The New Atlantis
A Journal of Technology & Society

All Activities Monitored

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Around 2006, a holy terror must have seized Iraqi insurgents. It must have seemed that, just as at Homer's Troy, the gods were watching the battle from above and took sides. Seemingly without regard to whatever precautions they might take, insurgents were being slaughtered left and right—not only those directly confronting American troops or government forces, but even the financiers, couriers, bomb builders, and bomb placers. Death might find insurgents in their cars via Hellfire missile or in their homes in the middle of the night. Friends and compatriots were disappearing, snatched up in the desert or arrested at checkpoints. Precautions like using burner phones or in-person messengers no longer seemed to be working nearly as well. Terrorist and insurgent networks were collapsing, and the numbers of successful attacks against Americans were dropping. Why?

Eyes in the Sky
The Secret Rise of Gorgon Stare and How It Will Watch Us All
By Arthur Holland Michel
Houghton Mifflin Harcourt
2019 ~ 336 pp.
$27 (cloth)

Eyes in the Sky tells the story of a top-secret surveillance system that helped turn the tide in Iraq. In his debut book, Arthur Holland Michel investigates Gorgon Stare, an aerial surveillance system that uses drones or airplanes carrying massive cameras to observe areas as large as a major city. Images from the cameras are in turn fed to computer programs that allow analysts to track suspects, and even to rewind to look back over their paths, like watching TiVo. Gorgon Stare was first developed to disrupt attacks in Iraq by IEDs (improvised explosive devices), which had become the main cause of death among U.S.-led coalition forces. But Michel, who is among the most insightful writers today on how the technologies behind America's War on Terror are shaping us, shows how similar systems are now being used by intelligence agencies, police departments, and companies—with dramatic consequences.

Gorgon Stare and several other programs like it allowed American forces in Iraq to continuously surveil cities in their entirety, unblinkingly and without forgetting. After an IED attack, analysts could look back over the video to find the insurgents who had placed the bomb, and then further to find all of

U.S. Air Force photo by Tech. Sgt. Robert Cloys / Wikimedia

An MQ-9 Reaper equipped with Gorgon Stare takes off at Kandahar Airfield, Afghanistan, December 5, 2015.

the places they had visited. Analysts could also cross-reference this data to other intelligence or surveillance, and build up lists of likely insurgent hideaways. Algorithms could trace individual cars or people over time, and even highlight suspicious driving activity for further investigation, like cars that did U-turns or followed other cars. Operators of the system could do this work in real time as well, coordinating with troops on the ground to pass on fresh intelligence or transmit the live images.

The tactical impact was tremendous, both on its own and as part of a new way of doing counterterrorism. Big data analytics, persistent surveillance, and massive increases in computing power enabled more sophisticated ways of "attacking the network" of the enemy by fusing intelligence from all kinds of sources. Social media, cell phone intercepts, captured documents, interrogations, and Gorgon Stare's aerial surveillance could be used to build a nigh-inescapable net—even if every so often, innocents got scooped up as well.

One often hears radical new technologies described as "straight out of science fiction." Michel seems appropriately flabbergasted at the extent to which Gorgon Stare emerged from science fiction in a more literal sense—specifically, from the 1998 Will Smith action thriller *Enemy of the State*, which featured an NSA surveillance satellite tracking

the protagonist's every move. The researcher at Lawrence Livermore National Laboratories who first began working on wide-area mass surveillance was inspired by the movie. And one of the earliest consultants to the federal research team had done the special effects for the film, and eventually left the entertainment industry for the defense sector. *Enemy of the State* was an easy cultural touchstone for selling the idea of mass aerial surveillance in the Pentagon, on Capitol Hill, and later in police departments. It may well be that skeptical clients concerned about privacy, and surveillance without warrant, warmed up to the idea when they learned that the NSA had tried and failed to quash aerial filming of its headquarters for the movie.

This intermingling of art and technology, spectacle and science, speaks to one of the undercurrents in the book. The main theme is straightforward: Wide-area persistent surveillance, combined with machine learning and massive storage, is a novel technology that threatens civil liberties, even while it offers a number of new capabilities for serving the common good.

But another theme runs obliquely through the book: What capacity do we, as individuals or as a society, have to shape—or prevent—a dangerous technological development? Programs like Gorgon Stare were, strikingly, inspired by a movie about government abuse of surveillance power. From the beginning, all involved understood exactly what they were trying to build, its power, and its potential for abuse. As a noted philosopher of science once warned: "Your scientists were so preoccupied with whether or not they could that they didn't stop to think if they should."

While the original idea was to use wide-area surveillance systems for intelligence collection, particularly on weapons of mass destruction, the proposal got little purchase in the halls of power. But when American casualties from IEDs began to mount in Iraq, Congress was willing to throw billions of dollars at any project that promised to reduce the threat, and the first pilot programs were born. While Gorgon Stare (the Air Force's program) was one of the most advanced, there were a number of others (the Army's Constant Hawk, the Marines' Angel Fire, and more) that advanced the same concept: capturing and analyzing a huge geographic area at once. Thanks to Congressional wrangling, eventually the programs shared their technological breakthroughs with each other.

