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2 DEMOCRATIZING SURVEILLANCE: DRONES, SATELLITES, AND BALLOONS FOR THE PUBLIC GOOD

I wrote much of this book from my office in San Diego, an hour's drive from the birthplace of America's military drone industry. The birthplace is a garage—standard-issue R&D space for California innovators. The garage belonged to Abraham Karem. Born in Baghdad in 1937 to Jewish parents, Karem immigrated to Israel in 1951, where he worked as a prolific engineer. He built his first drone during the 1973 Yom Kippur War, at a point when Israeli engineers were moving from ideas to field tests in six months—an unheard-of rate of innovation. He brought this experience to the United States in 1977, and in 1984 he exited the lab with a surveillance drone, code-named Amber.

Karem's wasn't the first drone in the United States, but it was the first one to actually work. Each of his devices cost $350,000, which was about the amount needed to run the Army's crash-prone Aquila drone for a single hour.[1] Nevertheless, the project hit a wall of federal bureaucracy, the company was sold to San Diego-based General Atomic, and the Amber was mothballed. Karem persisted, developing for General Atomics a less-sophisticated version for export. He called it the Gnat 750, but

no customers stepped forward. By the late 1980s, there was every indication that Karem's work would come to naught. The Amber was killed off in a round of post-Cold War budget cuts. The Gnat 750 met the same fate.

When I met with Karem in his office, he told me what happened next: "It was during the Siege of Sarajevo. President Clinton was frustrated that so little was known about what the Serbs were doing on the ground," including possible violations of the Geneva Conventions. American intelligence agencies turned to satellites in an attempt to document Serb war crimes. While satellite data proved important for military operations, they were blind at night.[2] Breaking the siege required better data about Serb activities, yet persistent cloud cover blocked satellite photos. Complicating matters further, Serbs knew when satellites passed overhead and used this knowledge to evade detection. Surveillance planes like the U2 were vulnerable to being shot down, and they couldn't see through the clouds anyway. To make matters worse, Serb troops strategically dug mass graves at night, thereby eluding satellite surveillance. But CIA Director James Woolsey had heard about the Gnat. He had the unmanned aerial vehicles (UAVs) dusted off from storage in the Mojave, fitted with high-magnification and night-vision cameras, and sent them to the Balkans. By early 1994, two of the awkward-looking devices were being flown out of a clandestine base in Albania.

They weren't perfect. Signal noise from power lines distorted the feed, and control was difficult over great distances. Nevertheless, the Gnat impressed everyone on the project. The impact, Karem reflected, was two-fold: "It proved the value of the technology, and I believe the Bosnian conflict ended four to six times faster because the Gnat was deployed." What's more, Karem pointed

out, "the Gnat didn't have missiles! Instead, it had sensors hovering over these [Serb] guys." This proof of concept appears to have been enough for the US military. The platform was refined, armed, and renamed the Predator. Its emergence would profoundly change the nature of armed conflict. Perhaps Paul Virilio was right to argue "history progresses at the speed of its weapon systems."[3]

Talk to Karem for long enough, and it becomes clear that his worldview has been shaped by the Second World War, and the Holocaust in particular. "Look," he told me as we sat in his conference room, the door open to a clear view of the Gnat on display in the hallway: "As a Jew, I'm supposed to be dead, but I'm not because of military intervention by the United States." Karem is oft quoted as stating that he was never the one who armed the drone,[4] something he is at pains to put into context, emphasizing the importance to the United States of both crucial intelligence and credible deterrence.

Nevertheless, in this origin story we can outline an alternate history of the Predator, a device that made its first appearance as a Gnat in what we might now consider to be a humanitarian or "responsibility to protect" role. Critics will find much to carp at in this analogy, but this historical detail suggests a different path the technology might have taken had it continued to be used as a tool to document human rights violations and large-scale crimes against humanity, rather than as a weapon to assassinate "enemy combatants" in a "war on terror." This approach is at odds with a significant literature on the perils of weaponized drones, which overemphasizes the devices' kinetic capacity while perhaps underemphasizing the ethics they create and sustain.[5]

Such an alternate history also highlights the seldom-acknowledged role of satellites in human rights and advocacy

work. The Amber was used to complement American intelligence efforts to monitor a rights-violating state. Both technologies hold promise and peril. Here, too, the Gnat/Predator's history is illustrative. In our conversation, Karem made a point of observing that he never armed the device, and even Navy Captain Allan Rutherford cringed upon hearing the newly modified device had been named Predator, since it was "just a surveillance and reconnaissance drone, an eye in the sky. *Predator*, on the other hand, sounded like a weapon. Nobody had suggested arming the new drone."[6]

Once weaponized, Karem's invention was catapulted forward by a decade and a half of battlefield deployment, starting with the United States' invasion and occupation of Afghanistan in 2001, then Iraq in 2003. A desire for victory without sacrifice led subsequent administrations to deploy drones at ever-increasing rates. Reports of drone strikes, both successful and otherwise, dominated media coverage of the wars. Writing in *The Guardian,* North Waziristan resident Rafiq ur Rehman describes his experience of this decision:

> Nobody has ever told me why my mother was targeted that day. The media reported that the attack was on a car, but there is no road alongside my mother's house. Several reported the attack was on a house. But the missiles hit a nearby field, not a house. All reported that five militants were killed. Only one person was killed—a 67-year-old grandmother of nine.[7]

Coverage of this sort has suppressed enthusiasm for drone strikes within the general public and has given rise to a movement against "killer drones" among organizations like the Open Society Foundation, Human Rights Watch, and Amnesty International.

Their argument is simple: subject the United States' drone program to the same levels of scrutiny applied to other war-making efforts. Doing so would require taking drones out of the unaccountable hands of the CIA and placing the program into the military's ecosystem, thereby extending existing rules of engagement to this new technology and increasing accountability in cases of misuse. Activists organized die-ins, organizations launched petitions, and artists engaged the topic in installations meant to challenge the West's assessment of events half a world away.

A two-hour drive down Interstate 5 South from Karem's shop will take you to the southwestern-most edge of the United States. Here you will find the city of Chula Vista, which is home to a startup called ActionDrone. The founder was happy to show me around the space, packed with prototypes and custom models mid-production. Devices built by manufacturers like ActionDrone are upending this earlier conceptualization of drones as dedicated killers. Drones may be engaged in "precision" assassinations around the world, but their smaller cousins rely on similar communication and control systems to perform more benign activities. ActionDrone is using a proprietary platform to inspect wind farms for industrial giant Siemens, and has their eye on railroad inspection as well.

It has taken time for this technology to migrate, as the Internet did two decades earlier, from the military lab to the private sector. It took a decade for stable control systems to make their way into consumer-grade technology and to begin showing up on the streets (or sky). Affordable global positioning systems (GPSs) and stabilizers, sophisticated flight-control algorithms, and longer batteries made the jump from other industries at about the same time. The result of this fevered round of innovation can be seen

in the rapid sales of small devices available from manufacturers like Chinese DJI, American 3DR, and French Parrot, as well as industrial applications from companies like ActionDrone. At the University of San Diego, a collaboration with engineering colleagues Gordon Hoople and Beth Reddy (now at the Colorado School of Mines) generated classes that bring engineering and peace studies students into the same classroom in order to debate the use of drones, and then build them in heterogeneous teams focused on uses that make the world a better place.[8]

We now build and fly piles of these things with an eye toward the public good.

