A SERIES OF TUBES

Molly Wright Steenson

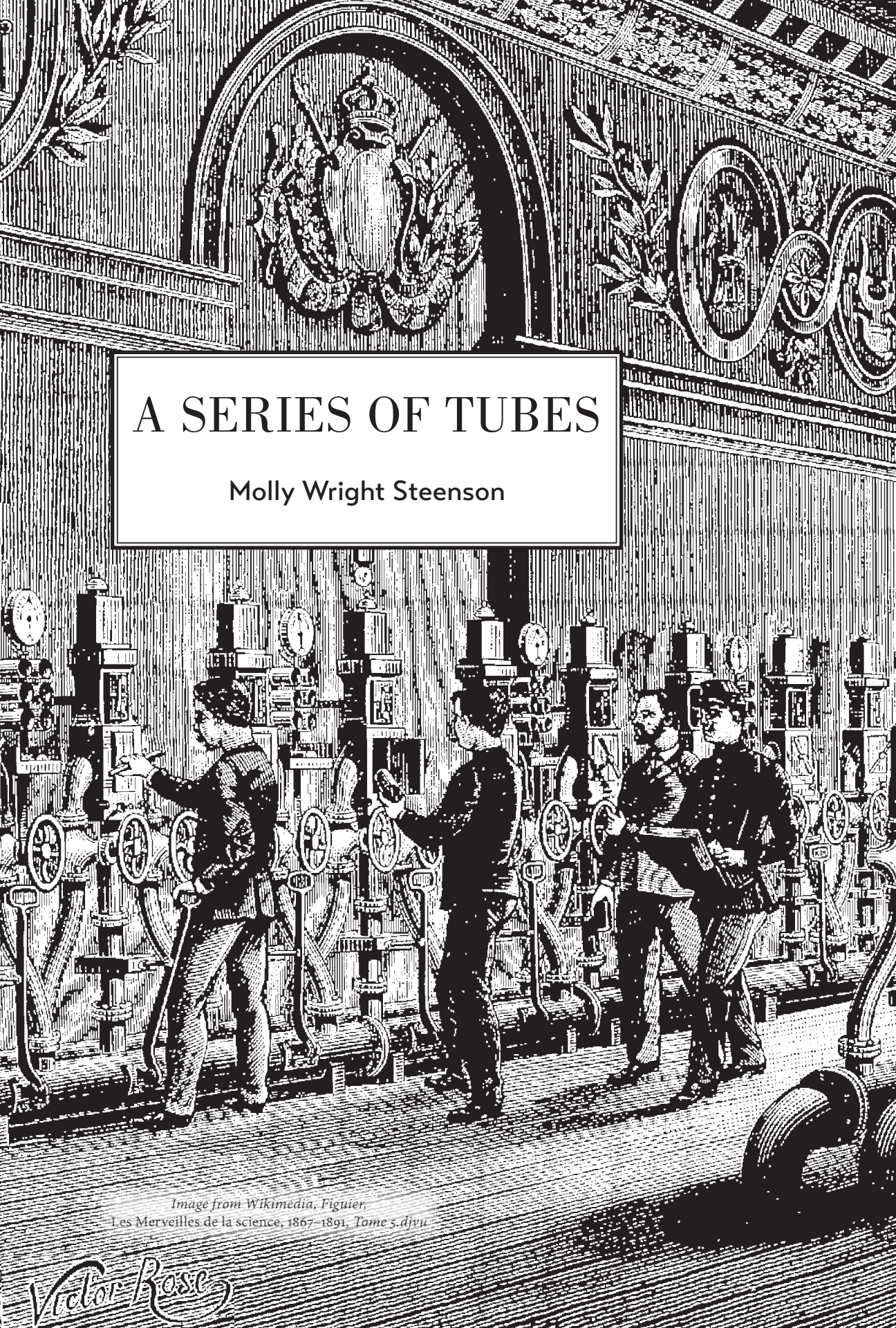
