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Limn 11 – The Obsolescence Issue
Edited by Townsend Middleton, Gökçe Günel, and Ashley Carse
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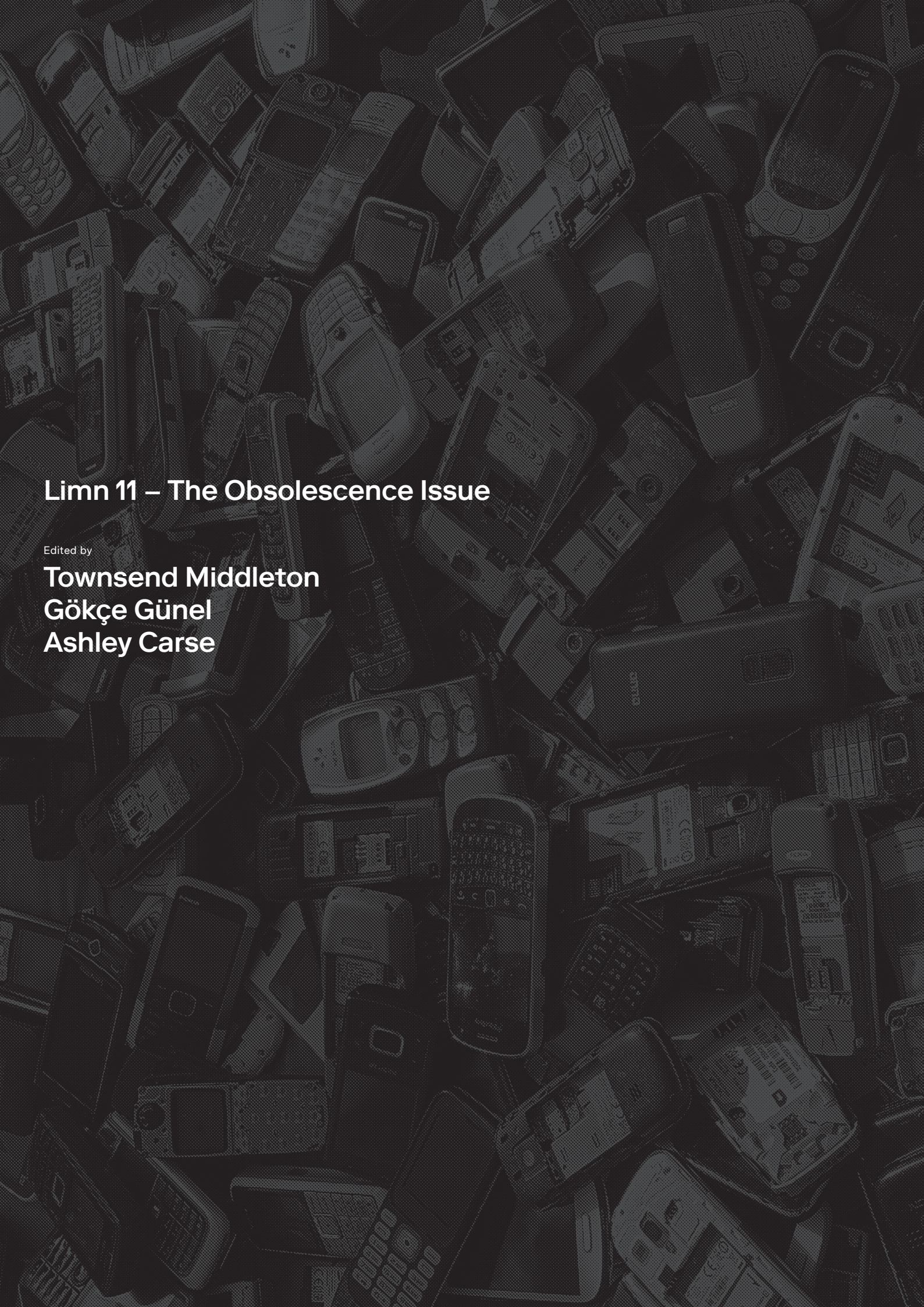
Cover image: *Elike* by Dela Anyah, 2022. PHOTOGRAPH BY AARON ASHITEY. COURTESY OF DELA ANYAH

↓ Pile of Electronic Waste.
BY LEO ARSLAN VIA PEXELS

Limn is an experiment in collaborative inquiry. Published in print and open-access online editions, the journal gathers scholars, artists, and activists to illuminate–or limn–problems emerging at the interface of technology, politics, and contemporary life.



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In this issue, *Limn* gazes into innovation's rearview mirror.

Contemporary life has become an endless parade of technological advancements. Yesterday's futuristic devices suddenly appear to be artifacts of the past. The idea that things, jobs, and languages become obsolete—that the old must continuously make way for the new—is a seemingly indisputable tenet of modernity. The churn is relentless, with effects that ripple across industries, labor markets, and our everyday lives.

Obsolescence is often considered the endpoint of a developmental trajectory—a necessary side effect of progress. The term evokes history's also-rans. Out-of-date. Antiquated. Useless. It indexes the hardscrabble realities of postindustrial zones and animates fears about what artificial intelligence will mean for a variety of livelihoods. Obsolescence can also be more than a label, description, or threat. It materializes in mountains of e-waste rising across the world, and in that box of retired gadgets lurking in your attic. But what if we approached obsolescence as more than an endpoint? Could it turn out to be something different, even hopeful?

The Obsolescence Issue marks *Limn*'s return after a six-year hiatus. Since its founding in 2010, the journal has brought together eclectic groups of thinkers to reframe contemporary problems.[1] As we worked to resuscitate a scholar-led, design-forward print publication in 2024, obsolescence emerged as a provocative concept, both for *Limn* as an intellectual project, and for a world at once fixated on and anxious about innovation. Many magazines have published an "innovation issue." To our knowledge, *Limn* is the first to flip the script with an obsolescence issue.

The problem of obsolescence is not new. Derived from Latin, the English term *obsolete* has connoted out-of-date things and practices since the sixteenth century.[2] Although the twin processes of innovation and obsolescence have appeared across human history, the cycle intensified with the rise of industrial capitalism.[3] Since the nineteenth century, analysts have highlighted how the active process of making commodities, processes, and livelihoods obsolete is integral to economic growth. The production of obsolescence grew increasingly sophisticated, and by the 1920s, thinkers were arguing for "investing in obsolescence," reframing the replacement of old mechanical equipment not as undesirable or as a loss, but as a part of progress.[4] From the worker's vantage point, however, this progress often meant displacement, as skilled trades like woodworking and dressmaking gave way to the mass manufacturing systems of Fordism, and as revolutionary technologies like the automobile replaced the horse-drawn carriage.[5]

By the 1940s and 1950s, "planned obsolescence" had emerged as a purposeful design imperative—a business strategy to increase profits by manufacturing goods with shorter lifespans, rather than producing high-quality items that last.[6] The arrival of the digital age has prompted new iterations. Tech companies refuse to offer software updates for aging models; plugs and cables no longer fit the latest ports; parts-pairing codes prevent repairers from using salvaged parts to fix broken devices. As this short history shows, obsolescence—planned and otherwise—has profoundly shaped today's culture of consumption and disposability. This is an important story, but it's far from the only one. Obsolescence is still mutating and on the move.

With that in mind, *Limn* invited scholars, artists, and activists to grapple with the concept of obsolescence. On closer examination, the

objects in innovation's rearview mirror prove livelier than they first appear. Locked out of their tractors by proprietary operating systems, farmers hack their way to the fore of the Right to Repair movement. An old drug cures a new disease. A once-forgotten art form births a new vintage of cool. From state efforts to plan for a circular economy, to communities of activists and artists that organize around the recovery and use of old things, there is more to obsolescence than meets the eye.

This collection of essays, art, and interviews illuminates the problem from multiple angles: some oblique, others head-on. Our contributors present a nuanced understanding of obsolescence and its stakes. To call something obsolete is to devalue it—to deem it anachronistic. As a label or a claim, obsolescence sticks to both things and people, making it a matter of pressing environmental, social, and ethical concern. The good news is that not all of its effects are dire. It may be OK to desire obsolescence; after all, many of us would like to do away with racism, violence, and fossil fuel dependency. For a world in peril, these shifting meanings and usages should be a source of concern and curiosity. Here, then, are five provocations for the encounters to come:

Obsolescence is not necessarily a permanent state.

In fact, obsolete things have an uncanny knack for returning. Amid the onslaught of digital media, for example, vinyl records and cassette tapes find new life in the nooks and crannies of contemporary culture. Aging materials, like the forest hiding behind the walls of Detroit's dilapidated homes, are reclaimed.

Obsolescence is as much a claim as a condition.

Weaponized in the name of profit and progress, it has agents, actors, and subjects. Developers may declare a site a used-up wasteland to justify extraction, even as residents resist and work to short-circuit the self-fulfilling nature of these claims. As a claim, obsolescence is subject to refusal.

Obsolescence is unevenly distributed.

It looks different depending on who one is and where one stands. From computers and medical devices to skills and expertise, things considered outdated in one setting can be vital, even cutting-edge, in another. In a world of global connection, the variegated geographies of obsolescence versus usefulness can create problems and opportunities.

Functionality is only part of the equation.

Though often deemed useless, many obsolete things work fine. Others would, too, if they could only be repaired. Yet they are discarded. Part of the problem is the glue that prevents us from fixing things—and part of the problem is how we think about obsolescence. Just as value is ascribed, so is its lack. There is no set correlation between obsolescence's material and symbolic registers.

Obsolescence can be generative.

Artists thrive amid the rusted-out corners of the postindustrial world. Plants, animals, and humans left in the wake of empire find new ways of living together. Obsolescence, in these instances, is not just a field of struggle, but one of creativity and life itself.

These provocations hit close to home for *Limn*. For decades, commentators have argued that print media is on its way out. And yet, *Limn*, a hybrid digital and print publication since its inception, thrived in this shifting media landscape. But then, its first run came to an end. In the afterword to this issue, *Limn*'s founders—Christopher Kelty, Stephen Collier and Andrew Lakoff—reflect on their vision for a publication that would respond to the puzzles of obsolescence emerging in scholarship and publishing in the 2010s. In 2023, a new team of editors took up the challenge and asked whether we might make *Limn* new again. This has required a careful balancing of what the publication was, and what it could be.

