could then automatically weave the

pattern. Essentially, each punch card functioned like a modern computer program, furnishing the machine with encoded instructions that informed a set of mechanical processes. This machine, though simple by modern standards, was arguably the inspiration for all modern programming and inspired an eccentric mathematical genius named Charles Babbage who, along with his friend and fellow mathematical prodigy Ada Lovelace, designed the world's first computational machine.

Babbage and Lovelace's device, called a "Babbage Engine" or an "Analytical Engine," wasn't finished during their lifetime and was, essentially, a giant and staggeringly complex calculator.

The second of two engines that Babbage and Lovelace designed was 11 feet long, had 8,000 parts, and weighed several thousand pounds. In Lovelace's writings, it is clear that the machine was the direct descendant of Jacquard's loom, "We may say most aptly that the Analytical Engine weaves algebraic patterns just as the Jacquard-loom weaves flowers and leaves."[3]

From the World Wars to the Digital Age

It was in the twentieth century that the idea of thinking machines and robotic automata became familiar and it was during this time that scientists began to wonder if the human mind itself was really just a type of machine. Young British polymath Alan Turing's 1950 paper *Computing Machinery and Intelligence* discussed the possibility of building a thinking machine and, further, detailed methods that might be used to test such a machine's intelligence.[4] Turing didn't just imagine thinking machines, but also imagined that machines would one day be able to achieve consciousness, free-will, and self-awareness. Turing developed a test, now known as the "Turing test," but called "The Imitation Game" by Turing, involving a conversation in which a judge would try to determine whether the "person" that he or she was conversing with was a machine or a human.[5]

Six years after Turing's seminal paper on machine intelligence was published, a group of similarly minded academics and researchers held the world's first conference on machine learning. Pioneering theorists Allen Newell, Cliff Shaw, Herbert Simon, John McCarthy, and Marvin Minsky, who took part in the 1956 conference, became the pioneers of artificial intelligence over the next half century, with much of their research funded and supported by the Defense Advanced Research Projects Agency (DARPA), one of the world's largest military research organizations. From the beginning, therefore, the development of computational technology that would give way to artificial intelligence was funded and supported, in part, by the military with the goal of using robotics and thinking machines to aid in defense and warfare. It was pioneer John McCarthy who has been credited with creating the term "artificial intelligence" (AI) at the conference.

From the late 1950s to the early 1970s, military and government grants pushed AI development, with massive advances in computer technology coming as a result. Among the most notable milestones was the creation of ELIZA, created by Joseph Weizenbaum between 1964 and 1965 at the Massachusetts Institute of Technology (MIT) Artificial Intelligence Laboratory. ELIZA was a language-processing machine

The A.I. "Gaydar" Study and the Real Dangers of Big Data

By Alan Burdick
The New Yorker, September 15, 2017

Every face does not tell a story; it tells thousands of them. Over evolutionary time, the human brain has become an exceptional reader of the human face—computer-like, we like to think. A viewer instinctively knows the difference between a real smile and a fake one. In July, a Canadian study reported that college students can reliably tell if people are richer or poorer than average simply by looking at their expressionless faces. Scotland Yard employs a team of "super-recognizers" who can, from a pixelated photo, identify a suspect they may have seen briefly years earlier or come across in a mug shot. But, being human, we are also inventing machines that read faces as well as or better than we can. In the twenty-first century, the face is a database, a dynamic bank of information points—muscle configurations, childhood scars, barely perceptible flares of the nostril—that together speak to what you feel and who you are. Facial-recognition technology is being tested in airports around the world, matching camera footage against visa photos. Churches use it to document worshipper attendance. China has gone all in on the technology, employing it to identify jaywalkers, offer menu suggestions at KFC, and prevent the theft of toilet paper from public restrooms.

"The face is an observable proxy for a wide range of factors, like your life history, your development factors, whether you're healthy," Michal Kosinski, an organizational psychologist at the Stanford Graduate School of Business, told the *Guardian* earlier this week. The photo of Kosinski accompanying the interview showed the face of a man beleaguered. Several days earlier, Kosinski and a colleague, Yilun Wang, had reported the results of a study, to be published in the *Journal of Personality and Social Psychology*, suggesting that facial-recognition software could correctly identify an individual's sexuality with uncanny accuracy. The researchers culled tens of thousands of photos from an online-dating site, then used an off-the-shelf computer model to extract users' facial characteristics—both transient ones, like eye makeup and hair color, and more fixed ones, like jaw shape. Then they fed the data into their own model, which classified users by their apparent sexuality. When shown two photos, one of a gay man and one of a straight man, Kosinski and Wang's model could distinguish between them eighty-one per cent of the time; for women, its accuracy dropped slightly, to seventy-one per cent. Human viewers fared

substantially worse. They correctly picked the gay man sixty-one per cent of the time and the gay woman fifty-four per cent of the time. "Gaydar," it appeared, was little better than a random guess.