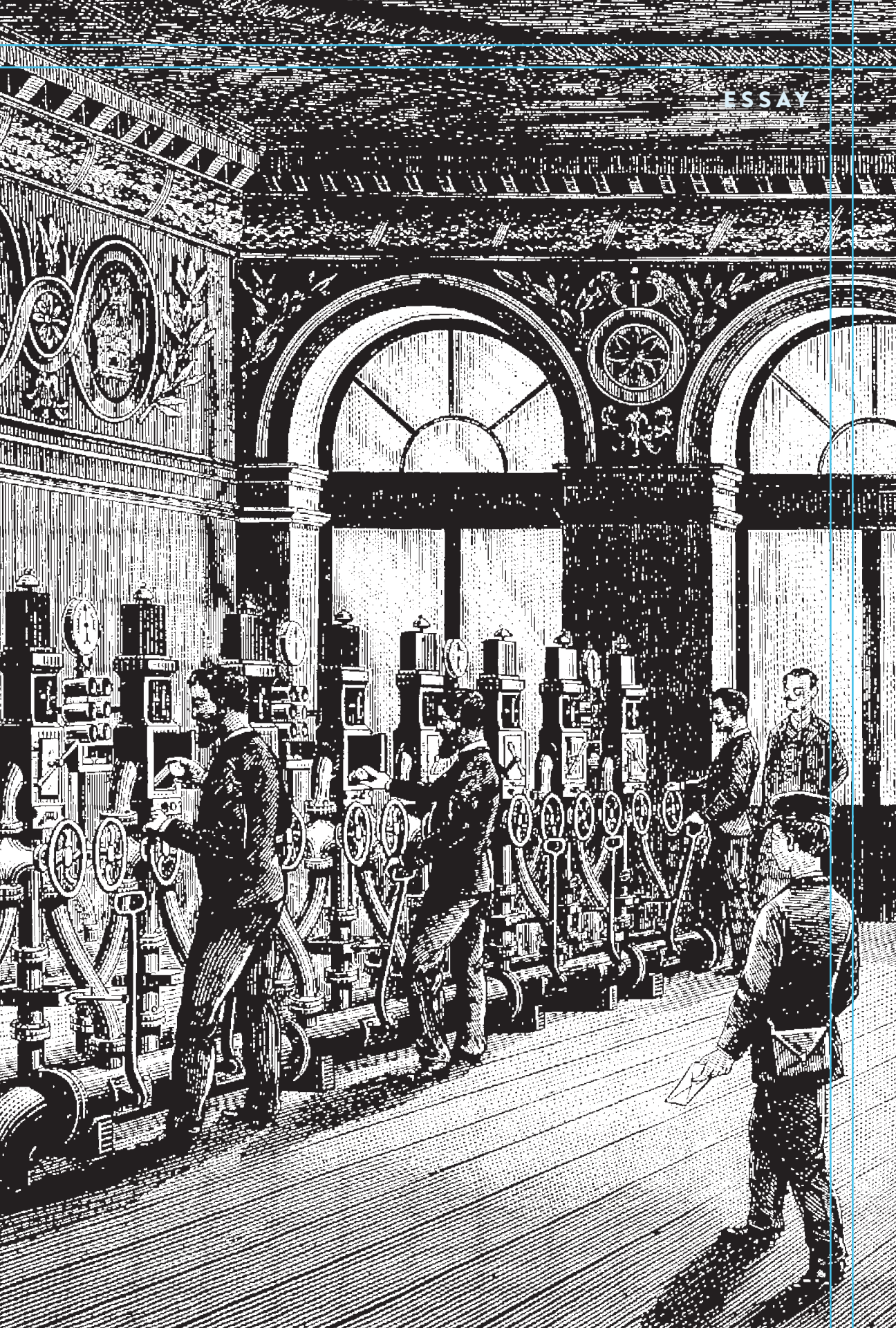