In beginning again with *Limn* 11, one thing is clear: obsolescence is not obsolete. How we understand the problem and what we make of so-called obsolete things will do much to determine our shared futures. Accordingly, we invite you to rummage around in the dustbin of history with us as we explore the possibilities of obsolescence. ■

↓ **NOTES**

1 Stephen J. Collier, Martin Høyem, Christopher Kelty, and Andrew Lakoff, "Experimenting with Collaboration," in *Collaborative Anthropology Today*, eds. Dominic Boyer and George E. Marcus (Cornell University Press, 2020), 102–114.

2 *Oxford English Dictionary*, 2024, "Obsolete."

3 Obsolescence has long been a shadow concept in critiques of capitalism. In 1848, for instance, Marx and Engels wrote of the cycles through which old things and fixed relations "with their venerable ideas and views are swept away, all new ones becom[ing] obsolete before they can ossify." See "Manifesto of the Communist Party," in *The Marx–Engels Reader*, 2nd edition, ed. Robert C. Tucker (W. W. Norton, 1978). Marx later addressed capitalism's quickening yet deleterious cycles of production and consumption in his 1857 *Grundrisse* (first published in 1939 and also available in Tucker's *Marx-Engels Reader*).

The idea that obsolescence is innovation's twin comes from Joel Burges's essay, "Obsolescence/Innovation," in *Time: A Vocabulary of the Present,* eds. Joel Burges and Amy Elias (New York University Press, 2016). Though it is innovation's lesser-known counterpart, obsolescence nevertheless has been central to capitalism's ever-evolving forms of "creative destruction"; see Joseph A. Schumpeter's *Capitalism, Socialism, and Democracy*, Third Edition, Ch. 7 (Harper Perennial Modern Classics, 2008). No surprise then that its wasteful qualities have featured in books ranging from Vance Packard's 1960s bestseller *The Waste Makers* (Ig Publishing, 2011) to John Scanlan's more recent *On Garbage* (Reaktion Books, 2005).

Daniel Abramson and Mark Goble have tracked obsolescence's central place in the fields of architecture, urban design, and modernism more broadly. See Abramson's *Obsolescence: An Architectural History* (University of Chicago Press, 2016), and Goble's "Obsolescence," in *A New Vocabulary for Global Modernism*, eds. Eric Hayot and Rebecca L. Walkowitz (Columbia University Press, 2016).

Perhaps the most well-known treatment of obsolescence comes from Canadian philosopher Marshall McLuhan, who framed it as one of media and technology's four-fold ("tetrad") effects. See McLuhan's *Laws of Media*, ed. Eric McLuhan (University of Toronto Press, 1988).

4 Joel Burges, "Obsolescence/Innovation," in *Time: A Vocabulary of the Present,* eds. Joel Burges and Amy Elias (New York University Press, 2016), 85.

5 Costas Cavounidis, Qingyuan Chai, Kevin Lang, and Raghav Malhotra provide compelling case studies in *Obsolescence Rents: Teamsters, Truckers, and Impending Innovations* (Cambridge National Bureau of Economic Research, 2023).

6 For more on purposeful and planned obsolescence, see Paul Gregory's "A Theory of Purposeful Obsolescence," *Southern Economic Journal* 14, no. 1 (1947): 24; and Giles Slade's *Made to Break: Technology and Obsolescence in America* (Harvard University Press, 2006).

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Opening image on p. 6: LED Bulb Lot. BY MEDHAT AYAD VIA PEXELS


CREATIVE
52X max
SUPERKIT
56X max
32X max
CREATIVE

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Planning for Obsolescence

The emergence of
China's circular economy

Amy Zhang

In 2013, I visited a disassembly site

for cars and electronics in Hunan, China. The tour was organized by the China Recycling and Resources Association (CRRA), an industry group that promotes the nation's scrap sector, and it showcased a private electronics and automobile disassembly enterprise called Sichang[1]. Since 2006, Sichang has established itself as a leader in implementing China's national policy of developing a circular economy. The company has invested in specialized facilities for the disassembly of electronics, automobiles, and industrial waste, and for processing non-ferrous and rare earth metals. In 2013, at the time of my visit, cities across China were welcoming a record number of cars onto their roads. Recycling industry leaders like Sichang, however, were looking decades ahead, creating facilities in anticipation of the obsolescence of the current generation of vehicles.

Our group, composed mainly of CRRA representatives and municipal bureaucrats, toured a newly constructed disassembly plant. We watched as workers in uniforms and helmets used excavators to crush auto bodies already stripped of their wheels and windows. The tour later took us to a disassembly line focused on household electronics, where workers stationed at a conveyor belt took apart CRT monitors, separating circuit boards from glass tubes, the disassembled and recovered components effectively procuring a store of valuable resources.

INFRASTRUCTURES OF DISASSEMBLY

Since China's Reform and Opening in 1978, economic growth has relied on the continuous expansion of industrial capacity. State-sponsored factories and export development zones mobilized cheap labor for the production of textiles, electronics, and other consumer products to be shipped to the West. From the late 1990s to 2017, China also became a center for processing postconsumer waste. Shipping containers carrying exports to the West returned with postconsumer paper, plastics, and electronics.[2] A largely informal electronic waste disassembly network emerged, made up mostly of rural laborers who extracted copper and other precious metals by hand, with little regard for the environment or their own safety. China's ecology, in effect, was twice polluted: once during the manufacture of electronics, and again during disassembly and reprocessing, which exposed both bodies and environments to lead and a host of other contaminants.

In the twenty-first century, China set out to realize a more sustainable development model. Alongside clean technologies such as solar and wind power and electric vehicles, waste management was to become a key site of state intervention. Chinese policymakers and planners promoted the idea of a circular economy—a technoscientific approach to waste management. Instead of displacing waste's negative externalities to other locales,[3] China endeavored to build a sustainable and modern system for managing waste that would rely on technological innovation to minimize or even eliminate the toxic effects of waste disassembly and reuse.

↗ E-waste arriving at Guiyu from the US and Europe. PHOTO BY GREENPEACE/NATALIE BEHRING

→ Workers disassembling CRT monitors at Sichang. PHOTO BY AMY ZHANG


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“In the twenty-first century, the circular economy presents an alternative approach to material circulation, one in which planned obsolescence is increasingly supplanted by a process of planning for obsolescence.”

In 2017, China closed its borders to foreign waste imports, shut down informal recycling businesses, and re-established zones designated for waste recovery.[4] The state invested in a new generation of technologies, including waste-to-energy incinerators and biogas facilities, as well as "circular economy industrial parks," large centralized facilities for disassembly and conversion of matter into resource.[5] Through better technology and social innovation, the circular economy envisions a closed loop where products and materials are recycled indefinitely.[6]

Facilities like the Sichang plant are critical nodes within the emerging infrastructures of disassembly—networks where discarded products are systematically disassembled so that their parts can be directed back into channels of production. While production under capitalism is predicated on the logistics of delivering goods cheaply and quickly to consumers,[7] infrastructures of disassembly create systems of circulation in a network of *reverse logistics*. Composed of institutions, technologies, and labor, infrastructures of disassembly are an essential component of the circular economy and, by extension, of China's transition to clean, sustainable development and green capitalism.

A STATE-LED OBSOLESCENCE

Obsolescence was once considered to be the unanticipated outcome of capitalist creative destruction.[8] But since the middle of the twentieth century, the concept of planned obsolescence has been used to describe an approach that emerged in western industrial manufacturing, which aims to shorten the lives of industrial products. It continuously sustains markets for new iterations of products, stimulating consumers to replace products rapidly,[9] and sending older versions to the dump. Planned obsolescence sustains a system of disposal.

In the twenty-first century, the circular economy presents an alternative approach to material circulation, one in which *planned obsolescence* is increasingly supplanted by a process of *planning for obsolescence*. Planning for obsolescence offers a vision of development capable of sustaining continuous growth at a time of increasingly constrained resources. It focuses not only on production and consumption but also on a totalizing approach to disposal and reproduction. In China, novel interventions in the treatment of electronic waste are critical to realizing this vision.

← Automobile disassembly at Sichang.
PHOTO BY AMY ZHANG, JUNE 2013

In the 1990s, only half of the households in China's ten largest cities owned a refrigerator.[10] Since the mid-2000s, the Chinese state has pursued policies to stimulate consumption, particularly of domestic appliances, electronics, and vehicles. While China has long produced goods for export to the global market, trade-in programs are meant to expand domestic consumption by incentivizing consumers to trade in old refrigerators, washing machines, and other household items for newer models. In the wake of the 2008 financial crisis, the state mobilized such trade-in programs to encourage consumption in both large cities and in the countryside. By 2023, according to the Ministry of Commerce, more than three billion refrigerators, air conditioners, and washer units were in use across the country.[11]

In April 2024, China announced a national trade-in program for cars and home appliances. This program was framed in ecological as well as economic terms, asserting that appliance trade-ins would promote energy efficiency. The program, notably, was accompanied by an expansion of the nation's e-waste treatment capacity. The state aims to raise the volume of home appliances recycled by fifteen percent and the volume of cars recycled by fifty percent from 2023 to 2025.[12] China's quest for sustainable growth thus centers on the creation of a network for resource recovery and reuse. Planning for obsolescence

→ An e-waste display at Sichang.
PHOTO BY AMY ZHANG

promises to resolve the tension between economic growth and sustainability by using the tools and techniques of a planned economy.

This is not the first time that Chinese economic planning has seized on waste. In the 1950s, during the Maoist period, China established one of the world's first state-sponsored recycling systems. Material scarcity and foreign embargos led the state to encourage citizens to collect steel and other materials under a central material resources system.[13] The All-China Federation of Supply and Marketing Cooperatives set up a network of local depots for scrap metal collection and processing to support national policies that prioritized industrial development.

"The process of planning for a future of continued obsolescence in China illustrates that a circular economy carries the potential to obscure the consequences of limitless growth."

In the twenty-first century, the "waste regime"[14] that the Chinese state is perhaps most concerned with is that of e-waste. Electronic waste is valued for the metals and other useful materials that it contains. At the same time, the breakdown and disassembly of e-waste has the potential to release hazardous chemicals. Extracting rare metals from old computers and cell phones therefore calls for a turn toward high-tech sustainable development. Today, as China's new electric vehicles are poised to dominate the domestic car market, Sichang's planned vision seems to have arrived ahead of schedule.