There were immense technical hurdles to be conquered. To be able to pick out a single vehicle, much less a person, in an image of a whole city would require camera resolutions of tens of millions, and eventually billions, of pixels. Even at speeds

of only two image frames per second, the resulting files were so large that they required blazing-fast networks to transmit. At first, the files were hand-couriered on hard drives to the United States for closer analysis. But the amount of data collected far outstripped the capacity of even large analyst teams to fully mine. In order to get the most out of it, new image classification techniques and tracking algorithms had to be invented and refined. In the end, what made it all work were rapidly developing civilian technologies: tiny, high-resolution cameras for cell phones, graphics processing chips for video games, and cloud computing and networking infrastructure designed for Silicon Valley behemoths.

While Michel's contribution is to shed light on the origins and nature of an important but little-understood technology, his main concern is with how it is, and might be, used. The second half of the book explores the harnessing of data-analysis technologies to adapt wide-area surveillance to new purposes. Like so many other technologies created for war, this type of surveillance has come home, and early adopters have found many inventive uses. Security companies have used it to protect events like NASCAR races—in one case, the surveillance system allowed a security team to quickly track back a hostile fan to his trailer to eject him from the event. The Forest Service deploys wide-area surveillance to monitor potential forest fire zones. And of course, a number of law enforcement agencies, ranging from the FBI and the Department of Homeland Security to local police departments, have experimented successfully, if controversially, with using the technology to fight crime.

Ross McNutt, the early designer of the Marine's Angel Fire program, started a private company to adapt the technology after he retired from the military. Persistent Surveillance Systems was first used in 2009 to monitor a drug war in Ciudad Juárez in northern Mexico. Beginning in early 2016, McNutt's cameras were flying above crime-ridden Baltimore, with knowledge only of the police department—even the city government at first didn't know about it. Michel writes:

> As McNutt and I conversed, a staffer walked into the conference room and hovered at the door. McNutt turned to him. "Yes, sir?"
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> "It's a homicide," the man replied.
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> "I should go deal with that," McNutt said, leaving me alone in front of his godlike view of Baltimore. When he returned, he appeared unfazed by whatever had taken place in the adjoining room.

Michel, like almost everyone he talks to about wide-area surveillance, is filled with a mixture of awe and apprehension. Even to jaded denizens of the twenty-first century,

a live aerial view of happenings on Earth, complete with a rewind button, feels indeed like science fiction. The advent of this technology, combined with artificial intelligence and vast data banks, makes almost nonsensical the ideas of privacy and probable cause of an earlier age. Historically, anything viewable from the sky was considered public, and members of law enforcement could act on what they saw. Wide-area surveillance makes it possible to observe all of a place all of the time, with perfect recall, aided by algorithms that can search out any behavior. The police need a warrant to put a GPS tracker on a car, but they can follow the same car indefinitely from above without one. And, of course, the airways are public to anyone who can file a flight plan.

Michel suggests that insurance companies will be, and in some cases already are, eager to use these systems to examine disaster areas and detect fraud, as aerial images can help them to compare claims against visible damage. While Michel's sources were remarkably informative about Gorgon Stare and similar military programs, those now working in private industry refused to say much about any work with insurance companies. Other uses are still in the planning phase: Retail stores might want to track traffic around them to know where their customers come from and where they go; major utility companies might want to observe construction activities along underground pipelines. A single surveillance company could serve a host of clients all at once, and it likely won't be long before such companies emerge, selling wide-area data to loan collection agencies, hedge funds, and anyone else who can pay.

At the dawn of the nuclear age, the engineers responsible for bringing atomic weapons into the world reached for the mythological language of creation and destruction. J. Robert Oppenheimer named the first bomb Trinity, after the metaphysical poetry of John Donne, and quoted the Bhagavad Gita. Now at the beginning of the age of pervasive digital surveillance and remote warfare, the engineers have turned instead to the more humanistic landscapes of Greek and Norse mythology. They speak of a "god's-eye view" and name their programs after Gorgons, creatures whose gaze turned any mortal who met it to stone; Perseus, slayer of the Gorgon Medusa (Persistent Stare Exploitation and Analysis System); Argus, the hundred-eyed giant (Autonomous Real-Time Ground Ubiquitous Surveillance); and Odin, the god of knowledge and war (Observe, Detect, Identify, Neutralize).

The gods of our ancient forebears often took the form of hawks and eagles, peered down from the clouds above, and threw the occasional lightning bolt to strike down those who

displeased them. However remarkable the innovation, something seems almost natural and expected about these projects. Instead of the transcendent power of the unleashed nucleus, our age is one of superhuman powers tied to all-too-human motives.

Michel's story thus displays the ethical problem of technological development in high relief. A small group of engineers came together to build a powerful weapon to meet the needs of war. In so doing, they have shifted, for everyone, the balance of power between citizen and state, between individual and corporation, and have eroded to the point of extinction what little remained of the natural rights of privacy, all around the world.

For the masses, the feeling that technology develops along an inevitable path reflects their lack of agency—the fact that the crucial decisions about the technological conditions of society will be made by a largely self-regulating confraternity of elites. For engineers and scientists, technological development appears to be driven by a combination of what they can imagine, what is technically feasible, and what governments or markets demand. Even those whose particular genius produces the breakthroughs feel this as an inevitability, as if they are possessed by some inner logic that is the real force ushering in this new world.

Samuel Morse was perhaps speaking for all builders of world-changing inventions when he asked, in the first long-distance telegraph message, "What hath God wrought?" We might ask the same.

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