Image from Wikimedia, Figuier,
Les Merveilles de la science, 1867–1891, *Tome 5.djvu*

Victor Rose



Although widely ridiculed for the statement, the late Alaska Senator Ted Stevens was right when he said, "The Internet is a series of tubes." He was just off by a century.

Starting in the mid to late nineteenth century, pneumatic tube postal services linked post-telegraph offices with each other in every major financial hub in the world, on every continent but Antarctica. As improbable as it seems, propelling messages through hundreds of kilometers of subterranean tubes and pipes was a good solution for delivering messages across a busy city jammed with carriages and motorcars. The first pneumatic post system opened in London in 1853; New York's pneumatic post shuttled first-class mail across the Brooklyn Bridge till 1953, its postal workers called "rocketeers"; the Prague system was in operation till 2002. Paris's Poste pneumatique was the most extensive, encompassing some 450 kilometers of tubes in 1945, and it wasn't until 1984 that telephone service became reliable enough to merit shutting down the Poste pneumatique. There were pneumatic postal systems in more than sixty cities around the globe.

Thanks to the 1910 patented invention of the electric Gissot motor that weighed a mere 400 pounds (compared to the 3,300-pound engines of the steam age), pneumatic tubes could be installed inside buildings. The Lamson pneumatic tube brochure from 1920 bragged that Sears Roebuck sent 135,900 messages a day via pneumatic tube. A double stereoscopic postcard from the time shows its long lines of parallel pneumatic tubes popping out of the card in 3D. Pneumatic tubes became the conduit for moving messages, bills, money, checks, and goods, for air traffic, rail, and mission control, for lollipops and doggie treats.

My mom drove up at the new First Bank Grand auto-banking lane in St. Paul, cranked open the window of our tan 1977 Datsun 510, and pulled into the car a heavy plastic cylinder ten inches long and four inches across with rubber on each end. She opened the latch on the canister door, slipped in the checks she'd just endorsed, latched it closed, and returned it to the dark brown plastic-and-metal box. A loud fan sucked the canister underground. The teller waved at us from across the lanes, and my brother, Andy, and I lifted the paw of Pepper, our gray schnauzer-poodle, to wave back at her. The fan started up again and launched the carrier through fifty feet of tubes.

US Patent 4,059,246, for the "Pneumatic Tube Banking System," was granted to Diebold on November 22, 1977, four days before my sixth

birthday, and it describes the system as I remember it. The inventors, Walter Anders, Michael Cole, James Duncan, and Paul Leipelt, all of Canton, Ohio, according to the patent, write in the abstract:

> A pneumatic tube system for conducting banking transactions with a noncaptive carrier traveling between a bank teller terminal in a two-tube carrier conveyor connected with a remote customer terminal with visual communication between the teller and the customer. The terminals and tube structure and their components are combined, interrelated, and cooperatively arranged with simple and inexpensive construction to provide quiet and reliable operation. Prior complex carrier delivery and dispatch holding and release devices and blower operating timers and controls are eliminated. The operation of a blower located at the customer terminal, which supplies air for pressure or vacuum movement of the carrier in the two-tube system, is controlled by carrier arrival at or dispatch from either terminal. Noise emanating from air currents in the system is reduced by mufflers located at the terminals in the tube system. The carrier moves through one of the mufflers during travel. The terminals are readily accessible for repair of contained devices.

There are forty-three drawings accompanying the patent, including a drawing of the system in section, showing the tellers, the tubes, the driver-side station, even the blocky 1970s cars at the drive-through. What the drawings don't capture is the magic of my brother's and my sticky legs in the vinyl back seat, waiting for the carrier to come back, like something out of my favorite TV show, *Dr. Shrinker.*

To send a *pneu*, the *tubiste*—the French postman specializing in pneumatic post—operated a gleaming brass device that sat atop two parallel cast-iron tubes that ran along the wooden floor. He pulled a wrought-iron lever as tall as a walking cane that opened the connection to the lines of air. It hissed in response. He cranked open the hermetically sealed brass box connected to the pneumatic lines along the floor. He picked up a brass carrier, ten inches long and three inches in diameter, with rubber bumpers and a flanged leather skirt on the back, and dropped it into the box, building a train of six carriers in a row. Each one could hold thirty-five special pneumatic tube messages, called *petits bleus* even after they stopped being sent on blue stationery, curled to fit into the canister.

The *tubiste* turned one of the two steering wheels, the left for the compressed air that pushed the carriers in one direction, the right for suction that pulled it in the other direction. He cranked the brass door closed, watched the needle on the dial above, and adjusted the air pressure accordingly, then rang an electric bell to alert the next station of the delivery. He pushed back the wrought-iron lever, and the carriers hurtled through the tubes to their destination. When the next delivery arrived five minutes later with a *bruit de choc*—the noise of shock—it shot into the tube and up into the brass box, where the *tubiste* removed the canisters and rebuilt the train, then sent it off again. To receive a message by pneumatic tube was called "*attraper un bleu*"—"to catch a blue."