LEAKY CIRCULATION

The circulation of e-waste has generally been understood through the lens of displaced toxicity. From the 1960s to the 1980s, microchip manufacturing sites in Silicon Valley left behind enormous quantities of harmful chemicals. Sites where electronics were produced and disposed of were contaminated with chlorinated and brominated substances, toxic metals, and plastic additives.[15] Chemicals from the production of electronics were stored in large tanks

that leaked underground, leaving many parts of the area so polluted that, for example, Santa Clara County is home to more Superfund sites than any other county in the United States.

In the 1990s, in the wake of more stringent environmental legislation, the US and Europe began sending their electronic waste overseas for disposal; China became a key destination. Western media coverage described environmental and health impacts in Guiyu, a village in southern China that became the center of a large informal electronics disassembly network. As China turned toward sustainable development and closed its borders to foreign waste imports in 2017, the circuits of electronic waste removal migrated yet again. Now, Ghana and Vietnam are popular destinations for international e-waste.[16]

The circulation of waste, however, has created more than just a geography of disposal. It has drawn many lives and diverse forms of labor into networks of circulation. A multiplicity of geopolitical and social relations have been formed, all in the name of a techno-utopian vision of smooth circulation. These changes underscore the types of political work necessary for sustaining new forms of circulation. The process of planning for a future of continued obsolescence in China illustrates that a circular economy carries the potential to obscure the consequences of limitless growth. And China's capacity to capture and redirect waste as a resource is predicated on severing older political and economic ties.

China is planning for obsolescence by creating new infrastructures of material disassembly, meant to sustain growth in a period of ecological precariousness. These circulations will, however, inevitably produce new material networks, and new economic relationships—which may themselves have the potential to undermine the vision of continuous, green growth at the heart of the circular economy. ■

↓ NOTES

1 Sichang is a pseudonym.

2 Adam Minter, *Junkyard Planet* (Bloomsbury Publishing, 2013).

3 Max Liboiron, *Pollution is Colonialism* (Duke University Press, 2021).

4 Yvan Schulz and Anna-Lora Wainwright, "In the Name of Circularity: Environmental Improvement and Business Slowdown in a Chinese Recycling Hub," *Worldwide Waste*, no.1 (2019): 1–13.

5 Amy Zhang, *Circular Ecologies* (Stanford University Press, 2024).

6 Robert A. Frosch and Nicholas E. Gallopoulos, "Strategies for Manufacturing," *Scientific American* 261, no. 3 (1989): 144–52.

7 Deborah Cowen, *The Deadly Life of Logistics* (University of Minnesota Press, 2014).

8 Joseph Schumpeter, *Capitalism, Socialism, Democracy* (Harper Perennial, 2008).

9 Giles Slade, *Made to Break* (Harvard University Press, 2006).

10 Deborah Davis, *The Consumer Revolution in Urban China* (University of California Press, 2000).

11 Adam Blair, "China Offers 'Strong Financial Support' to Help Boost Recycling of Household Appliances," *Retail TouchPoints*, April 15, 2024, www.retailtouchpoints.com/features/news-briefs/china-offers-strong-financial-support-to-help-boost-recycling-of-household-appliances.

12 Jiahui Huang, "China Releases Details of Trade-In Program for Consumer Products," *Wall Street Journal*, April 12, 2024, www.wsj.com/economy/china-releases-details-of-trade-in-program-for-consumer-products-25a8c249.

13 Joshua Goldstein, *Remains of the Everyday* (University of California Press, 2021).

14 Zsuzsa Gille, *From the Cult of Waste to the Trash Heap of History* (Indiana University Press, 2007).

15 Peter Little, *Toxic Town* (New York University Press, 2014).

16 Peter Little, *Burning Matters* (Oxford University Press, 2022).

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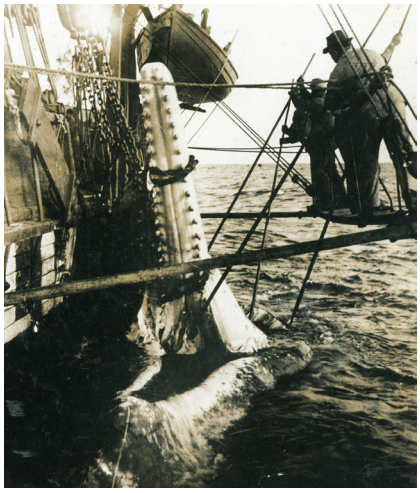
Opening image on p. 12: Junk Old Computers in Stacks. BY DANIEL DAN VIA PEXELS

21

Beam Ends

How whaling history lives on
in Nantucket's energy politics

Jamie L. Jones



↑ Hoisting in the lower jaw of a sperm whale, with four crew men on a catwalk, suspended from the ship Daisy, c. 1912. PHOTO BY ROBERT CUSHMAN MURPHY. COURTESY OF THE NANTUCKET HISTORICAL ASSOCIATION

Two centuries ago, Nantucket was a major producer of whale oil,

the proto-energy resource that illuminated Great Britain and the young United States. After commercial whalers serially depleted whale populations close to shore, they had to venture farther afield. By the early 1800s, Nantucketers were leaving the island in whaling ships bound for the Pacific Ocean, returning years later with hulls full of oil. The US market for whale oil continued to grow along with the settler nation until the 1860s, when petroleum from the Pennsylvania oil boom pushed whale oil out of the market.

Today, Nantucketers profit from other big businesses, such as residential real estate and tourism. And where workers once prayed for the sight of spouting whales on the horizon, some Nantucketers are trying to halt another energy industry bursting into their view: offshore wind power. The offshore wind farm Vineyard Wind is currently being built in the waters south of Nantucket. When completed, it is expected to supply the grid with enough electricity to power four hundred thousand homes.[1] Vineyard Wind is still growing, its turbines rising in sight of Nantucket's south shore beaches. There she blows.

While protesters decry the wind farm's proximity to the island, Nantucket's obsolete whaling industry still haunts public life. Whales are the main feature of Nantucket's vernacular design and style. A spouting sperm whale adorns the Nantucket town seal. The local brewery's signature beer is Whale's Tale Pale Ale. Nantucket is an epicenter of Ivy style, famous for the salmon-colored go-to-hell pants known as Nantucket Reds. The iconic pants are sold exclusively by Murray's Toggery here in town, and sometimes adorned with embroidered whales. Murray's even sells whale-pant pants, embroidered with tiny representations of the iconic whale pants.

Whaling on Nantucket has become what Raymond Williams called "residual culture": a culture of the past that remains an active and "effective

↑ The Whale Fishery “In a Flurry.”
LITHOGRAPH BY N. CURRIER. COURTESY OF THE NANTUCKET HISTORICAL ASSOCIATION

“Residual culture is one of the ways that obsolete things persist. It is also an underappreciated feature of energy transition.”

“Nantucket’s relationship with whaling shows obsolescence to be a process of partial persistence and selective memory.”

element of the present."[2] The uncanny return of whaling heritage in present-day Nantucket demonstrates just how powerfully obsolete technologies and dead industries can shape local economies and environmental practices. Residual culture is one of the ways that obsolete things persist. It is also an underappreciated feature of energy transition.[3]

"Energy transition" is a deceptive term. The history of energy is not a neat procession of different energy regimes, but a messy entanglement of resources and infrastructures that never really go away. The whale oil industry was brought to its end by a successor oil, petroleum. But as a residual energy culture, whaling performed cultural work in the early days of fossil fuel modernity, shaping the labor and infrastructure of petroleum extraction as well as the terms by which Americans understood modernity. And whaling is still at work on Nantucket today.

Nantucket's relationship with whaling shows obsolescence to be a process of partial persistence and selective memory. Commercial whaling in Nantucket is a case study in extractive capitalism. It produced wealth for a few, but labor exploitation for most. Its annals contain the familiar fare of environmental degradation, imperial expansion, industrialization, and rough economic cycles of boom and bust. Some of the foremost whaling historians in the world steward the presentation of this bloody industrial history at the Nantucket Historical Association and its flagship Whaling Museum. But Nantucket's charm can lull visitors and locals alike into simpler, more selective historical understandings, which conveniently offshore extractive violence when explaining the island's wealth.

↓ Splendid restored houses on upper Main Street. At center, Hadwen House, built in 1846 together with its twin next door by whaling merchant and silver retailer William Hadwen. PHOTO BY JAMIE L. JONES

These selective renderings of history invite the island's visitors and residents to imagine that Nantucket's present-day conspicuous wealth has a deep history reaching back to the whaling days. Weathered shingles make manicured historical houses and new mega-mansions just quaint enough: they refer to that nineteenth-century past without making anyone think about extractive violence. The luxury landscape also hides the fact that whaling wealth left Nantucket in the mid-nineteenth century, leaving houses derelict and residents impoverished for decades, before summer tourism emerged as the key industry it is today. The island's current prosperity owes much to part-time summer residents who bring considerable wealth with them.

The median sale price for a home on Nantucket hovers around $3 million. The record for the island's most expensive residential real estate was broken last summer, when the 3.5-acre waterfront estate called Beam Ends sold for $38 million. Whaling history is written—often apocryphally—into real estate listings for such summer mansions. The real estate agent who sold Beam Ends told the local news outlet, the *Nantucket Current*, about the property's connection to whaling history: "The purchasers are an old New England family who we feel will be respectful stewards of the property and appreciate its history which included ownership by a whaling captain a century and a half ago."[4] The main house at Beam Ends was built in 2008.

The debate over offshore wind power on this tony island does not fall exactly into familiar NIMBY protocols. Offshore wind generally divides people along political party lines. Many on the left support offshore wind development because wind is a renewable energy resource that will lessen dependence on fossil fuels and mitigate the damages of climate change. Those on the right tend to oppose climate change mitigation in favor of protecting fossil fuel jobs, infrastructure, and financial interests. Wealthy liberals have also historically opposed offshore wind turbines sited too close to their properties. But this time, offshore wind opponents on Nantucket and elsewhere are attempting to stop turbine construction on behalf of—you guessed it—whales.