What are all these devices—drones especially—doing? The clear answer from the human rights world is that they threatening civil liberties, violating privacy, and disrupting terrestrial and traditionally sovereign approaches to security. There seem to be no end of foreboding books, a trend that only accelerated after the 2016 elections in the United States. Yet I hope to write here about a quite different range of uses, and am unabashedly rooting for new tools that have a clear benefit to the public. While this particular round of innovation is extremely dynamic, it is obvious that drones are being used to support human rights, humanitarian efforts, and advocacy uses worldwide. This book is not about where Karem's invention ended up—as a beta test for killer robots—but about how it began: as a Gnat supporting humanitarian intervention. Perhaps a fresh genealogy of the drone can trace a new line from Karem's animating vision to the humanitarian efforts of the future. Indeed, as I write this, General Atomics has announced that its Predator C will be available for humanitarian payloads. Drones, satellites, balloons, and kites are tools in use, and at various times, and for various

reasons, have formed particular repertoires. This chapter, and those that follow, trace the opportunities and implications of incorporating these tools into the repertoires of those trying to make the world a better place.

GEOSPATIAL AFFORDANCES

While this book focuses on small drones, the origin of the Predator holds several important lessons. First, it suggests an alternate history of the drone, not as a killer robot, but as a supporting actor in an effort to end ethnic cleansing. The second point is that Karem's early devices were deployed to complement, rather than replace, satellite imagery and a host of terrestrial tools and technologies. ActionDrone, like all other contemporary drone manufacturers, relies on global positioning imagery to increase the stability of their platforms and ensure ease of flight. These system effects are indicative of the ways drones rely on earlier innovations, including the explosive growth of mobile phones, as well as innovation in control solutions from other sectors.

The previous chapter suggested that technology should be thought of as *tools in use* and that affordances are the *possibilities that things offer for action.* In this chapter, I will suggest that an important new range of tools are being put to use in the air, and that these tools cluster into stable patterns of use that we can think of as *geospatial affordances.*

By geospatial affordance, I simply mean those possibilities that *mobile* things offer for action *from the air.*[9] A focus on mobility rules out technology like the closed-circuit television, while a focus on the aerial rules out terrestrial, subterrestrial, submarine, and subcutaneous robots. Of all possible geospatial

affordances, I consider but a handful: drones are discussed rather extensively, while satellites, balloons, and kites are discussed in far less detail. Ignored altogether are expensive technologies that already have pride of place in the scholarly and popular imagination: helicopters and airplanes.[10]

Each of the four technologies I reference here—drones, satellites, kites, and balloons—open new spaces for political contestation. This fact should be of some interest to anyone focused on the impact communication technologies have on the emergence and spread of new ideas. My use of the term geospatial affordance draws extensively on the work of Steven Livingston, who has suggested the term applies to the flexible deployment of "spatial and pan-optical awareness and virtual presence."[11] Livingston's work on the use of satellites by human rights advocates leads him to note they make visible "denied access areas using tools that provide verification of eyewitness testimony when available; information even when eyewitness and survivor testimony is unavailable by other means, and types of data that are unavailable to other nontechnical means."[12] He is right, and satellites are not alone in this space.

Geospatial affordances lower the cost of acquiring crucial information about things happening beyond unassisted human sight. Satellites, for example, gather spatial, spectral, and temporal data about the earth.[13] Spatial resolution, most easily thought of as the amount of detail in an image, has grown more powerful as imaging technology increases in sophistication. Yet the quality of the image might not be the most important factor at play in social change efforts. If an environmental advocacy group is focused on rates of deforestation, then spectral resolution might be most important. Spectral resolution refers to the kind of light the satellite's sensors pick up (e.g., ultraviolet, thermal, visible

light). Temporal data indicates the frequency with which images are made of a particular area. In quickly unfolding human rights events, having frequent updates in low-resolution might be more important than waiting longer for higher-resolution images. Livingston's work also emphasizes the importance of "temporal reach-back capabilities" of imagery with high temporal resolution. Having extensive imagery of a single place increases our ability to track changes over time. While these factors are most frequently associated with satellite-based earth-observation practices, they apply to balloons and drones as well.

Geospatial affordances increase the data that can be gathered about the earth, but they also increase the tools change-oriented actors have available for action. Livingston has argued that new geospatial, forensic, and networking affordances democratize the process of interpreting what all this data means. Students of social movements call this process *framing*, as advocates set out to define issues, tell causal stories about those issues, and mobilize public sentiment around particular sets of solutions.[14] Geospatial affordances help tell old stories from new perspectives, while also allowing for the emergence of new stories altogether, as temporal data helps advocates to see previously undetectable environmental changes, for example, or when increased spatial resolution brings previously invisible issues into focus for the first time. Lower-cost devices also democratize the process of gathering data that had once been the purview of university and government laboratories. David Hess and his colleagues have documented the challenges involved in having issues of public concern categorized as worthy of official attention—exploring lay efforts to gather data about empirically accessible issues that are overlooked by those with resources and prestige. Citizen science efforts put key resources into the hands of community

members themselves, allowing them to challenge dominant narratives of environmental health.[15]

Thinking in terms of geospatial affordances also highlights the importance of spatiality to politics. Drones, for example, are able to maneuver with more freedom than previous technologies. Geospatial affordances reshape the view from the top down, but also produce a kind of *surround sight*.[16] While geospatial affordances can be explored using existing conceptual tools—research and development, the role of regulators, diffusion of technology, reception by publics, embeddedness in sociotechnical systems, and so forth—they also open spaces for and raise new questions about contestation, meaning making, and resistance. In particular, these tools require fresh theorizing of the verticalization and colonization of the ground, the sky, and the subterranean, something discussed at greater length at this chapter's end. New questions about what space is public and which is private will take time for regulators and societies to sort out. New policies and new norms are needed, but will take time to emerge.

But enough with the *geospatial affordance* jargon. What, exactly, are we talking about?

KITES

"Cling, cling, like the lizard, to the ceiling.
Stick, stick close to the side of heaven."

—MAORI KITE-SONG[17]

Let us focus first on the thing that makes me the happiest. Kites. I will tell two histories of the kite. The first is personal. On our first anniversary, my wife and I purchased a kite, agreeing that

whenever a disagreement got so strong that it seemed unresolvable, we would go out to fly a kite. Nothing, we decided, would be as soothing as standing there, a string in our hands, staring into the heavens. We've needed it fewer times than we anticipated, and now fly it with our children. Every one of the steps is lovely—the running to catch the wind; the unraveling and unspooling; the sitting, standing, and staring; the handing to a neighbor, friend, or stranger so they can have a go; and then the re-ravelling and re-spooling and coiling as it is drawn back to earth for the folding and packing for storage.

The whole thing is a ritual, a blessing, a sacrament.

I would like to think this has always been the way of it.

Kites are, without a doubt, the oldest of the four technologies considered here.[18] While satellites date back to the 1950s, crewed flight to the turn of the last century, and balloons to the late eighteenth century, the kite's timeline is on a different order of magnitude.

The kite's history disappears into mist, the trail lost in the clouds of Chinese history some two millennia back. Was it perhaps a farmer whose hat was clipped to his shirt, and who noticed it caught in a gale, suspended over his head—aloft and dancing?[19] Or was it the philosophers Mozi and Lu Ban, following after Confucius in the Warring States Period (475–221 BCE), who designed and flew the first kites for some reason that has been lost to history?

The story I like least, but is perhaps the most plausible, involves a siege. During the Han Dynasty (206 BCE–220 CE), General Han Hsin made clever use of a kite to fly over an enemy's battlements, and thereby estimated the distance needed to tunnel under the walls to which his army was laying siege. The

estimate was secured, the tunnel was dug, the defending warriors were surprised, and the city was sacked. Perhaps leaning too heavily on magical realism, an alternate version of this story suggests that, in fact, Han was quite small of stature, and it was he himself who was lofted by the kite so that he could espy the enemy's position with his own eyes. The defending forces took him for an apparition, and he obliged, telling them that they should return home or face certain and terrible death. The soldiers fled. In both stories the city was sacked, and its fall marks the beginning of the Western Han Dynasty. This is the second history of the kite.