The sending devices smelled of acidic brass polish and sweat, the scent of ships and clocks and church organs.

If a pneumatic canister got stuck and couldn't be cleared by reversing airflow, there was another solution: firing a pistol into the tube line, which created a sound wave that traveled at 330 meters per second to the point where the tube was obstructed. A chronograph and recording cylinder marked the distance, making it possible to find the obstruction within two meters and access it through the sewer. It was a better but perhaps less festive solution than in Berlin, where frozen pneumatic tube canisters would be loosened by pouring copious amounts of wine into the tubes.

In 2008, I spend eight hours each day on my feet in the archive, sifting through architectural drawings, carbon paper correspondence, advertisements, and whatever else might be in the archival boxes I've pulled. My goal is to capture anything I can with my digital camera, record in an Excel file where to find it again, and make sense of it when I get back to the United States. It is surprisingly physical work. After three weeks, I relent and buy a pair of silver Birkenstocks because my flimsy sandals give me plantar fasciitis.

I do not love Paris in the springtime. I love Paris because it has pneumatic tubes and sewers and a fascination with its own bureaucracy, because of its bibliographic history, because its national archives and library have digitized its old documents. A few months later, I am sitting in my green particleboard cubicle in the PhD room at school. It is 1:15 AM, and I am staying here late to read PDFs of the 1891 encyclopedia *Les Merveilles de la Science*, which would be a thick tome if I could hold it in my lap and turn the onionskin pages. Instead, I download the public-

domain files from Google Books, hitting the Apple key and the plus sign to zoom me into the details of the engravings, black lines hashing the depth, the curves, and the lengths of the pipes, tanks, workers, and maps. I also love Paris because the research allows me to sit in the PhD room at 1:15 AM and talk to my secret crush in San Francisco. He calls me Fallopia, a name more Thomas Pynchon than steampunk, and texts me a picture he drew of me as Fallopia driving a sports car in the pneumatic tubes. I tweet, for him to see, "Molly Steenson has come unstuck in time."

In Kurt Vonnegut's book *Slaughterhouse 5,* Billy Pilgrim, a prisoner of war held by the Germans, is kidnapped by the Tralfamadorians, space aliens who can see in four dimensions. They view life the way you or I might see a mountain range. When someone is dead, the Tralfamadorians aren't sad about it—they just see it as the person being in a particularly bad way at that moment. When someone dies, this is why they (and Vonnegut) say, "So it goes." It's a book that I loved in high school, especially for a scene in which Billy Pilgrim watches a World War II movie backward and then forward again. It starts like this:

> American planes, full of holes and wounded men and corpses took off backwards from an airfield in England. Over France a few German fighter planes flew at them backwards, sucked bullets and shell fragments from some of the planes and crewmen. They did the same for wrecked American bombers on the ground, and those planes flew up backwards to join the formation.

And so it continues, magically. The bullets become steel and steel becomes ore, and the minerals in the ore are shipped off to specialists far away. "It was their business to put them into the ground, to hide them cleverly, so they would never hurt anybody ever again," Vonnegut writes. Everything destroyed becomes new again, Soldiers become kids become babies.

In the 1990s, those of us who designed, coded, and organized information for the Web called ourselves architects: web architects, information architects, system architects. Architecture was the right word for this exercise of designing and coding and building the early Web because we hadn't created anything like this before. We used architecture and its

metaphors to imagine how people would dwell in and use these digital spaces we were designing, as we imagined structures much bigger than us, working down to the smallest details and back again, then publishing this work to a server and having thousands or even millions of people use what we made.

I was the producer for the second-most-hit page on the Internet, the Netscape search page, in 1996. It was second in traffic only to the Netscape home page, the jumping-off point for everyone using the Netscape web browser—which is to say almost everyone who used the Web. Google wasn't founded until 1998, so the page I managed helped web surfers find what they were looking for, randomly delivering one of five search engines: Excite, Infoseek, Lycos, Yahoo, or Webcrawler.

I was responsible for things that broke and were out of my control. My coworker Gregory kept a red playground ball in his cubicle, the kind of ball that once broke my nose in grade-school dodgeball. We took it out to the hot, fresh asphalt in the parking lot and hulk-smashed the ball against the ground, shouting the names of the developers on our team who didn't check in their code. When we had brownouts that killed the electricity in the June heat, gasoline generators bigger than Humvees kicked into loud action outside the cafeteria. And when the Excite search engine didn't show up often enough on the Search page, the CEO of Excite showed up at our offices, purple in the face, to yell at us.