← Wind Turbines, New Brighton. commons.wikimedia.org/wiki/File:Wind_Turbines,_New_Brighton_-_DSCF2299.JPG#metadata. CREATIVE COMMONS LICENSE (CC BY-SA 3.0). COURTESY OF GREEN LANE

↑ A piece of astroturf washed up on Sconset Beach, evoking the island's possibly astroturfed, possibly grassroots resistance to wind energy. PHOTO BY JAMIE L. JONES

On Nantucket, a group called ACK4Whales is attempting to halt offshore wind development on the grounds that wind turbines endanger whales. (ACK is the island's airport code and a popular insider shorthand for the island.) ACK4Whales is focused on threats to critically endangered North Atlantic right whales, which feed off the coast of New England. The group raises valid concerns about how a massive offshore infrastructure project will—at best—interrupt the lives of whales. But there are reasons to wonder how much offshore wind opponents actually care about whales. Protecting these marine giants should also surely mean caring about climate change, ocean acidification, ship strikes, and the offshore oil and gas infrastructures that are also, demonstrably, *very bad* for whales. But this latest phase of the "save the whales" campaign is focused very narrowly on the offshore wind threat.

Nantucketers are not the only people protesting wind power on behalf of whales. Offshore wind's threat to whales has made its way into regional and national right-wing political rhetoric. Even Donald Trump has weighed in, claiming that offshore wind turbines "drive whales crazy."[5] Some believe that protest groups like ACK4Whales have not been organized at the grassroots level, but have instead been fabricated and astroturfed by distant right-wing groups interested in preserving the hegemony of fossil fuels.[6] On its website and Facebook group, members of the ACK4Whales network deny connections to fossil fuel interest groups and point out—rightly—that offshore wind companies are themselves enmeshed in fossil fuel interests.

Marine scientists at the National Oceanic and Atmospheric Administration state that there is no evidence that offshore wind causes whale deaths.[7] According to NOAA, the biggest threats to large whales are vessel strikes, entanglement in fishing gear, and climate change. Recently, NOAA

proposed to Congress a rule that would, according to its scientists, actually protect North Atlantic right whales: a speed limit requiring boats larger than thirty-five feet to reduce their speed to ten knots during critical times in the right whale's migration.[8] Commercial and sport fishermen, ferry operators, freight companies, town governments, and tourism industry leaders all along the East Coast are raising the alarm, claiming that the rule would devastate their businesses. The speed reduction proposal has made strange bedfellows of groups who are otherwise fighting one another on the issue of offshore wind.

On Nantucket, it might be too late for opponents of offshore wind to halt turbine production. During the permitting and public input process over four years ago, wind power developers struck a good neighbor agreement with the government of Nantucket and local heritage nonprofits.[9] During those negotiations, it was not whale welfare but Nantucket's whaling heritage that steered conversations about offshore wind. At that time, the negotiating partners tried to determine whether the wind turbines would have an adverse visual impact on Nantucket and thereby endanger its National Landmark status. The island claimed this status owing to its unique whaling heritage and its unbroken sea view, which planners call the "viewshed."

In 2024, I interviewed Mary Bergman, the executive director of the Nantucket Preservation Trust and one of the signatories to that good neighbor agreement. In compelling terms, she explained to me how climate change represents the biggest threat to Nantucket's heritage. "If we don't have an island because it's eroding into the sea, because the sea levels are rising, there's nothing to preserve. [Climate change is] a bigger threat to the landmark than seeing windmills on the horizon." The Nantucket Preservation Trust has created a Resilience Toolkit to help islanders deal with the imminent dangers of climate change. Bergman also brings a deep and complex understanding of Nantucket's history to debates about offshore wind. I asked her to think about why the blank ocean horizon has become a resource in need of protection. She said that it has to do with the idea of isolation, which is "integral to the way that Nantucketers think about themselves today."

It takes an enormous amount of energy, fossil-fueled and otherwise, to keep Nantucket feeling isolated: fuel for ferries, yachts, and ever-larger private jets; gas for the big four-wheel-drive vehicles required to navigate the island's unpaved roads; umbilical undersea power cables connecting the remote island with the grid. Intensive energy consumption makes it possible to enjoy wealth while remaining isolated from its origins or consequences—to wear whale pants without thinking too hard about harpoons.

Isolation is a myth in the age of climate change—particularly when whales, Nantucketers, and all the rest of us on the planet confront existential threats and our own implications in them. Herman Melville, that great chronicler of Nantucket whaling, disputed an earlier myth of isolation almost two centuries ago: "They were nearly all Islanders in the Pequod, *Isolatoes* too, I call such, not acknowledging the common continent of men, but each *Isolato* living on a separate continent of his own. Yet now, federated along one keel, what a set these Isolatoes were!"[10] We, on Nantucket and off-island, too, are a set. Climate change federates us. It *is* ironic that last summer's real estate blockbuster is called Beam Ends, because to be on "beam ends," in nautical parlance, is to be in dire circumstances, blown over, helpless. In the age of climate change, we are all at beam ends—and confederated along one keel. ■

↓ **NOTES**

1 Stanley Reed and Ivan Penn, "A Giant Wind Farm Is Taking Root Off Massachusetts," *New York Ti mes*, June 28, 2023.

2 Raymond Williams, *Marxism and Literature* (Oxford University Press, 1977), 122.

3 Jamie L. Jones, *Rendered Obsolete: Energy Culture and the Afterlife of U.S. Whaling* (University of North Carolina Press, 2023).

4 Bruce Percelay, "$38 Million Sale of Monomoy Home Breaks Island Record," *Nantucket Current*, June 30, 2023.

5 Lisa Friedman, "No, Wind Farms Aren't 'Driving Whales Crazy,'" *New York Times*, February 16, 2024; Molly Taft, "The Latest Culture War Starts with Dead Whales," *New Republic*, November 15, 2023.

6 Molly Taft, "The Latest Culture War Starts with Dead Whales," *New Republic*, November 15, 2023; Climate Nexus, "Offshore Wind and Whales," *Climate Nexus* blog, January 2024.

7 NOAA Fisheries, "Frequent Questions—Offshore Wind and Whales," *NOAA Fisheries* blog, June 1, 2024.

8 Michelle Gustafson, "A Boat Speed Limit Is Pitting Yacht Owners against Whale Lovers," *Wall Street Journal*, March 14, 2024; John Carl McGrady, "'Devestating' Speed Restriction Proposal Gains Momentum in D.C., Prompting Alarm on Nantucket," *Nantucket Current*, May 23, 2024.

9 Nantucket Parties, "Good Neighbor Agreement," Government of Nantucket website, accessed August 24, 2024.

10 Herman Melville, *Moby-Dick* (1851), Third Norton Critical Edition, ed. Hershel Parker (W. W. Norton, 2018), 101.

JAMIE L. JONES is an Associate Professor in the English Department at the University of Illinois at Urbana-Champaign. Her most recent book is *Rendered Obsolete: Energy Culture and the Afterlife of U.S. Whaling* (University of North Carolina Press, 2023).

Opening image on p. 20: Tail of a Humpback Whale. BY SILVANA PALACIOS VIA PEXELS


RIGHT TO
REPAIR
NO
PLANET
B
REPAIR
FOR
FUTURE

Kyle Wiens

The movement to fix broken things

↑ Man driving a John Deere tractor, pigs and corn crib in the background, Iowa / WKL. Iowa, 1963. BY WARREN K. LEFFLER, COURTESY OF U.S. LIBRARY OF CONGRESS

In 2023, Colorado farmers won back the right to repair their own tractors.

John Deere, one of the world's largest producers of agricultural equipment, sold machines with proprietary software that made independent repairs almost impossible. Locked out of their equipment's operating systems, some American farmers hacked their way in. Others turned to the political and judicial systems. Supporters of Colorado's Consumer Right To Repair Agricultural Equipment bill faced stern resistance and high-dollar lobbying—not only from John Deere, but also from large technology companies and the trade associations that represent their interests. Clearly, there was more at stake than tractors.

This case, featuring a veritable icon of America's heartland, is emblematic of the broader Right to Repair (R2R) movement. The premise of the R2R movement is simple: to ensure that individuals and independent repair shops have the information, tools, and parts to fix their own stuff. The stakes of this fight are personal and planetary. Landfills across the world are overflowing with e-waste and unfixable technologies. And the human and environmental consequences are only getting worse.

A significant actor in this struggle is Kyle Wiens, chairman of the advocacy group Repair.org and founder and CEO of iFixit.com, a free online repair manual. Long before Wiens slung his first stone at Big Tech, his grandfather would take him to thrift shops to buy printers and other devices to take apart and reassemble. Those childhood experiences instilled a keen interest in technology. As the tinkerer grew into an engineer, Wiens became increasingly concerned about where the treadmill of innovation and obsolescence was taking us. He now stands as a key player in the Right to Repair movement, leading initiatives, driving legislation, and speaking widely on the importance of repairing what is broken.

Limn sat down to speak with Wiens about his life and work. Below are excerpts from our conversation on May 15, 2024. →

↑ Ghanaians working in Agbogbloshie, a suburb of Accra, Ghana, 2011. en.m.wikipedia.org/wiki/File:Agbogbloshie.JPG.
CREATIVE COMMONS LICENSE (CC0 1.0). COURTESY OF MARLENENAPOLI

TOWNS MIDDLETON Kyle, how did you get involved with the Right to Repair movement?

KYLE WIENS We started iFixit because we were interested in technology and fixing things and trying to pay our way through college. After graduating, my co-founder and I traveled around the world. We went to Ukraine and Russia and all over Africa, investigating: How do people use things? What are the needs globally? I went to Agbogbloshie, the electronics market and scrapyard in Accra, Ghana. Around it, there are all these repair markets, where the workers were making more money than the kids burning electronics. When we asked them how they learned to repair things, they said, "We just Google it." This inspired us to think: what could we do to transform the jobs burning copper and move them up the food chain?

So the idea that emerged was: we're going to make repair manuals for everything and put it all out there for free online. We'll write repair manuals for all the Logitech products and show them that this is a better way. We thought they would instantly see the obviousness of what we were doing and want to work with us. We spent ten years tilting at that windmill and completely failing.

Then, we started working with the Global Electronics Council's EPEAT environmental standards and trying to use those benchmarks to influence manufacturers. But we quickly realized that the regulatory process had been totally co-opted by the manufacturers. There was this big moment in 2012 when Apple rolled out the first new MacBook with glued-in batteries. There's language in the Green Laptop Standard that said that a laptop must be readily disassembled with commonly available tools. So we went to the Global Electronics Council and said, "This laptop does not meet that standard." We disassembled it for them and showed them the process. I was like, "You can't do this in a non-destructive fashion." But then Apple showed them that there was a technique. My theory is that they just took a sledgehammer to it, like, "Look! We took it apart. It didn't say it needed to be reversible."