From China, kite technology diffused along the local trading routes of the day, and during the Han Dynasty probably reached India, Japan, and Korea. Legend has it that kites were used as a brilliant military tactic and effective piece of propaganda during the Silla Dynasty (595–673 CE). The general Gim Yu-sin was charged with putting down a revolt but was unable to mobilize his troops, who, believing a large shooting star to be a bad omen, refused to fight. Gin Yu-sin set out to undo the apparent curse by reversing the arc of the falling star. He used a kite to loft a ball of fire into the air, restoring the star to its firmament and reassuring the men that their efforts to rout the rebels were on spiritually firm footing. The campaign was a success.[20]

Where I suggest an alternate history of the drone emerges from my conversation with Abe Karem, the history of the kite—from trade routes to routing rebels—leaves room to again imagine a number of origin stories. Whatever the case, each of these stories disappears into the mist of love, art, and war.

The kite's path forward is a bit clearer, as the innovation spread from China to its neighbors, and soon well beyond, over trade routes like those developed by Marco Polo, who may have

first introduced the device to European society upon his return in 1293.[21] From this eclectic and rumored range of uses a handful of stable applications emerged in military, science, and cultural spaces.

Science—Leonardo da Vinci, who history helpfully reminds us did everything before anyone else, designed a kite-based system for spanning a valley. To the relief of subsequent generations, he didn't get around to building all of the stuff he designed. That task fell, it seems in part, to Charles Ellet, Jr, who in 1848 deployed a kite-based technique for spanning Niagara Falls so that the first suspension bridge could arc the 240-meter-wide gorge.[22]

Ellet wasn't alone, as the eighteenth and nineteenth centuries were a heyday for scientific exploration, and kites were no exception. Inventors lofted science instruments, tested wing designs (biplanes are just motorized box kites), and, perhaps most famously—at least in the United States—were used by the American inventor Benjamin Franklin and French inventor Jacques de Romasto to prove that lightning is made of electricity.[23]

Plaudits for the first scientific use of a kite go to Alexander Wilson, who in 1749—four years before Franklin—used a kite with stacked wings to simultaneously measure temperature at multiple altitudes.[24] For the next century and a half kites served in many roles, continuing to hoist meteorological instruments, inspire or prototype airplane designs (Alexander Graham Bell and the Wright brothers both appear to have tested kites capable of lifting humans), and suspending communication antennas for transmitting multiple frequencies.

But the story I like best is that of the Nobel Prize–winning pioneer of long-distance radio transmission, Guglielmo Marconi,

who in 1901 lofted a 500-foot antenna into the air. The goal on a chilly December 12th was to catch a signal sent from a transmission station in Cornwall, on England's West Coast. The antenna was suspended from a Levitor kite flying high over the small town of St. John's in Newfoundland.[25] St. John's was doubtless chosen for its convenient location, and Marconi's team was not the first to notice the location's merit. The team's successful trans-Atlantic wireless transmission took place near the same spot that the first transatlantic submarine telegraph cable made landfall in 1888, and adjacent to the place John Cabot's expedition first made landfall more than four centuries earlier.[26] St. John's then, is an unlikely but important node in the curious stitching of the circuits of capital and empire. The Levitor kite—to return to the focal point in this small story, as Marconi has already made his own mark on history and I leave St. John's to a more able scholar—was the brainchild of B. F. S. Baden-Powell, whose patent for a "man-lifting" kite was granted by the British patents office in 1895.

Scholars of the history of science suggest it was the intersection of the telegraph and qualitative meteorology that produced the idea that climate might be predictable on a global scale.[27] This realization, and a series of international conferences on meteorology starting in 1853, highlighted the need for sensors that could remain stable at particular altitudes. Both the balloon and the kite fit the bill, though the latter was more affordable.

Kites and balloons were considered, more generally, to be platforms for a number of payloads. The American journalist William Eddy used kite trains (stacked kites originally used by meteorologists) to loft cameras to altitudes of 1,200–1,800 meters.[28] Since kites are essentially wings, they were also used

by aviation enthusiasts to test a range of theories related to aerodynamics, though by the 1930s the airplane did most of these tasks more easily. The history of the kite is a tangle of entrepreneurs working across platforms and for any number of motives. Desire for flight is a dream with many manifestations.[29]

Military—The Cody War-Kite, named after the Wild West Showman Samuel Franklin Cody, was patented in 1901 as a "man-lifting kite" intended to, well, lift a person into the air, thereby giving the military an on-demand vantage point for surveying the enemy.[30] Here, too, I would like to stage a minor intervention: the use of the word "man" in the term "man-lifting" is wrong on two fronts. The first is grammatical and familiar to most readers: the use of the pronoun "man" for "persons" is silly and sexist. But the term is wrong-footed as well as wrong-headed: the first person to be carried aloft by a kite was a woman. Her name, too predictably, seems lost to history, but of the 1827 encounter George Pocock, the inventor of the apparatus, wrote: "We must not omit to observe, that the first person who soared aloft in the air, by this invention, was a lady, whose courage would not be denied the test of its strength."[31]

A spate of experimentation in the late nineteenth and early twentieth centuries was undertaken by the French, Italians, Russians, British, and Americans.[32] These platforms were used to surveil enemy positions, drop bombs, and serve as barrage kites. Legend has it that in Cody's Wild West Showman days, his cook, originally from China, introduced him to the technology. While we have no way of verifying this origin story, Cody indeed went on to develop the device for the British War Office in 1901, used it in the Second Boer War, flew it to an altitude of 2,000 feet over London, and traversed the English Chanel in

a collapsible lifeboat pulled by kite. He also experimented with balloons and airships before moving on to the airplane.

There are more stories to be told, but the short career of S. F. Cody (spanning the turn of the century to his untimely death in 1913) neatly captures the rapidity with which kites and balloons were tested, only to be discarded once airplane technology was sufficiently developed. Kites have been of little note in military use ever since, with the very recent exception of their use to firebomb Israel from launch positions in the Gaza Strip.[33] The Israeli Defense Forces responded by guiding a wave of small drones into the kites' strings, ensnaring them in an attempt to bring them to earth.[34]

Propaganda, like all political communication perhaps, lies in the space between military maneuvers, society, and politics. The first recorded use of kites for propagandistic purposes was in thirteenth century China, when a besieged city used kites to distribute pamphlets that incited their imprisoned comrades to escape.[35] During the American Civil War, the same technique was used by Union forces, who fitted kites with pamphlets announcing Lincoln's Amnesty Proclamation to the rebel forces.[36]

Politics and society—Few scholars have explored the kite's social and political implications. My hunch is that there is something of import in the string linking earth and sky, and something significant about individuals performing this act together. I want to say that the kite creates publics, as with the kite fighting—made famous by the novel *The Kite Runner*—that has a long history in Afghanistan and Pakistan.

Events like kite fighting create opportunities for civic engagement, even in the form of friendly competition.[37] In this way, an overarching public sphere is created from scratch. Indi-

viduals collectively and intentionally occupy space in the air, on the land, and conceptually as a public. Everyone is doing something altogether, and something altogether has a public and shared meaning: these shared meanings and collective actions take place when everyone deploys creative objects that occupy *and even create* public space. This possibility should give us pause, and it suggests the public-creating effect of kite fighting deserves additional attention from scholars of politics. Why else, we should ask ourselves, would the Taliban prohibit kite fighting in Afghanistan, as the Germans did in France and the British did over England during the Second World War?[38]

I have no desire to carve out new political space for the kite. In fact, I would prefer it remained in the world of art and leisure, discarded by those seeking wealth and power and instead taken into the hands of children and sky-gazers. The Chinese, after all, believed kite flying was good for your health, and that the simple act of releasing the string would turn one's fortune and settle the mind. In Polynesia, some scholars suggest, the kite may have functioned symbolically as a life token, or *liberated external soul*. This is conceptual play, but even here, in perhaps the toughest test case of our four, we encounter the ways in which objects in new space can, for reasons unintelligible in other contexts and perhaps impossible to replicate in other times, threaten the status quo and the powerful.