At that point in time, Netscape ran on thirty-five servers in the main building. When friends came to visit me at work, I showed off the blinking servers on display behind a smoked glass window. In 1996, Netscape had four buildings. By 1998, there were twenty-seven buildings. By 2002, the company had merged with AOL and become the stuff of late-night TV commercials. By comparison, today, Google processes 7 billion searches a day, including my searches on Google Books. It runs on between 900,000 and 1 million servers in data centers all over the world.

The joint expansion of the rail and telegraph changed the human experience of time and space in the nineteenth century. In 1843, Heinrich Heine wrote that the coming of the railway produced "tremendous foreboding such as we always feel when there comes an enormous, an unheard-of event whose consequences are imponderable and incalculable." Everything far away felt as if it were encroaching upon him in Paris, Germany's forests, and the waves of the North Sea. "What changes must now occur, in our way of looking at things, in our notions! Even the

elementary concepts of time and space have begun to vacillate. Space is killed by the railways, and we are left with time alone."

Dionysius Lardner dispensed with both space and time. The Irish science and technology writer, who was fascinated with the steam age, wrote in "Railway Economy, A Treatise on the New Art of Transport, Its Management, Prospects and Relations" (1850), "The Electric Telegraph for the transmission of intelligence, in the most literal sense of the term, annihilates both space and time." These new possibilities for what Lardner called "intercommunication" supported the transmission of intelligence from one point to another. He imagined that the telegraph would not only connect rural people to cities but even support peace and make wars shorter. Annihilating space and time, in short, would facilitate the human condition.

"To annihilate" meant a number of things at that time, according to the *OED*. It referred to reducing material or immaterial things to nonexistence; making null and void; blotting out of existence; "to extinguish virtually; to reduce to silence, powerlessness, or humiliation." It meant "to destroy the soul (as well as the body)" or to "destroy the collective or organized existence of anything." By the 1950s, "annihilation" was a word of the atomic age, referring to the creation of a nuclear event that produced transformations of matter into "radiant energy." Consider these possibilities: What is it when distance and time are null and void, silent? What is it to destroy the soul of time and distance? What is it when space and time collapse so quickly that all we have is radiant energy? We spent much of the twentieth century trying to answer that question. We still don't have the answer.

"I wanted to talk to you of modern architecture, and I have ultimately talked about the architecture of the future," architect Julien Guadet told the Society of Civil Engineers in 1886 about his crowning achievement, the Hôtel des Postes, Paris's new central post office. The post office was a suitably authoritative and sober civic building. What made it special was the way it could process mail like nowhere in Europe. In late-nineteenth-century Paris, mail was delivered seven times a day. The sorting never stopped.

Guadet touted the elevators in the Hôtel des Postes that brought the mail up to the third floor for sorting and the helix-shaped chutes to get the sorted mail sacks down to the basement in seven seconds, a "veritable rain of mail bags," he said. It was hard to fathom the speed of the

post. The post was alive, "permanently febrile, I would even say epileptic at moments," Guadet said. "The battle against time, that eternal and inflexible enemy, must be conquered at every instant."

The post office even had its own cryptographers, *déchiffreurs*, who cracked the code of poorly addressed letters. The chronicler of Paris's bureaucracy, Maxime du Camp, wrote that one white-haired *déchiffreur* "of singular perspicacity" was able to determine the addresses of some 950 of 1000 maladdressed letters by using a magic volume that listed every house and building in Paris. Sometimes, however, "their mystery is too profound: it is necessary to give up on fathoming it," du Camp wrote. Those missives came to rest in an iron-barred dead-letter office: "embryonic letters" that never reached their destinations.

It is easier today to research nineteenth-century postal history than to experience the 1990s World Wide Web. This is because the French government digitized many of its archives, whereas the Internet Wayback Machine's holdings are often spotty and broken, and the CGI scripts and Flash movies that brought the Web to life no longer work. My old websites, including the pop-culture feminist webzine *Maxi*, which I ran with three collaborators from 1997 to 1999, has disappeared from the Internet, and there are no *déchiffreurs* to find it, thanks to a file-overwriting mistake and an ex-boyfriend who didn't renew the domain name. The new owners of Maximag.com uploaded a file that struck out the previous archive, and there wasn't a backup. Two and a half years of work disappeared, unrecoverable.