We got the White House involved. The city of San Francisco said they weren't going to buy Apple products for a little while. But, ultimately, we realized that engaging these environmental standards was futile. There was too much money on the line. The manufacturers were sending lawyers into the process, and their only job was just to make sure the standards didn't get better.

We had tried collaboration and the carrot approach. It didn't work. We realized, OK, we're going to have to pass laws. So I started building the coalition and looking for an easy win. The easy win that we identified was the cell phone unlocking bill. When the Library of Congress decided that unlocking cell phones without the carrier company's permission would violate copyright laws, the US became, in 2012, the only country in the world where it was illegal to unlock a cell phone, which is ludicrous to anyone who travels internationally. So we helped augment a White House petition that Sina Khanifar put together. The White House replied, and basically said, "Yeah, we agree. Congress should do something." It was kind of common sense. And it was a relatively easy lift to get it through Congress. [The Unlocking Consumer Choice and Wireless Competition Act officially passed in 2014.] OK, cool, we passed a bill. It wasn't a repair bill, but it had huge positive environmental impacts. After that, it took us another nine years to get enough momentum to actually start passing state-level Right to Repair bills. We have introduced hundreds and hundreds and hundreds of bills, and we've passed seven.

↑ Assorted Camera Parts. BY KEI SCAMPA VIA PEXELS

TM Why the long odds?

KW The corporations registered to lobby against us in New York State alone have a cumulative stock market value (market cap) of more than ten trillion dollars. It's very easy to stop legislation. The lobbyists are pretty savvy. They tend to stop it quietly behind the scenes. It dies in rules, or it dies without a vote. We've gotten very few up or down votes that we've lost.

ASHLEY CARSE In a 2023 interview with the New York Times, you mentioned the cultural prohibition that exists around taking technologies apart. When you brought an iPod into a place where kids were hanging out and asked them to open it up, they looked at you like you were crazy. That seems to speak to this question about how you change the culture around repair.

KW We brainwash kids into not taking things apart. I'm aware that part of raising children is, "Please don't take that thing out of the drawer." But somewhere in that process we convince them not to open anything up. We remove that curiosity. And it's baked deep into the psyche. You have to reverse that. It doesn't take much. Once you give them a printer and a screwdriver, they have a blast. And they never stop. That's a life-changing moment that ninety-nine percent of the population never gets.

TM I want to ask you a more conceptual question. Much of what you're up against could be called planned obsolescence. But there are other kinds of obsolescence out there, right?

KW The framing of planned obsolescence really gets manufacturers' hackles up. This is justified, because there is not a smoke-filled room where they're sitting there saying, "How are we going make our product die in exactly warranty-plus-one-day?" But they *are* choosing to prioritize investment in new software features rather than security updates for seven-year-old devices. That's not mal-intent. But it is a mal-allocation of resources with lots of long-term societal implications.

AC You were talking about how you traveled to Russia, Ukraine, and Ghana. But it seems like a lot of iFixit and

the Right to Repair movement has been focused on North America and the North Atlantic world. How do you think about obsolescence and repair outside of that context?

KW The number one requirement for me—and *all* the Right to Repair movement—is that the information has to be freely available. A dollar is too much. A log-in barrier is too much. The information has to be dispersed as widely as the products are. I know a refurbisher in South Africa where they track the serial numbers of computers, and they have sold the same computer three, four, five times. The best way to get technology into the hands of people that need it—to bridge the digital divide—is to make the product last long enough for it to be able to get there.

GÖKÇE GÜNEL What's the biggest thing on your agenda these days?

KW Parts pairing is number one. [This is the growing trend of manufacturers incorporating software into their products to block would-be repairers from using salvaged parts.] We've spent the last six to nine months stymying Apple on that. We got two laws passed. Then we're working on ratcheting up for Right to Repair laws for next year.

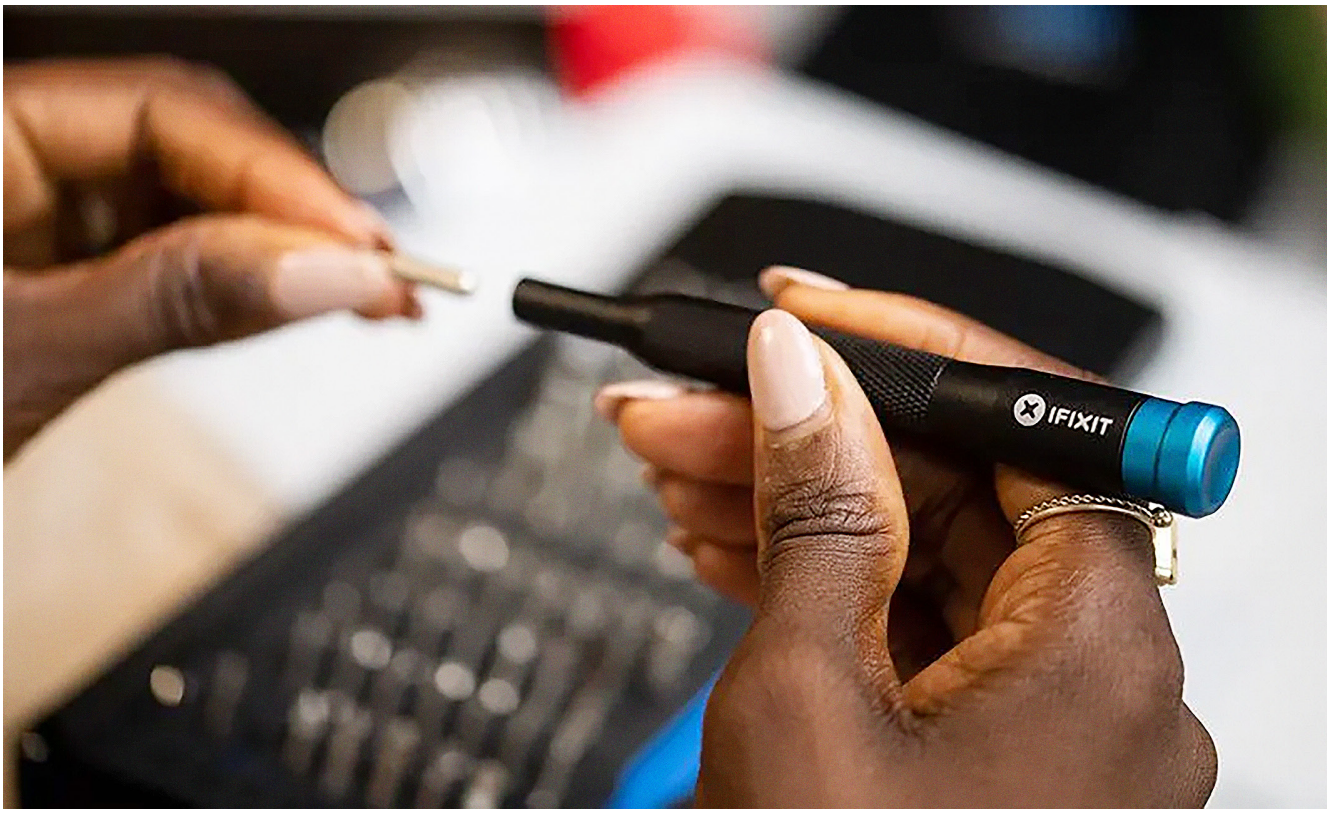
If you take the long-term view and ask, "What's the inflection point that's happening around obsolescence or short-lived products?" Right now, it's the integration of software into things that didn't have software before. The addition of a microchip is a fundamental pivot point. It prevents things from lasting. Why is the lifespan of a refrigerator or a washing machine only seven years? It's because of a capacitor or something inside it that didn't need to be there in the first place. We have to push back against that and try to get as little electronics in things as possible. But then, when we do, we've got to find ways of repairing those.

Another important area is consumer behavior research. How do we get people to bias toward higher-quality, longer-lasting products? There's been great work at PLATE, the Product Lifetimes and the Environment Conference, showing that if people know something is repairable, if they have information up front, it can change people's buying behavior. This would then drive product designers to invest in making things modular and repairable. The French Repairability Index that has come out is hugely effective in this area. Until we fix the signal at purchase time, the problem is only going to keep getting worse.

But to your question, Gökçe, of where we are at present: You get the sense that we are just wandering through the wilderness, trying to nudge the world in a better direction and pulling on every lever that we possibly can in order to get there. ■

↓ iFixit tools at work. COURTESY OF KYLE WIENS

Opening image on pp. 28–29: The R2R Movement in Action. COURTESY OF KYLE WIENS



Art Beyond Waste

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An artist reimagines objects discarded in Accra’s vulcanizer shops

Dela Anyah


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FAVOUR OF GOD

My artistic exploration centers on the discarded objects within vulcanizer and mechanic spaces, delving into their histories and potential futures. This fascination is deeply rooted in renewal, self-discovery, and transformative change, echoing throughout my personal life and creative production. Using found objects like tires, inner tubes, license plates, and bicycle rims, I craft new forms that weave the stories of forgotten materials into works of significance. Ultimately, my artwork aims to infuse vitality into seemingly mundane objects, celebrating the potential for renewal in what may appear lifeless or resigned. My work explores the value in the overlooked, the failures of the transportation industry in managing its waste, and the environmental impacts of improper disposal practices. With a focus on rebirth and revitalization, I draw parallels between the transformation of discarded objects and the human experience.

A typical day of scavenging for materials starts with a trip to a preselected destination, often chosen based on previous experience. There is no set routine, but one thing is certain: I can’t resist the allure of repair shops along the way. The more forlorn an object appears, the more captivating it becomes. It is in these overlooked and undervalued items that I see potential for transformation. Drawing inspiration from fashion, where ordinary fabric is turned into wearable forms, I borrow various weaving techniques as a primary method of upcycling, knitting together the discarded objects I find.