Artifacts have politics, even the humble-glorious kite.

Kites may have started with warfare and spread through the early but extensive global circuits of private capital, but they have now ended up in the public's hands. Of the four technologies discussed in this chapter, the kite owes the least to Western science, and has turned out to have few features useful for either

warfare or commerce. It is simultaneously the oldest, most widely distributed, and most affordable of the four technologies discussed in this chapter.

BALLOONS

Where kite are ancient, balloons are relatively young.[39] Starting in the late eighteenth century, French inventors began consistently experimenting with lighter-than-air flight, and this early lead paid off in a number of breakthroughs.[40] The years 1782–1783 proved to be particularly fruitful, as brothers Joseph-Michel and Jacques-Étienne Montgolfier developed and tested a load-bearing balloon to such an extent that they were prepared, within a few months of experimentation, to host an exhibition flight. Less than a year later, they launched the world's first passenger flight, comprised of a sheep, a duck, and a rooster.

The first human animals to go up in the brothers' device was Jacques-Étienne, and the second was Jean-François Pilâtre de Rozier, who went up later that same October day in 1783. These first flights were tethered and brief. Within a month, de Rozier, joined by a colleague, conducted the world's first free flight by humans—ascending to 500 feet and, in the course of their 20-minute flight, traveling about five and a half miles. Within months of this voyage, the first crewed hydrogen balloon flight took place from the Jardin des Tuileries in Paris. By 1785, the first successful balloon flight across the English Channel was completed by Jean-Pierre Blanchard and John Jeffries, French and American balloonists, respectively. By the 1790s, Americans had begun experimenting with the technology as well. The French philosopher Paul Virilio mused that inside each inven-

tion is its accident.[41] This was no more true than in the case of Pilâtre de Rozier. Often considered to be the first person to fly in a balloon, he also appears to be the first to be killed in a balloon. Two short years after his first record-breaking flight, he perished along with his co-pilot, the Marquis d'Arlandes, in an unsuccessful attempt to cross the English Channel.

Originally built and flown by individual inventors for the purpose of adventure and entertainment, balloons were soon adopted by military and scientific communities. The nineteenth century saw ballooning evolve from an area of experimentation by individual inventors to an industry of interest to the nation-state. Their use as observation decks and later as payload-delivery systems (i.e., bombers) proved to be short-lived, as they were difficult to control but easy to spot and shoot down. By the late nineteenth century, two distinct areas of inquiry emerged: the use of lighter-than-air devices to travel and deliver payloads (alternately called airships, zeppelins, or dirigibles) and other balloons (used for entertainment, solo travel, or observation).

Airships emerged in the 1860s as hobbyists, inventors, and entrepreneurs experimented with hydrogen and silk. Military uses were pursued between the Civil War (where they were used to observe the enemy and direct artillery fire) and the First World War, at which point they were written off as a wartime platform. Airship manufacturers turned their attention to peacetime use and developed the dirigible as a form of transportation. The Empire State Building, for example, was constructed with a tall mast for docking transport dirigibles. The British built masts in England, Egypt, Afghanistan, and Canada in anticipation of an empire-wide mail system connected by airships.[42] This plan built off Germany's successful deployment of airships

in international transportation. Through the 1930s, hundreds of dirigible flights were conducted between Germany and the United States and between Germany and Brazil. The 1937 *Hindenburg* crash that brought the era to an end occurred within a day of its sister ship's landing in Rio De Janeiro.

Both the *Hindenburg* and the *Graff* were part of a larger aerial effort by the Nazi Reich. In 1936, they were used to drop political fliers from the air and to play patriotic music, political slogans, and political speeches through loudspeakers. The crash of the *Hindenburg* brought this to an end once and almost for all. A brief exception to this airship winter bears noting, and it occurred when the United States launched, in the 1950s and 1960s, high-altitude reconnaissance balloons with the intention of overflying the Soviet Union and China.[43] These flights came to an end when it became clear that satellites and faster aircraft could do the job more reliably. Thus discarded by military elites, the creation, care, and preservation of balloons reverted back to the inventors, adventurers, and scientists who created them in the first place.

Today a handful of these platforms are in operation, with some being used for advertising products and filming events (e.g., the Goodyear blimp), while others are tested by the military-industrial complex in the hope that the technology can finally be refined for transporting heavy payloads over long distances to inhospitable areas. Heavy-lift balloons—imagine sending drilling equipment to the North Pole or tanks to Kandahar—are plagued by the same kind of control challenges that bedeviled their predecessors a century earlier.

For almost a decade, Greenpeace has owned and operated an airship, the A. E. Bates, which they use in much the same way as the Goodyear blimp. In a 2014 campaign to highlight

the prevalence and power of the US National Security Agency's (NSA) domestic spying activities, Greenpeace and the Electronic Frontier Foundation flew the A. E. Bates over a large NSA data center in Utah. Greenpeace owns the piloted airship, and previously owned a hot air balloon. These have proven to be high-profile messaging platforms and have helped draw attention to other social, environmental, and political issues, including a Southern California retreat organized by the conservative Koch brothers. However, these appear to be the only contemporary uses for balloons for advocacy purposes.

The dream of long-haul and heavy-load transportation via airship continues to elude investors, and current use is limited to novelty flights. Much the same can be said for a series of solo-ballooning initiatives, as with current efforts to break records related to altitude and duration. Balloons for scientific study have a parallel but less dramatic history. In a pre-satellite era, they presented the most affordable platform for high-altitude tests. The 1886 development of a weather balloon by French meteorologist Léon Teisserenc de Bort represented one of the earliest such efforts, and eventually led to the discovery of the tropopause and stratosphere, the existence of which were unknown to scientists of the day.

While balloons are not in widespread and consistent use by any set of actors this study has been able to identify, they have captured the attention of activists, sometimes to great effect. When the Deepwater Horizon oil rig ruptured, BP attempted to restrict access to the affected area,[44] perhaps hoping to prevent images of the 200 million gallons of crude oil disgorged into the Gulf of Mexico. This embargo prevented the press from capturing images from the air.[45]

Jeffrey Warren, an MIT grad student at the time, used grassroots mapping techniques to help fisherfolk and other community members document the spill's impact. Their imagery demonstrated the spill's scope in ways the embargoed press couldn't. Their footage was made using readily available balloon technology and homemade platforms for their cameras. Warren's effort applied lessons he had learned using balloons to support landless laborers' claims to land in South America.[46] He later pointed out that "there was no publicly available, orthorectified imagery available in the initial weeks of the spill," as the public had to make do with lower-resolution imagery from NASA's Terra and Aqua satellites.[47] These grassroots mapping efforts were subsequently funded by the Knight Foundation and eventually became the non-profit advocacy group Public Lab.[48]

As mentioned previously, Public Lab now sells a wide range of do-it-yourself science kits for activists doing what the sociologist David Hess has coined as *undone science*: the rigorous inquiry into problems that have been written out of official scientific discourse and inquiry.[49] For the DIY user, Public Lab sells a modified version of Warren's setup. Balloons and kites share a notable feature—accountability. Want to know who is overflying your home or community? Simply follow the string down to find the terrestrially bound person holding it in their hands, and you have your answer.