I spent eight years in architecture grad school studying the intersection of information, the physical and the digital, the ephemeral and the material. Although I had wanted to do contemporary research on mobile phones and the Internet, a professor told me there wasn't enough historical distance. "You need forty years," she told me in a graduate seminar. Forty years are too few and too many. Even a period of a few years needs historicizing, yet we need a century to make sense of these long movements of information. The history of information has come unstuck in time.

Pneumatic tubes endure for what we can't digitize. Under the walls and even under streets of big hospital systems, they deliver blood, urine, tissue samples, and medication. On Roosevelt Island, in New York's East River, the pneumatic trash system sucks up the island's garbage.

"I dream of a utopia where a pneumatic postal system to individual households is the norm," reads a comment on a YouTube video of a self-built pneumatic tube system in Krakow. Another reads, "Amazing. What other goods can be sent over this system? Scaled to a larger infrastructure?" These viewers might know about Elon Musk's Hyperloop, but they don't know that Antoine Doinel sent a *pneu* to break up with his lover in François Truffaut's 1968 film, *Stolen Kisses,* that love and money and heartbreak crisscrossed the pneumatic tubes. What these commenters *do* seem to know is that tubes tie to our memories and the possibility of rendering them tangible, to our hopes of something real to bind us to one another, and of something else, of a magical mechanism that we can't quite see but know is there. Pneumatic tubes are the opposite of ephemeral.

I have total laryngitis when I visit the New York Public Library for Science and Industry on a winter day in 2009. I search for the library's holdings on pneumatic tubes, including some congressional reports about pneumatic tubes and the 1920 Lamson pneumatic tubes brochure. I copy my requests onto carbon-paper forms the size of personal checks, making sure my pencil marks push all the way through to the third layers. When I hand them over to the librarian, he picks up a metal canister with pink bumpers and opens a black rubber door covering a chute in the desk.

"Hey! Did you see what's written on my request?" I whisper as loudly as I can. "Pneumatic tubes!"

I point where he's about to drop my request—into the pneumatic tubes. I get the librarian to crack a smile.

My mom pulled out the canister from the Diebold machine at the First Bank and unlatched the door. She took out two crisp twenties and put them in her wallet. She reached back to hand me and my brother the red and orange lollipops from the teller, who also included a Milk-Bone for the dog. "Shake," Andy said to Pepper, who offered us a furry paw for the doggie treat, part of which fell on the Datsun's floor as she ate it. We waved to the teller as my mom put the canister back into the pneumatic tubes, and we drove home.

MOLLY WRIGHT STEENSON

My dissertation should have been on pneumatic tubes, not the history of AI in architecture. In grad school, I wrote a paper about the central post office in Paris (1886), which led me to discover the improbable and magical pneumatic postal services that ran under the streets of every important financial center of the world. I called it "a regressive glossary" of the Poste pneumatique and examined its interfaces and components to understand communication and information, then and now. Pneumatic tube systems breathe. They are our imaginations of communication brought to life.

I gave a lightning talk about pneumatic tubes at a tech conference in 2009, not long after I finished the paper. It got a roaring ovation, and the video went viral. I've since given talks about pneumatic tubes at the Smithsonian, in a bar in Madison, at a private Google conference in Arizona before Google's founders, and as a keynote speech to a sold-out software developer conference in San Francisco. *99% Invisible* interviewed me about pneumatic tubes, and last month, CNN interviewed me about them for an article on Elon Musk's Hyperloop. I love telling these stories about pneumatic tubes to audiences; this essay is another way to do just that. It's my first published piece of experimental-form nonfiction.

Molly Wright Steenson is a historian of architecture and technology and the author of *Architectural Intelligence: How Designers and Architects Created the Digital Landscape* (MIT Press, 2017), a history of artificial intelligence in architecture. She is senior associate dean for research in the College of Fine Arts and associate professor of design at Carnegie Mellon University. Molly holds a PhD in architecture from Princeton University and lives in Pittsburgh with her husband, Simon, and their small gray dog, Emoji.