Vulcanizer shops are a common sight in Ghana. They are hard to miss—usually overflowing with old or discarded tires serving as signboards to alert drivers in need of repair services. A day in the life of a vulcanizer entails patiently waiting for a car with damaged tires to pull up. The vulcanizer either repairs the tires, or replaces them with new or second-hand ones. Drivers usually leave their old tires at the vulcanizer shop. As a result, these places of repair become waste dumping sites for old tires, the value of which drops exponentially. Vulcanizer shops are an environmental hazard: the water that collects inside discarded tires is a perfect breeding habitat for mosquitoes, increasing the risk of malaria.

Due to low demand and abundant supply, abandoned tires cost next to nothing. Prices range from about a thousand Ghanaian cedis for a new tire, to one cedi or even zero for an abandoned tire. These tires are everywhere, scattered across shops and street corners, so charging any more will only cause a buyer to walk a few steps and find another one. Sometimes, I get lucky and acquire items for free; other times, I negotiate a price based on the weight of the sack I take.

Vulcanizers often ask me how I will use these discarded objects. In the simplest terms, upcycling is what I do, but upcycling alone does not necessarily give an object new meaning. Transforming discarded objects into art is not merely about repurposing materials, but also about reshaping perspectives and narratives. As I stand outside a vulcanizer shop, negotiating for discarded tires, I am reminded of the intricate interplay between value and perception. These spaces, normally deemed waste dumping sites, become a fertile ground for artistic exploration and social critique. Through my artistic interventions and creative process, each piece tells a resurrection story. As I navigate these spaces and exhibit completed pieces, engaging with the community and reclaiming the discarded, I hope to inspire introspection, instill hope in the possibility of new beginnings, and spark conversations about value and creativity. I invite others to see the beauty and potential in the overlooked, and to embrace the power of transformation in their own lives.

PORTRAIT ON P. 36 BY AARON ASHITEY, 2023. COURTESY OF DELA ANYAH
PORTRAIT ON P. 38 BY MICHAEL DAKWA, 2022. COURTESY OF NOLDOR ARTIST RESIDENCY
PORTRAIT ON P. 43 BY OHENE KAY, 2023. COURTESY OF DELA ANYAH
ALL OTHER IMAGES BY DELA ANYAH

DELA ANYAH is a Ghana-based artist, who reimagines discarded materials—such as inner tubes and tires—into sculptures that explore themes of rebirth and identity. His work critiques conventional notions of value, emphasizing narratives of renewal and the socio-cultural implications of waste and sustainability.
You can learn more at delaanyah.com.


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The Tighty-Whities Test

Why are farmers burying underwear in their fields?

Keren Reichler

↑ Decomposition of underwear buried in five sites with distinct soils. Oregon City, Oregon, 2019. PHOTO BY LISA KILDERS, CLACKAMAS SOIL AND WATER CONSERVATION DISTRICT

David, a soil scientist

with a molecular biology PhD from Stanford, described a soil test that many farmers use: "You take a pair of tighty-whities, you bury them in the field at the beginning of the season, and you can measure the biotic life in the soil by how degraded the tighty-whities are at the end of the season." He had learned about this low-tech soil test during a sales meeting with "pretty old-school farmers" while working for a Silicon Valley start-up that develops AI-based soil sensors and diagnostic tests. In recounting this story, he expressed admiration for the farmers' scrappy ingenuity mixed with a sense of bewilderment. As he recalled, "We had developed this sophisticated set of models with eight or so PhDs and some very impressive tech. But our test really couldn't beat the tighty-whities test, and it also cost the farmer a bunch of money."

He expressed some humility in sharing the tighty-whities story with me, but ultimately, he believed that innovation in agricultural technology would soon make this "classic farmer hack" obsolete. In the meantime, the tighty-whities test provided a yardstick for David and his team to develop a product that could rival underwear in its utility and cost. To do this, they mobilized the promise of precision, something the underwear could never provide.

David is one of many engineers, scientists, and entrepreneurs worldwide working on technology for agricultural production, at times referred to as AgTech or "precision agriculture." In the context of increasingly unpredictable climate patterns and rising demand for food and biofuels, emerging agricultural technologies aim to help growers maximize crop yields, reduce synthetic inputs, and conserve water and land through digital tools. This vision of a digital revolution in agriculture requires a sensory infrastructure of networked devices—such as drones, robots, and in-ground sensors—to provide real-time data on agricultural conditions, often using machine learning and artificial intelligence.

For industry actors, the underwear test is both an object of concern and a quintessential "other" against which to define the aspirations of AgTech. Tighty-whities cannot stream real-time information, nor can they connect to a mobile app. They require neither special expertise, nor sophisticated lab instruments to translate their findings. Yet growers read the underwear for valuable data that informs their decision-making. Even as the imperatives of precision and prediction drive mainstream AgTech, the underwear test exposes competing assumptions—about how farmers can best *know* the farm,

what counts as valuable data, and how or by whom decisions about the farm should be made. Therefore, underwear is an unlikely but revealing object for exploring the tensions raised by AgTech, and for showing how claims of obsolescence are interwoven with discourses of innovation. Digital technology increasingly mediates agricultural practices, often proposing to disrupt or revolutionize the agricultural sector with claims of increased efficiency, higher yields, and more sustainable practices. Critical questions then surface about the role of farmers, and about what kinds of farming futures are being brought into being.

A BRIEF HISTORY

Cotton briefs, later termed "tighty-whities," were designed by Arthur Kneibler, who was inspired by the tight fit of a French swimsuit, as well as by the design of the jockstrap. First introduced as "jockey shorts" in 1935 by the Cooper Underwear Company, now known as Jockey, they sold out quickly at the Marshall Field's department store in Chicago. Made of one hundred percent cotton with an elastic waistband, they had a snug, legless fit and a front Y-seam. The briefs were embraced as a revolutionary design. In the decades that followed, marketing campaigns highlighted their sex appeal. No longer a modest, invisible undergarment, they were rebranded as an article of clothing worthy of attention.

→ Jockey Underwear Advertisement, Life Magazine, March 27, 1950. openverse.org/image/1d3b7f59-2b13-43fb-9f1d-a10bc94ddf85. CREATIVE COMMONS LICENSE (CC BY 2.0). COURTESY OF SENSEIALAN

→ A cotton strip to study microbial activity and diversity, recovered from a field. Brookings, South Dakota, 2020. PHOTO BY ANTHONY BLY, SDSU EXTENSION SOILS FIELD SPECIALIST. COURTESY OF SDSU EXTENSION [2]

At some point, farmers transformed these undergarments into instruments of agricultural revelation. A quick internet search yields dozens of news articles and blog posts showing farmers standing in their fields, proudly holding up unearthed underwear stretched between their hands. (In the ideal scenario, only the elastic waistband remains, demonstrating abundant biotic life in the soil.) Initiatives led by agricultural research institutes, extension services, and university soil scientists have encouraged hundreds of underwear tests. Cheeky campaigns like #SoilMyUndies, shared via social media platforms and associated with regional farming networks, have spread across the United States, Canada, Australia, and the United Kingdom, emphasizing the importance of soil health, and encouraging no-till and reduced tillage practices.

The origins of the tighty-whities test are difficult to pin down. One California-based campaign facilitator jokingly suggested that loincloths were buried beneath the soil of the Fertile Crescent. A clearer connection can be traced to the British textile industry in the 1940s, when strips of cloth were buried in soil to measure the effectiveness of fungicides. A standardized cotton strip test was developed in the Netherlands in the 1960s and updated in the UK in the 1970s to study cellulose decomposition.[1] Although originally intended to study the properties of fabrics, it was eventually reversed to study soils. The International Biological Program used the cotton strip test to investigate decomposition cycles in various ecosystems around the world, and is often credited for the widespread adoption of the cotton strip test among environmental scientists. How exactly this practice got taken up by farmers remains a mystery, although it's not difficult to imagine resourceful farmers using an old pair of briefs to replicate the test in their own fields.

This would not even be the first time that underwear made its way into agricultural fields. In the days when most clothing was made of natural fibers and leather, old textiles were removed from cities in Europe and added to farm fields along with sewage and manure. This practice ended during the industrial revolution, when cotton rags became valuable as material for making paper. Later on, in several European countries, the burial of natural textiles was again taken up between the great wars to build soil fertility. An even deeper history implicates underwear with the violent and racialized labor history of cotton production, the first global commodity sustained by the transatlantic slave trade. Far from being a neutral tool, the threads of cotton that make the tighty-whities test relevant to soil measurement are entangled in a long, brutal history of global industrialized capitalism and technological innovation. Even an apparently simple hack has complex roots.

SENSING WITH UNDERWEAR

Given advancements in science and technology that promise more complex soil assessments, what makes the tighty-whities test so persistent? Underwear is cheap and easy to acquire. The elastic waistband makes it easy to locate the decomposed underwear at the end of the experiment since it can't degrade. In contrast to the definitive analytics produced through many mainstream AgTech evaluations, the underwear test encourages a dialogic and open-ended analysis. The farmer can interpret the underwear in context to gain valuable insights, making connections between countless interacting variables that shape the soil's ecology.

The underwear also offers a welcome antidote to the disempowering doom-and-gloom narratives about the current state of food production. With

↓ Dr. Oliver Knox (right), soil scientist and Soil My Undies campaign champion, holds up a pair of unearthed undies alongside Tim Thompson (left), agriculturalist and educator. Armidale, NSW, Australia, 2023. PHOTO BY DR. IVANAH OLIVER

extensive topsoil erosion, herbicide toxicity, biodiversity loss, and acute and chronic human health impacts caused by corporate-driven agricultural production, it can be overwhelming to find a way forward. It can also be easy to take soil for granted and thus forget the importance of good stewardship. As a citizen science project, the underwear test offers a playful encounter with soil and community, in contrast to the expert-dominated and often inaccessible language of climate and agronomic sciences. Journalists have leaned into the rakish quality of the test, using titles like "I see London, I see France, Farmers Buried Underpants" and "Bury Your Briefs" to bring attention to the cause. Without diminishing the severity of the challenges at play, underwear invites a wide array of people to actively engage with soil as an essential part of life.

"The persistence of the tighty-whities test unsettles the entrenched ideas of progress that are often tied up in technological innovation, including the idea that other modes of knowing will inevitably become obsolete."