Here it bears mentioning that the earliest ballooning efforts, going all the way back to the Montgolfier brothers, were undertaken not by industrialists or governments, but by individual inventors eager to see what could be done. In the American Civil War, the Union Army deployed them reluctantly, and indeed they proved to be an unwieldy observation platform.[50] In the

First World War, the French, Italians, and Germans deployed airships with some enthusiasm. However, it became clear that, once in the air, they were vulnerable as aircraft and unreliable as missile-delivery systems.[51] For all intents and purposes, these debacles ended most governments' interest in balloons as a reliable and scalable weapon in modern warfare.[52] This detour was dark, but relatively short-lived. In the 235 years since the Montgolfier brothers set to work, only 60 were spent in ambitious exploration of their military applications.[53] Balloons might not be widely used, indeed there are few cases in this volume, but I do want to be attentive to technologies that are increasingly available to and used by those traditionally left out of earth-observation efforts. It may be that the future of ballooning lies in the hands of large institutional actors like Google, who have experimented with solar-powered and Internet-equipped balloons as Internet service platforms. It is just as likely, however, that the future lies with community-mapping efforts like those championed by Jeffrey Warren and Public Lab.

SATELLITES

From the Soviet Union's launch of Sputnik in 1957 to the present day, the ability to put sensors into orbit has driven space programs in rich and aspirational countries alike.[54] Satellites created the "intellectual space of globalization"[55] and initiated a televisual era that continues into the present, argues media scholar Lisa Parks.[56] Payloads have gotten larger, sensors have gotten more sophisticated, the number of relevant actors has ballooned, and the orbital space available to satellites has grown more crowded. The decades since that first launch have also seen radical changes

in the availability of satellite imagery. While satellite technology has a history of its own, the accessibility and usability of this imagery (also called remote-sensing data) can be thought of in three broad phases.[57]

The first is an era of specialist technicians. At its inception, images produced by the United States' remote-sensing efforts were primarily accessible to those in the specialized field of earth observation. This trend continued with the launch of LANDSat I in 1972, which made more imagery available, but only to those with the means to gain access and the ability to render raw imagery into photographs amenable to scientific analysis.

The second era began in 1994 with the passage of the Open Skies Act by the Clinton Administration. The act made a wealth of data freely available to anyone who wanted it. This availability was a breakthrough in accessibility, and it accelerated interest in the use of satellite imagery to analyze deforestation and other environmental concerns. The 1980s and 1990s also saw the launch of new platforms by the European Space Agency and later national efforts by China, India, Japan, and Brazil. These new platforms boasted larger and higher-quality sensors for scanning the earth's surface for visible and invisible light. Starting around 2000, commercial satellite operators began building and deploying their own platforms, reducing reliance on systems owned and controlled by various nation-states.

The third era began in 2005 with the launch of Google Earth. The prior proliferation of platforms meant a wealth of data was available, but its flow to the public has been limited. One factor was price—most simply could not afford to buy imagery from large commercial enterprises. A second factor was the legibility of the images—in many cases imagery needed to be processed by specialists in order to be useful for the average

user. A final factor dampening demand was utility—seeing your home from space is cool, but it was not immediately clear why everyone might want, or how they would use, satellite imagery. Google's large-scale acquisition of the imagery required to build Google Earth and to populate Google Maps removed each of these obstacles simultaneously. The widespread availability of Google's interface meant that a host of applications could be easily integrated into this original ecosystem, making it the clear market leader in public-facing satellite imagery.

Perhaps unsurprisingly, what people have chosen to look at has changed over these three eras.[58] Military uses have predominated since the inception of the US satellite program. National prestige, national security, and national interests are bound up with one another in every country's space efforts. Commercial interests have followed soon thereafter, whether for the production and sale of images or the maintenance of the GPS infrastructure that is pivotal to a growing number of terrestrial technologies. Likewise, scientists working in earth and environmental sciences have been using satellite data for several decades. Early work that benefited the general public focused on crop forecasts, tracking storms, and mapping and planning land use. Over the past two decades, these have been complemented by the use of satellites to monitor deforestation, track climate change, assess agricultural extensification, monitor urbanization, map electricity adoption and consumption, and identify polluting factories.[59]

Gradually, satellites have also been used to document human rights violations, what Andrew Herscher has called *surveillance witnessing*.[60] This chapter started with the CIA's adoption of Abraham Karem's Gnat 750 to augment satellite imagery. The layering of technologies presaged US reliance on interlaced satellite

and Predator data in its failed efforts in Iraq and Afghanistan five short years later. In 2003, the US Committee for Human Rights in North Korea secured satellite imagery of prison camps in the Democratic People's Republic of North Korea.[61] Images of the camps were combined with first-person accounts of survivors. The firms Digital Globe and Space Imaging Corporation provided the images to the advocacy group, and reporting on the process suggested that American officials had declined to release similar images, citing national security concerns. This early use of satellite imagery for advocacy purposes may be one of the longest-running, as the original study's author, David Hawk, released a fresh report on the country's continued use of prison camps nearly 15 years later.[62] In North Korea, the horrors of forced labor persisted, yet one thing about the latest report was quite different—the images had been obtained from Google.[63]

As a geospatial affordance, satellites have clear strengths and weaknesses. Satellites are positioned in either fixed geospatial orbit, from which they are able to maintain a continuous view of a fixed position, or they make regular and predictable passes over the earth's surface. The strength of the former is that they provide a near-continuous view of a particular piece of the planet. On the downside, they can see only a particular piece of the planet. The benefit of satellites in geosynchronous orbit is that they are able to provide broader coverage, yet are only able to do so at the particular time they are overflying the surface area in question. These problems can be overcome by launching many satellites, yet this solution raises its own unique challenge of cost. While the cost of putting a satellite into orbit has been driven down by competition, commercial-grade and on-demand imagery remain costly.

Social science scholarship on satellites remains thin on the ground, perhaps because they are out of sight and out of mind, "so firmly beyond the visceral worlds of everyday experience and visibility" in the words of Stephen Graham, a British scholar of cities and urban life.[64] Since we use them for so many things, satellites are now "a key part of the public realms of our planet," whether that be in support of military domination, to coordinate GPS-equipped technologies, or helping advocacy groups track human rights abuses.[65] In other words, satellites are yet another technology of the spatial public sphere, critically comprising what the German philosopher and cultural theorist Peter Sloterdijk has called the *inverted astronomy* of earth observation. For Sloterdijk, satellites are a reversed Copernican revolution, allowing us to discover ourselves as if for the first time, as we digitize our increasingly computational planet.[66]

On the surfaces they cover, satellites create publics and politics. Satellites see things the powerful would prefer to keep hidden. Previously invisible rights violations are now subject to scrutiny. Satellites have been used to document war crimes and state violence in Darfur, Zimbabwe, the Balkans, Syria, Burma, Sri Lanka, Nigeria, and the Democratic Republic of Congo.[67] They have helped to identify social, economic, and political inequalities, including by allowing Palestinian activists to better document the expansion of Israeli settlements and control over land, helping to identify tax cheats in Greece (turns out they are the ones with the swimming pools), and illuminating the extent to which a small elite had captured land in Bahrain, leading to a 2011 uprising in that country.[68] Satellites change what we can see of the ground, and in so doing create a new audience for activists and artists. In an earlier era, land art might have been an

offering to the cosmos or the gods, but it is now a challenge to the all-seeing eyes of the state and capital, as seen in chapter 4.

DRONES

While drones are used by corporations and governments, I focus here on the use of these platforms *for the public good*. As a result, I have restricted my analysis to nonviolent and nonmilitary uses. The features that first caught my attention about the kind of technology Tautis and I first used in Budapest were its low cost, its ease of flight, and the extent to which we operated without interference.

The most popular of the new drone technologies, and what we used in our efforts, was the quadcopter. Though the quadcopter design can be traced back to the 1920s and 1930s,[69] it wasn't until important questions about control were solved in the early 2000s that it became commercially successful. These theoretical solutions emerged from the lab at the same time as the evolution in mobile telephony, the prevalence of GPS systems, and as steady progress in power storage made consumer platforms possible. One of the earliest companies, Microdrones, was founded in 2005[70] and was soon followed by others, including Parrott (first drone in 2010)[71] and DJI (founded in 2006,[72] first drone in 2013). The year 2012 saw the rapid increase in reports of drone use of all kinds.