The study immediately drew fire from two leading L.G.B.T.Q. groups, the Human Rights Campaign and *GLAAD*, for "wrongfully suggesting that artificial intelligence (AI) can be used to detect sexual orientation." They offered a list of complaints, which the researchers rebutted point by point. Yes, the study was in fact peer-reviewed. No, contrary to criticism, the study did not assume that there was no difference between a person's sexual orientation and his or her sexual identity; some people might indeed identify as straight but act on same-sex attraction. "We assumed that there was a correlation . . . in that people who said they were looking for partners of the same gender were homosexual," Kosinski and Wang wrote. True, the study consisted entirely of white faces, but only because the dating site had served up too few faces of color to provide for meaningful analysis. And that didn't diminish the point they were making—that existing, easily obtainable technology could effectively out a sizable portion of society. To the extent that Kosinski and Wang had an agenda, it appeared to be on the side of their critics. As they wrote in the paper's abstract, "Given that companies and governments are increasingly using computer vision algorithms to detect people's intimate traits, our findings expose a threat to the privacy and safety of gay men and women."

The objections didn't end there. Some scientists criticized the study on methodological grounds. To begin with, they argued, Kosinski and Wang had used a flawed data set. Besides all being white, the users of the dating site may have been telegraphing their sexual proclivities in ways that their peers in the general population did not. (Among the paper's more pilloried observations were that "heterosexual men and lesbians tended to wear baseball caps" and that "gay men were less likely to wear a beard.") Was the computer model picking up on facial characteristics that all gay people everywhere shared, or merely ones that a subset of American adults, groomed and dressed a particular way, shared? Carl Bergstrom and Jevin West, a pair of professors at the University of Washington, in Seattle, who run the blog Calling Bullshit, also took issue with Kosinski and Wang's most ambitious conclusion—that their study provides "strong support" for the prenatal-hormone theory of sexuality, which predicts that exposure to testosterone in the womb shapes a person's gender identity and sexual orientation in later life. In response to Kosinki and Wang's claim that, in their study, "the faces of gay men were more feminine and the faces of lesbians were more masculine," Bergstrom and West wrote, "we see little reason to suppose this is due to physiognomy rather than various aspects of self-presentation."

A piece of data itself has no positive or negative moral value, but the way we manipulate it does.

Historically speaking, the hair-trigger response to the study was understandable. Regardless of the accuracy of the method, past schemes to identify gay people have

typically ended in cruel fashion—pogroms, imprisonment, conversion therapy. The fact is, though, that nowadays a computer model can probably already do a decent job of ascertaining your sexual orientation, even better than facial-recognition technology can, simply by scraping and analyzing the reams of data that marketing firms are continuously compiling about you. Do gay men buy more broccoli than straight men, or do they buy less of it? Do they rent bigger cars or smaller ones? Who knows? Somewhere, though, a bot is poring over your data points, grasping for ways to connect any two of them.

Therein lies the real worry. Last week, Equifax, the giant credit-reporting agency, disclosed that a security breach had exposed the personal data of more than a hundred and forty-three million Americans; company executives had been aware of the security flaw since late July but had failed to disclose it. (Three of them, however, had off-loaded some of their Equifax stock.) The collection and sale of consumer data and buying patterns has become a vast business of which consumers are largely unaware, although they actively contribute to it by clicking on ads, accepting cookies, and agreeing to be tracked. But each new security breach reveals again that the data-collection farms feel little obligation toward us; their customer is the data buyer, not the data source. The latest version of Apple's Safari browser features "Intelligent Tracking Prevention," which makes it harder for advertisers to monitor your online activity; several ad groups wrote the company to complain that the technology would "sabotage the economic model for the internet." Earlier this week, ProPublica revealed that Facebook's ad-buying system had enabled advertisers to target their messages at people with such interests as "How to burn jews" and "History of 'why jews ruin the world.'" The categories were created not by Facebook employees but by an algorithm—yet another way in which automated thinking can turn offensive.

Facial-recognition technology makes it harder for individuals to hide, but privacy is already in short supply. "The growing digitalization of our lives and rapid progress in AI continues to erode the privacy of sexual orientation and other intimate traits," Kosinski and Wang wrote at the end of their paper. They continue, perhaps Pollyannaishly, "The postprivacy world will be a much safer and hospitable place if inhabited by well-educated, tolerant people who are dedicated to equal rights." A piece of data itself has no positive or negative moral value, but the way we manipulate it does. It's hard to imagine a more contentious project than programing ethics into our algorithms; to do otherwise, however, and allow algorithms to monitor themselves, is to invite the quicksand of moral equivalence. It's very nineteenth-century to say so, but our machines still can't do our hard thinking for us; they're improving in their ability to read the emotion in a face, but they're a long way yet from sharing it. A face tells one story or a thousand, all of them human, all still ours to tell.

Print Citations

CMS: Burdick, Alan. "The A.I. 'Gaydar' Study and the Real Dangers of Big Data." In *The Reference Shelf: Artificial Intelligence*, edited by Micah Issitt, 157-160. Ipswich, MA: H.W. Wilson, 2018.

MLA: Burdick, Alan. "The A.I. 'Gaydar' Study and the Real Dangers of Big Data." *The Reference Shelf: Artificial Intelligence*. Ed. Micah Issitt. Ipswich: H.W. Wilson, 2018. 157-160. Print.

APA: Burdick, A. (2018). The A.I. "gaydar" study and the real dangers of big data. In Micah Issitt (Ed.), *The reference shelf: Artificial intelligence* (pp. 157-160). Ipswich, MA: H.W. Wilson. (Original work published 2017)