RETHINKING INNOVATION

Some AgTech industry professionals describe farmers as "stuck in their old ways" or "too old" to appreciate the value of adopting innovative technologies. But my conversations with growers reveal a more complex set of considerations. Most farmers don't operate according to binaries of high versus low technology. Rather, they mix and match technologies and practices that support their needs, often embracing hybrid approaches. The underwear test coexists alongside multiple ways of knowing the soil, which can also include mailing a soil sample to a laboratory, or comparing notes with other farmers in the region.

Farmers often describe a desire for autonomy and agency in making decisions about the tools they use and how they use them. Rejecting the role of adopters of technologies developed by others, many farmers prioritize active participation in technology development, including managing and sharing data collected about their farms on their own terms. Several grassroots collaborations have emerged across the globe to support this mission, bringing farmers and engineers together to build alternatives to business-as-usual corporate technology development. Innovations range from bicycle-powered threshers to open-source digital applications that enable farmers to manage and share data about their operations.

In December 2023, I visited a farmer in California who had been testing prototypes of small soil sensors designed by a venture capital-funded technology start-up. When I asked about the sensors, he laughed, admitting that he had recently driven over them with his tractor while preparing his fields for planting. Climbing out of the tractor to remove each sensor from the ground felt like a waste of time and energy. The promise of the prototype had been superseded by the immediate imperatives of farm work. Shoved into the ground

and broken, those sensors' plastic parts were destined to leach into the soil and waterways over ages. Yet a pair of buried tighty-whities might have survived the tractor work, passing its days below ground, and slowly decomposing with the biotic life of the soil.

Perhaps this encounter demonstrates the enduring quality of "outdated" or "simplistic" technology in the face of supposedly superior digital technology. The underwear test also reveals a more subtle dynamic at play. Rather than marking a wholesale rejection of digital technology, the persistence of the tighty-whities test unsettles the entrenched ideas of progress that are often tied up in technological innovation, including the idea that other modes of knowing will inevitably become obsolete. Even in its most rudimentary form, reading unearthed underwear for insights about soil requires a careful practice of sensing and knowing the land. Farmers and soil scientists alike suggest that considerations such as time of year, location, and depth of underwear burial affect the readings, which shows how even a supposedly simple method involves complexity.

AgTech's claims about obsolescence also extend to farmers who are told *they* will become obsolete if they don't embrace the latest digital technology—autonomous and remote sensing tools that redefine the role of the farmer. The idealized future farmer no longer needs to walk the fields daily or even live near the farm. The underwear points to a different way forward, where the farmer remains integral to the practice of soil stewardship, incorporating real-time sensing with historical and embodied knowledge. Instead of moving decision-making away from the farm, the underwear test encourages farmers to become even more intimate with their soils.

AgTech aims to make the underwear test obsolete through digital innovation, while employing a strategy of planned obsolescence for its own products. Farmers are expected to continually adopt the latest digital tools to stay relevant. Claims about obsolescence are often mobilized to benefit corporations rather than farmers or the soils they care for. In stark contrast, the underwear test relies on an everyday object that gets repurposed. It offers an alternative, perhaps more ecological paradigm of durability—one based on transformation and decomposition.

Let's not romanticize underwear as a silver bullet or an ingenious hack. This would perpetuate the misguided solutionism that characterizes mainstream technological innovation. Rather, the underwear can be celebrated for its capacity to shape knowledge and practice—a capacity which resists the current order of expert-driven soil science and profit-motivated technology design, in favor of a more accessible, participatory, farmer-led approach to knowing soils. From its origins in the cotton plant, fashioned into a garment, repurposed into a soil test, and finally decomposing back into the earth, the tighty-whities destabilize modern assumptions about what makes an effective technology. ■

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Opening image on p. 44: Collage of decomposed cotton briefs buried in sites across Australia. Armidale, New South Wales, Australia, 2021. PHOTOS BY DR. OLIVER KNOX, COLLAGE ASSEMBLED BY DR. KIERAN MEANEY

↓ **NOTES**

1 P. M. Latter and D. W. H. Walton, "The Cotton Strip Assay for Cellulose Decomposition Studies in Soil: History of the Assay and Development," in *Cotton Strip Assay: An Index of Decompostion in Soils*, eds. A. F. Harrison, P. M. Latter, and D. W. H. Walton (Institute of Terrestrial Ecology, 1988), 7–10.

2 Debankur Sanyal, Johnathon Wolthuizen, and Anthony Bly, "Cotton Strip Soil Test: Rapid Assessment of Soil Microbial Activity and Diversity in the Field," South Dakota State University Extension, updated November 17, 2020, `extension.sdstate.edu/cotton-strip-soil-test-rapid-assessment-soil-microbial-activity-and-diversity-field`.

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Refusing Abandonment

Cochlear implants deemed obsolete in one country become vital in another

Michele Friedner

with Areeba Fatima

It was December 23, 2023, 11:00 p.m., and my last night in Karachi.

On my way to the airport, I had one final stop: to thank and say goodbye to Javid Bhai, a leader in Pakistan's cochlear implant advocacy world.

Cochlear implants are surgically implanted electrode arrays combined with an external sound processor. They mitigate hearing loss by bypassing the inner ear structure and sending signals directly to the auditory nerve. Considered the gold standard in deafness intervention, they are expensive to purchase and maintain, and there is little state or nongovernmental support to reduce costs. Moreover, surgical skill and rehabilitation expertise are required before cochlear implants can result in listening and speaking children. Even then, there are no guaranteed results.

I had traveled to Pakistan to learn how families with implanted children were interacting with this relatively new medical technology. Javid Bhai, himself the father of cochlear-implanted twin girls, connected me with families and checked in with me daily during my visit. Indeed, everyone I met knew Javid Bhai, or Javid Brother. To families of children with the implants, he was like kin.

Javid Bhai and his daughters greeted me and my research associate Areeba Fatima, leading us down a series of lanes to his home. On the way, he chatted with us about the many WhatsApp groups of parents, cochlear implant distributors, audiologists, and speech and language therapists that he coordinates. He told us of a man in Karachi who needed a part, which Javid Bhai was able to provide thanks to his redistribution networks that spread from Canada to Saudi Arabia. He proudly explained that he was able to price the part for less than half of what the Karachi-based distributor would charge.

Javid Bhai then showed us a message on his phone. It was from a deafblind Pakistani man in North America who sends cochlear implant processors and parts from the US, Canada, Europe, and Australia. Considered obsolete in those countries, the devices take on new lives in Pakistan. The man was writing to say that he was sending over more parts. Javid Bhai then launched into a discussion of the intricacies of getting an older cable coil to work with a newer processor. I thought that it was too late at night, at least for me, to be talking about parts and prices. By contrast, Javid Bhai seemed like he could talk about these things forever. He took great pride in sharing the ins and outs of his redistribution networks, and the ways that he was able to provide families with parts that they would not otherwise be able to afford.

At his modest apartment, Javid Bhai brought out a large bag full of cochlear implant parts—battery chargers, batteries, magnet coils, cables. These were the parts that would keep his kin's and friends' implants working. Never mind that they were obsolete elsewhere. With the vital parts spread out across his coffee table, Javid Bhai explained that they were going to be given or sold to needy people cheaply. I asked his cousin and sister-in-law, who were sitting there watching us, if he often talked about cochlear implants. They smiled and confirmed that he was always on his phone, checking his WhatsApp groups to ensure he hadn't missed a message from a family in need.

I had been introduced to Javid Bhai three years earlier through a Pakistani mother living in Dubai. She had explained that cochlear implant surgery and maintaining the devices is prohibitively expensive in Pakistan. Some of the key challenges that patients and their families face after surgery are finding parts, mapping their devices, and connecting with speech and language therapists. It was then that she began to describe a distribution network cutting

↓ Advanced Bionics cochlear implant processor BTE. commons.wikimedia.org/w/index.php?curid=123633067. CREATIVE COMMONS LICENSE (CC BY-SA 4.0). COURTESY OF MIKECORE9918

→ Cochlear implant kit containing spare parts. PHOTO BY MICHELE FRIEDNER

→ Cochlear implant magnet cables. PHOTO BY MICHELE FRIEDNER

→ Cochlear implant cables in their original bag. PHOTO BY MICHELE FRIEDNER

across class and caste differences—where Pakistani families were working to support one another in the absence of state and corporate support. While very wealthy families can afford to go abroad for surgeries, device mapping, and rehabilitation, poor and middle-class people must cobble together funds and fend for themselves within Pakistan's unregulated cochlear implant market. She subsequently introduced me to Javid Bhai, who promptly added me to the WhatsApp groups that he administers.

For the past ten years, deaf people and their families in Pakistan have no longer been able to travel easily to India for surgery and support. India has a more well-established cochlear implant infrastructure; three of the main device manufacturers have headquarters there. Previously, Indian surgeons and company representatives would also travel back and forth to provide training and support. These relationships with Indian institutions and individuals no longer exist. With the distribution of care and parts hung up in geopolitics, I was curious how Pakistani families were coping.

"There is more at stake here than the threat and refusal of technological obsolescence. Families are also refusing to permit their children to become obsolete, or to be excluded from social, educational, and familial worlds."

Globally, cochlear implant processors have become obsolete at different times, depending on geographic location. Bracketing concerns here about sensory hierarchies and questions about what kind of processor is "good enough," a processor that is currently obsolete in the United States is still considered to be top-of-the-line in Pakistan. A processor that is no longer eligible for servicing or repair in the United States is still supported in Pakistan, and people are still able to get spare parts and repairs through local distributors.

However, these distributors are considered to be unreliable and corrupt, unmonitored by cochlear implant manufacturers, and their prices are prohibitive. To avoid usurious distributors, families and activists like Javid Bhai have formed informal redistribution networks fueled by supporters in other countries. These intercontinental networks enable the pooling of resources including funding, parts, and knowledge of the devices' intricacies. Families, in turn, have taken to repairing devices themselves. Within this geography of obsolescence, families have learned to keep their implants working, thus ensuring that their children do not go "off ear."

There is more at stake here than the threat and refusal of technological obsolescence. Families are also refusing to permit their *children* to become obsolete, or to be excluded from social, educational, and familial worlds. Their actions are especially notable at this current political and economic moment in Pakistan, in which disabled people are seen by mainstream society as having no future. A mother from a rural area who moved to Karachi to implant her child told me that she did this because the deaf people whom she knew in her village were nameless and excluded from social life. She refused this future for her child. In collectively refusing their children's obsolescence, mothers offer to teach and provide speech therapy to one another's children, and parents pool tips for home-based speech therapy practices, books to read and activities to do, and where to go for professional therapy. Families routinely donate funds to one another, and they provide encouragement and prayers.