This book's evidentiary substratum is a large empirical effort to assess the nature and breadth of nonviolent drone use.[73] My colleagues and I gathered more than 15,000 publicly available reports on drone use drawn from Lexis Nexis, *Motherboard*, *New America*, UAViators, iRevolutions, and weekly reports from groups like the Center for the Study of the Drone at Bard

University. We coded for *purposeful use*—in other words, *the apparent or presumed goal-oriented behavior around a primary intended action*. People meant to do what they were doing, a contrast with a host of reports of flyaway drones and high-profile crashes. We further narrowed our focus on *nonviolent* drone use, thus excluding reports on violent military drone use, especially in high-conflict regions where the United States was actively involved in targeted killing. Manual coding techniques were used to narrow these 15,000 reports down to 1,131 unique, purposeful, and nonviolent drone uses in the six-year period between 2009 and 2015.

The reader may be additionally comforted to know that we controlled for additional terms on a year-by-year basis. For example, "the drone of the vuvuzela" was a popular reference during the 2010 World Cup games in South Africa. Likewise, honey-bee colony collapse was an area that focused on an altogether different drone. The band *The Drones* experienced a surge of attention in 2010, and we wish them well—we dropped them from our sample frame nevertheless.

This exercise shed light on the nature and range of adoption by advocacy groups and change agents and introduced us to many innovative efforts. A sustained examination of these innovative uses generated several of the case studies found throughout this book, allowing us to purposefully sample within a population of reported use. We found that small drones are being deployed in a host of novel ways and that regulators are struggling to keep pace. Drones challenge current regulatory regimes as cameras move to new places, such as over factory farms or crowds of protesters. Governments are acutely aware of their diminished control over both communication infrastructure

and national airspace. National governments are not the only ones facing a disruption of the status quo from UAVs. The number and types of uses and users has grown exponentially—from its roots in the military to a crowd that includes artists, activist groups, academic researchers, and private businesses.

Global trends in types of users—The year 2012 saw a dramatic uptick in experimentation by a wide range of actors, falling into seven broad categories. *Intergovernmental organizations*: transnational organizations that share responsibility equally among many national governments. Examples include the United Nations, treaty bodies, transnational organizations, and scientific institutions. *Governments,* including governing bodies, militaries, and police forces, and government use frequently overlaps with scientific inquiry, especially via university partnerships. *Businesses* are private, for-profit endeavors and they too overlap with other sectors, as when a business conducts research and development on behalf of a government. *Science and academia* includes universities, nonprofits, and research and development. *Civil society groups* are nongovernmental organizations, journalists, religious groups, and other civil society groups. *Named individuals* is a category that captures a range of people flying UAVs in their capacity as private citizens, rather than representing another user category. Finally, a large category, *unknown users*, describes all flights where we could not determine who was flying, or why.

The analysis in this volume centers on civil society's use of drones, basically ignoring government and business users, as well as instances in which the user was unknown. It is important to emphasize the difference between two similar-seeming terms. In our study, we use the term "civil society groups" to

describe social movement and nonprofit organizations. In this book, I use the term "civil society" to describe non-state and non-business use of drones. This covers individual users as well as the efforts of science and academia, civil society groups, and intergovernmental organizations. I have opted for ecumenicism, whenever possible.

Global trends in types of uses—Categorizing the way these users deployed drones is perhaps foolhardy. Our efforts to use a coding guide based on prior literature quickly fell by the wayside as a proliferation of uses extended well beyond those documented in my earliest work. I expect many other uses we documented will soon appear similarly archaic. This volume focuses on prosocial uses for drones, ignoring efforts that are primarily economic, like agriculture, commerce, and crime, and also ignoring UAV use within the state's domain, including for surveillance and by security forces.[74] Here too there is overlap as, for example, an agricultural drone is developed by a for-profit company focused on increasing crop yields in the Global South, or when a nonprofit uses technology to help small landholders get more crops from their land.

It should be immediately clear that the focus of this study, and this volume, is quite different from militaries' use of weaponized drones. A wide range of excellent scholarship is readily available on the use of drones in the battlespace.[75] This book instead captures those nimble and non-lethal platforms deployed by the kind of actors listed above. One takeaway from our data is that it is far too early to say where this space is headed, or what is likely to happen in the future. Many of the efforts we documented may prove to be unsustainable, and some of the organizations that I worked with as I began this book have

closed shop. I therefore am reluctant to use this data to make predictions about the rate and pace of innovation. I am similarly hesitant to make predictions about legislative trends, though I touch briefly on them in chapter 5.

I have no hesitation, however, in pointing to this rapid proliferation in users and uses as evidence that geospatial affordances are more accessible to civil society actors than at any other point in history. Drones—especially in the easy-to-fly and cheap-to-buy quadcopter category—are positioned to do something that neither satellites nor balloons have been able to do: cheaply and anonymously document social, political, and economic phenomena despite resistance from power brokers and elites—in other words, to be disruptive and emergent. Much of this volume is spent exploring that potential and explaining its impacts.

OBSERVATION LAYERS

Each of these geospatial affordances encourage new ways of seeing space. Each operate at altitudes the others are unlikely to enter easily. Each offers particular vantage points, from the wide-angle possibilities of the satellite to the land-on-a-dime capabilities of small quadcopters. These platforms' features can be thought of in comparative perspective, as seen in figure 2.1.

While this illustration radically simplifies some areas of great complexity, it also suggests areas for future research. In particular, it encourages volumetric thinking. This approach echoes the refreshing work of landscape architect Pierre Bélanger.[76] His essay and installation *Altitudes of Urbanization* (figure 2.2) incorporates several additional technologies, additional species, and subterranean layers into one conceptual space. I have chosen to

 doi:10.7551/mitpress/11739.001.0001

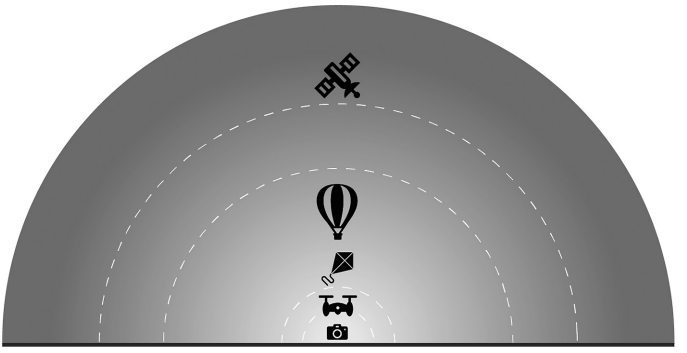

Figure 2.1
Observational layers: terrestrial camera, low-altitude drone, kite, balloon, satellite.

define uncrewed aerial vehicles by their aerial mobility and to lump them together with other things that have aerial mobility. This categorization process could have taken another direction, instead categorizing uncrewed aerial systems as a subspecies of robots. An inquiry into the possibilities that robots offer for collective action would lead in additionally fruitful directions, since robots are able to traverse the earth's surface, dig and travel underground, and float on and swim under water, and are increasingly able to enter and inhabit our bodies; these are perhaps *volumetric robotic affordances,* able to operate at multiple altitudes and in diverse spaces—from the body politic to our own bodies.

Seeing from the side rather than from above, Bélanger helps us recognize that the underground, the underwater, and the atmospheric are *often overlapping, intertwined, and entangled*.[77] Taking space seriously requires a recognition of spatial power and the air as a *thick, fuzzy, complex space* through which conflicts flow. Spatial risks, as a result, are *relative, temporal, and interconnected*.[78] This perspective fundamentally challenges the way we tend to

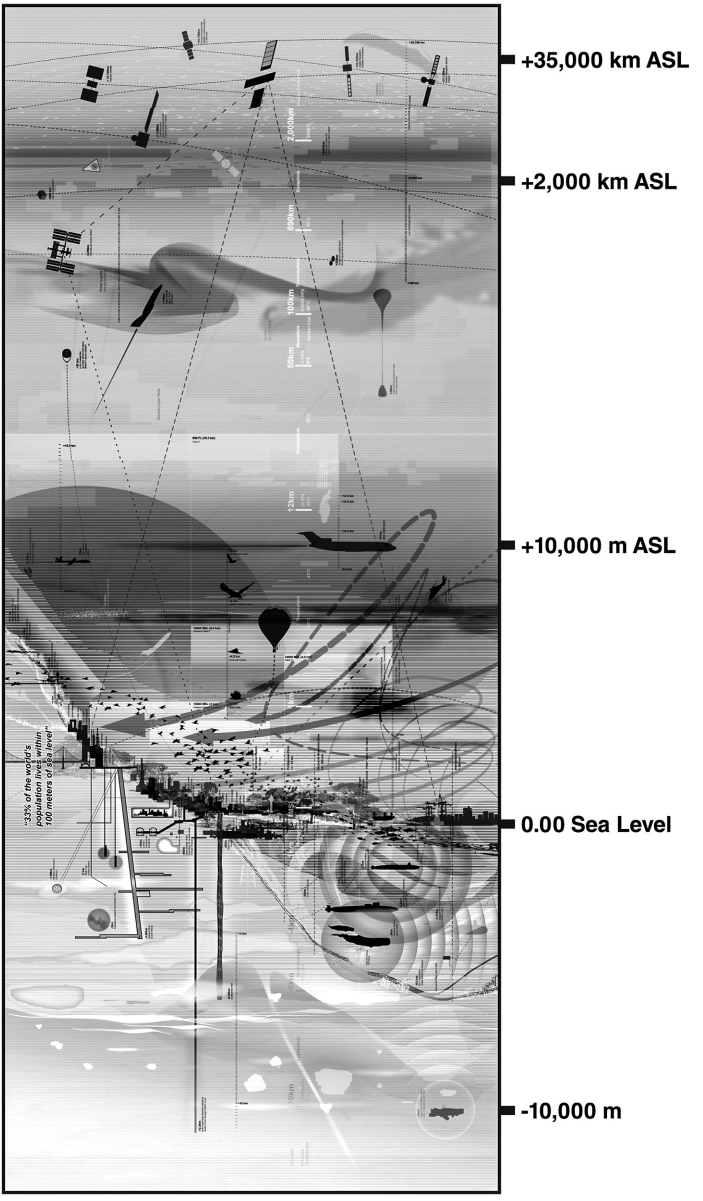

Figure 2.2
Pierre Bélanger's altitudes of urbanization.

think about how technology impacts civil society and what kinds of civil societies emerge through our technologies. In a stellar bit of scholarship, Stephen Graham traces this approach back to the ideas found on the cover of Buckminster Fuller's 1923 *Operating Manual for Spaceship Earth*. In the evocative thinker's imagination (figure 2.3), the planet is a node—central, but a node nevertheless—in a network where space and ethics intersect.[79]

For Fuller, the ethical and the spatial are bound up with one another. Thinking spatially is thinking ethically, and, by extension, politically. It is no huge leap to say that thinking politically should also involve thinking spatially. This is obvious to any actor with an army, and as the political anthropologist James Scott has pointed out, *seeing like a state* involves acute attention to space.[80] Identifying natural resources and taxable assets in one's own territory, or seizable land and resources in your neighbor's territory, always involves taking space very seriously. This is as true on the ground as above and below.[81]

FROM CIVIL SOCIETY TO THE CIVIL SPHERE

From their inception in the late eighteenth century through the possible future of autonomous flows of AI-guided aerial delivery systems, geospatial affordances have clear social and political implications: they create new space; their barriers to entry are consistently lowered; and new actors are invited to engage these systems. Such empirical observations have theoretical implications. New actors at work in new spaces necessitate new thinking about the civil sphere. Furthermore, the emergence of new tools in the hands of change-oriented social actors pushes us to think in new ways about how tools are adopted and deployed. In what remains of this chapter, I address both implications in turn.

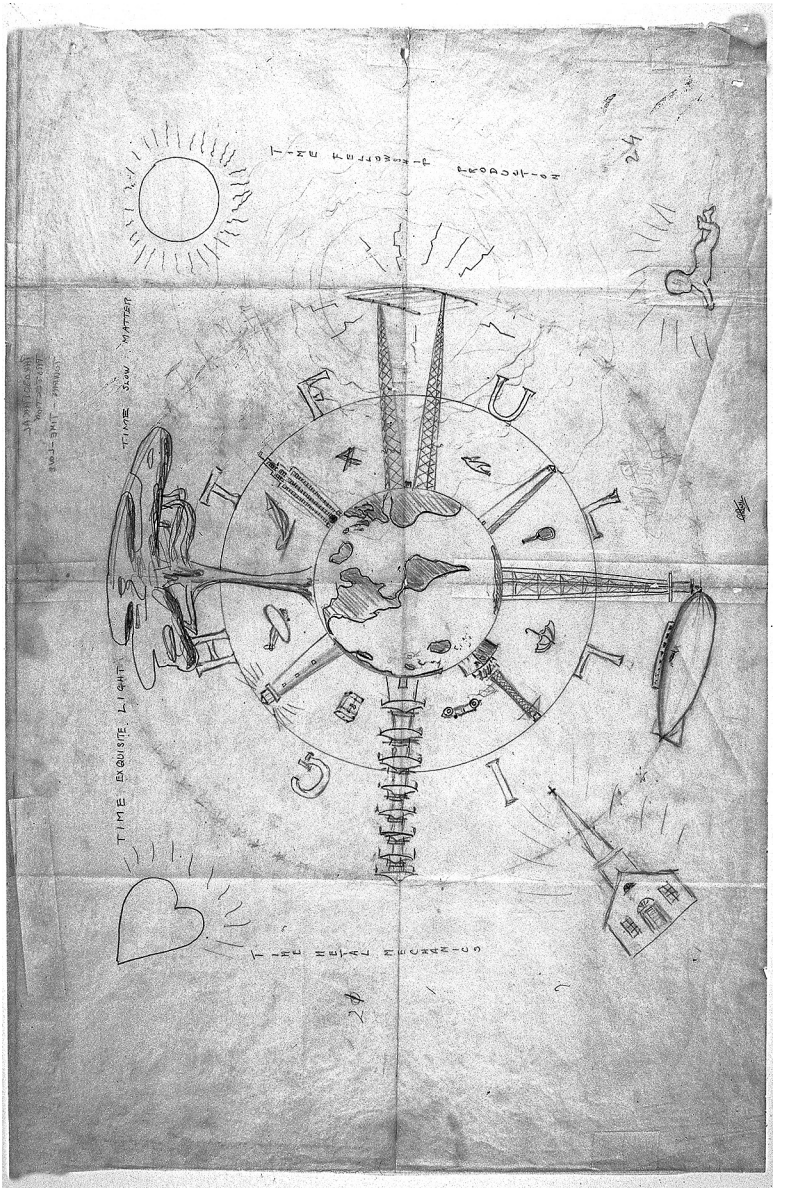

Figure 2.3
Buckminster Fuller's *Operating Manual for Spaceship Earth*.

Thinking about geospatial affordances begs new questions about civil society and the public sphere. I have focused my attention on nonviolent and prosocial uses of geospatial affiances by civil society and within the public sphere. In the case of drones, especially, geospatial affordances allow the public to hack space—to hack the world of atoms. Civil society is often thought of in one of three ways: as sets of associations like bowling leagues (by Tocquevillians); as a place for discussions about matters of public importance like coffee houses (by Habermasians); or simply as that broad space that is neither state nor market.[82] If I have focused broadly on *change-oriented social actors* up to this point, we can now look at geospatial affordances and ask: *where do they operate?* The short answer is that they operate in spaces falling perhaps into three categories: restricted areas (airports, military bases), private land, and public space. It may be helpful to think in terms of civil society actors operating within a public sphere—and recognize that the public sphere has volume.

What is meant by publics?

We could opt instead for a definition advanced by the critical theorist Nancy Fraser: "What turns a collection of people into fellow members of a public is not shared citizenship, but their co-imbrication in a common sense of structures and/or institutions that affect their lives."[83] This definition is meant to break the notion of the public sphere from its lock-step connection with the nation-state, setting it loose across (horizontal) *transnational* spaces. In the same way, the notion of geospatial affordances pulls the public sphere from its earthly moorings and sets it loose across vertical and *aerial* spaces. Geospatial politics, then, is a conceptual subset of the spatial politics that

lie beyond Westphalian horizontal politics and even beyond the politics of verticality.

New work in critical geography focuses on the importance of the vertical in social and political life. Political geographer Stephen Graham is emblematic of this approach: "*As the world's surface becomes more and more congested and contested and urbanisation girds more of our planet, so political and social struggle takes on an increasingly three-dimensional character, reaching both up from and down below ground level.*"[84] Graham tacks in the same direction as theorists and philosophers at work on the politics of space. These include Henri Lefebvre, whose *Production of Space* saw the world as increasingly dominated by the "independence of volumes with respect to the original land,"[85] a theme echoed by the British Israeli architect Eyal Weizman, whose work on Israel/Palestine suggests understanding the conflict is as much about air space as it is about walls.[86] The two work together to articulate power.

Slowly a politics of volume emerges.

A volumetric—or "spherical" in his terms—approach to geographies, imaginations, and public spaces have led the German philosopher and cultural theorist Peter Sloterdijk to write of *air quakes* and other *dangers from the atmosphere,* including gas, as when the air was weaponized as a poison vector by Nazi Germany during the Second World War.[87] The battlefield, and the horizontal terrain of engagement the metaphor implies, is a thing of the past, a vestige from a particular technological era.

The air becomes, suddenly, in the words of Paul Virilio, *battlespace*.[88]

All of this points to questions of spatial politics. This theme is explicit in British geographer Peter Adey's imperative that "we must ask just what kind of life our aerial world has produced as it

becomes increasingly the medium for the operation of violence, civil society protest and political power."[89] He goes further: "Just what are the politics of aerial life itself?" This question is echoed and extended by geographers Francisco Klauser and Silvana Pedroso, who specifically argue that drones usher in a politics of vision, and that new tools for engaging the volumetric require new thinking about the politics of visibility, the politics of the ground, and the politics of the air.[90] New conversations about the politics of visibility are refreshingly sophisticated and pick up on a normative nuance introduced by Virilio, who commendably theorizes *vision* machines rather than *surveillance* machines.[91]

Here we find a combination of people and technologies put to all sorts of uses (or, in technojargon, *sociotechnical assemblages with an interplay of actants as they are deployed by a range of actors*). None of this implies routine and systematic surveillance per se, but instead points to the broader and changing regimes of visibility that are at play in contemporary societies.[92] Writers like Klauser and Pedrozo have argued that drones should be thought of as tools for seeing—for vision and visibility—and not just as tools for surveillance. This more inclusive approach recognizes the fact that drones create *unsystematic visibilities* in the hands of public and private users.[93]

These new ways of seeing benefit the powerful and powerless alike.[94] The aerial turn in critical human geography driven by Adey, Elden, Graham, Klauser, Pedrozo, and so many others suggest something more complex than a beta version of *Terminator's* Skynet. They also open opportunities for new practices and new actors to engage in politics in new places, requiring us to explore not only surveillance, but also how new ways of seeing become and create new social and political issues.[95]

The air can no longer be thought of exclusively as a space for hegemonic conquest and ubiquitous surveillance. It is also a site of contentious politics. Increasingly, Graham argues, "the struggles over the right to the city, to living space, to resources, to security, to privacy, to mobility, to food and water, to justice—and even … the right to live rather than die—are increasingly shaped across vertical as well as horizontal geographies of power."[96]

These struggles are not one-sided.

The public sphere is comprised of those places where matters of public concern are made visible. This includes the sky, especially as it is increasingly occupied by devices. Returning to Nancy Fraser, what makes a public—what turns a collection of people into members of a public—is *co-imbrication in spaces that shape our lives.*[97] This includes the space around us. Publics are emergent properties of proximity, but publics are also temporal and spatial phenomena.

This linking of space and publics is not as radical as it sounds. The built space of architecture has always mattered to the establishment of a public. In France, the great debating spaces of the *salon* and the *précieuses* took their cues from the great hall in a royal court. A diminishment of the Court after the Glorious Revolution shifted attention to towns and their vibrant coffee houses.[98] The democratization of debate was preceded by the democratization of *space for debate*.[99]

A public sphere, in this line of thinking, is something like an emergent property of public spaces where politics and politically relevant actions happen. By emergent property, I mean to suggest that the "public sphere" is not just the process of discursive engagement, but also a thing with volume, a *place for politics*. These include public spaces (coffeehouses and piazzas),

cyberspaces (social media and virtual reality), and aero spaces (as argued in this volume). While most scholarship focuses on the discursive and communicative elements of political debate in the first two spaces, a significant amount of politically and policy-relevant activity in science, technology, medicine, education, and art happen in *all* of those spaces.[100]

By arguing for the expansion of the concept of *public sphere,* I am deliberately running together notions of social and physical space. This is an old observation, and once again I lean heavily on others. For Jurgen Habermas, the quintessential public sphere took the form of space *and* process, of architecture *and* debate. The former lays the groundwork for the latter. As already seen, this is also a lesson from critical geography. Emphasizing the intersection of physical space and social meaning pushes us to focus on verticality and volume. Within science and technology studies, Langdon Winner has argued "technologies are structure whose conditions of operation demand the restructuring of their environments."[101] It is not technological determinism to observe that things have effects.

Geospatial affordances require us to think about space, and this requires more critical thought about both verticality and volume in social, economic, and political terms. Important new work by Stephen Graham and Lisa Parks emerges alongside the classic work of Sloterdijk and Virilio, and pushes us to look down from space, up from the ground, and underground as well. But geospatial affordances—especially drones, kites, and balloons that can hover and stare—require volumetric thinking.

If the satellite—invisible to those it watches—exudes control while evading accountability, the balloon does quite the opposite. Low-altitude balloons are often controlled by means

of a string. I have a large balloon and a 2,000-foot roll of string on the shelf in my office, and have found occasion to use it from time to time (image 2.4).

The social impact of the string is profound: it allows anyone who can see the balloon to see the person operating the balloon. It is old-school analog accountability at its best. It is the kind of accountability that drones and satellites elude by design. Community mapping via balloon invites community members into the process of image gathering (by holding the string) and image making (by providing their input into the map-making process). The string, I want to write in homage, is a metaphor for technological accountability. It embeds seeing within relationship, context, and perhaps even community.

Here we have the technological antithesis to Donna Haraway's oft-cited *gaze from nowhere*. The view from nowhere is "tied to militarism, capitalism, colonialism, and male suprem-

Figure 2.4
Tautvydas Juskauskas (left) and the author (center) training independent journalists in Central Europe.

acy." The view from nowhere tries to "distance the knowing subject from everybody and everything in the interests of unfettered power."[102] The view from nowhere eschews accountability. An aerial view from *somewhere,* on the other hand, exudes accountability. The view from somewhere links the curious explorer to engaged publics by means of a simple thread. Different technological forms suggest different forms of publicness, accountability, and power. The humble string is evidence of this fact and should be a lesson to us all.

The Good Drone

How Social Movements Democratize Surveillance

By: Austin Choi-Fitzpatrick

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