I have argued elsewhere that obsolescence is not a neutral concept—that it produces abandonment, or a sense of being discarded and left behind.[1] When cochlear implant devices become obsolete, families frequently struggle to find funds for the "compulsory upgrade," as it is called. They experience obsolescence then as a betrayal of a promised present and future in which their children can hear. Pakistanis feel abandoned by cochlear implant corporations, leaving them vulnerable to untransparent price inflation by local distributors. If they complain to corporate headquarters, families fear that local distributors will blacklist them. "Why don't the corporations check up on us after surgery?"

is a common lament. "Why don't they come and see how we are doing? Why do they leave us at the mercy of these distributors?" The threat of technological obsolescence, as these statements attest, is closely tied to the realities of corporate abandonment. In fighting and circumventing this abandonment, families are refusing the abandonment of their children.

Javid Bhai introduced me to Umer Bhai, who owns a mobile phone repair shop in Lahore. Umer Bhai grew up with two siblings who wore hearing aids. Through trial and error, Umer Bhai slowly learned to repair these hearing aids for his family. After his own daughter was born deaf, he learned about cochlear implants, and he was able to have his daughter operated on through a charitable program. During his daughter's surgery, he met other parents who were in the hospital for the same reason, and they formed a small support group. After a few years, when the children's processors started showing wear and tear, Umer Bhai said that he would try to repair them, if the other families would support him. They said that they would. Similar skills, albeit a different device, and higher stakes.

Today, Umer Bhai is known throughout Pakistan (and according to him, throughout India and the Middle East) for his skill at fixing cochlear implants for a fraction of the distributors' fees. Recognizing the value of his abilities, Javid Bhai and a host of grateful parents collectively purchased a special microscope in order to support Umer Bhai's repair work. They call him Dr. Umer, in honor of his skills.

When I spoke with Umer Bhai, he contrasted the support that he provides to families against the support of corporations, distributors, and doctors, who he opined are only interested in profit, not in actual children. He does this work because he doesn't want children "off ear and not hearing" simply because of a processor not working. He is now so busy with implant repair work that his apprentices are responsible for his earlier business of mobile phone repairs. Umer Bhai is under constant stress, though—he gets calls from distributors threatening legal action against him, and calls from families frantic about getting their children's devices fixed. Still, he keeps on doing this work, even advising Indian mobile phone repair technicians on how to repair cochlear implants to expand the geographical reach of this network.

Javid Bhai and Umer Bhai are just two people who refuse to allow deaf children to become obsolete or abandoned, and in the process they take advantage of geographies of obsolescence.[2] To be sure, this is not an unusual story; other scholars and activists have chronicled how people in developing contexts have struggled to afford and maintain medical technology. Glucose strips and glucometers are well-explored examples.[3] There is also something uneasy about putting all of our hope in technology. In the cycles of innovation, these technologies will likely (and soon) become obsolete. All of these risks are especially pronounced when intersecting with the life-transforming rhetoric around cochlear implantation, which often frames this innovative technology as a cure for deafness. I wished that some of the families I'd met would learn Pakistani Sign Language and consider sending their children to deaf schools, which I and other deaf scholars and activists worry are also becoming obsolete; we see Pakistani Sign Language as important for resisting obsolescence and abandonment, as well as safeguarding against language deprivation.

But, there is much to be said for the work of refusing to allow children to go "off ear" through obsolete cochlear implants. This is work that involves vigilant attention—to WhatsApp messages; to sending, receiving, and redistributing small but consequential processor wires, batteries, and magnets; and to reinventing identities as redistributors and repairers of cochlear implants. ■

↓ **NOTES**

1 Michele Friedner, "Who Pays the Price When Cochlear Implants Go Obsolete?," *Sapiens*, March 29, 2023.

2 I am thankful to Kelly Fritsch for helping me think of abandonment in this way; she has a current project in which she analyzes the ways that a disability justice perspective means that we leave no one behind and that we refuse abandonment of people.

3 Amy Moran-Thomas, "Glucometer Foils," *Limn* 9 (November 2017).

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This research has been funded by the National Science Foundation (Grant #: 1922066).

Opening image on p. 52: Anatomical ivory model of ear. commons.wikimedia.org/wiki/File:Anatomical_ivory_model_of_ear_Wellcome_L0010001.jpg.

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When Crisis Calls

How the COVID-19 pandemic resuscitated old satellite technology in Thailand

Panita Chatikavanij

Like many other schools around the globe,

the daily routines at Wat Salakul School (WSS) were upended by the COVID-19 pandemic. Attached to a Buddhist temple on the small island of Ko Kret, this school of eighty-six students ranging from nursery to sixth grade had long relied on Distance Learning Television (DLTV) to overcome limited teacher allocation and the island's relative isolation—Ko Kret, on the Chao Phraya River just north of Bangkok, is only accessible by boat. Long before COVID-19, other Thai schools had gradually shifted to more advanced curricular platforms, leaving DLTV to underserved schools like WSS. When the pandemic struck, however, DLTV returned to the national mainstream as the preferred medium of learning. For WSS students and teachers, DLTV was already familiar. But in the throes of the pandemic, much of Thailand found itself encountering satellite-based DLTV as something newly necessary. To understand DLTV's uncanny return, and its enduring presence in far-flung corners like Ko Kret, one needs to go back a few decades to probe Thailand's royal tryst with technology.

In 1995, the Distance Learning Foundation, a royal initiative supported by King Bhumibol Adulyadej (Rama IX), spearheaded Thailand's nationwide Satellite Television for Distance Learning program. The project brought the Ministry of Education's General Education Department together with key partners to oversee the production of educational content. Private entities like Shin Satellite and public ones like the Telephone Organization of Thailand contributed technical and infrastructural support. At the heart of this initiative was Wang Klai Kangwon School, a privately owned institution of the royal family. The school served as the project's primary broadcasting studio. From this central hub, live educational broadcasts of DLTV were transmitted via satellite to schools across Thailand. Delivered through the benevolence of the king and the supervision of the General Education Department, the Distance Learning Foundation thus aimed to provide underserved areas access to quality education.

DLTV gained significant international attention in the 1990s, becoming a model for many other countries, including Laos, Vietnam, and Japan. Professor Dr. Duong Hong Quy, president of Vietnam's Technical University, expressed his admiration during a 1999 visit to the school where much of the content was being created. "Since the visit," he said, "we've dreamed of building a distance learning center similar to that in Thailand in our country."[1] Distance learning was integrated into Thailand's formal education system, with classrooms broadcasting live and offering innovative two-way communication capabilities—a remarkable feature for the 1990s, when videoconferencing tools like Zoom and Google Meet were not yet available. The project combined satellite technology with tools such as telephone, fax, email, and traditional textbooks. Teachers in rural schools could call or fax questions to the broadcasting classroom, which teachers at the studio could, in turn, address in real time. The Thai media heralded DLTV's distinctive design as "one of Thailand's greatest innovations."[2]

← A 1995 newspaper clipping featuring the inauguration of the Satellite Television for Distance Learning program, dedicated to the king's late mother, the Princess Mother Srinagarindra. COURTESY OF *DAILY MATICHON* [4]

↓ A 1993 newspaper clipping showing a pioneer in telecommunication—"'Thaicom': Thailand's First Satellite." COURTESY OF *THAIRATH* [5]

"In a crisis, the cutting-edge may not be always–or only–what is needed."

Despite its acclaim in the 1990s, the 2000s would see satellite-based DLTV become increasingly irrelevant in the eyes of the media, policymakers, and the public. The arrival of the internet and personal devices like tablets and laptops changed the educational landscape. In 2001, Thaksin Shinawatra, a policeman turned telecommunication tycoon, became Thailand's prime minister. He implemented several technology-related policies during his tenure, such as digitizing government services (e-Government) and launching the ICT Master Plan (2002–2006). He also drew inspiration from the One Laptop Per Child initiative that had been developed by the Massachusetts Institute of Technology to provide free laptops to children. With backing from the Thai state, the internet, laptops, and tablets became the technologies of the day in both education and politics. Satellite television and DLTV meanwhile took a backseat, becoming, for some, obsolete.

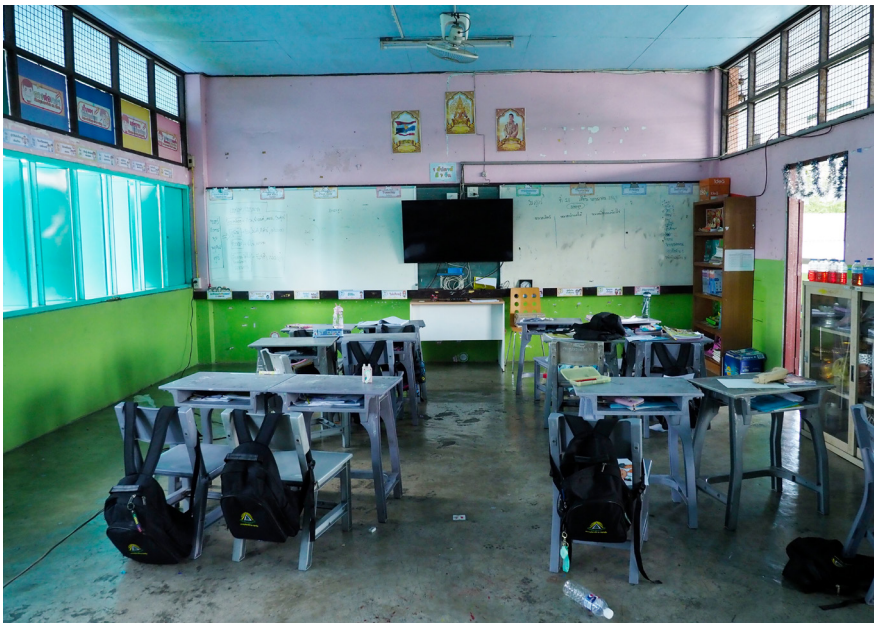
Yet, even as DLTV faded from the national limelight, the Distance Learning Foundation quietly carried on with its mission to support schools in rural Thailand. Schools in remote locations continued to adopt and use the system. After the passing of King Bhumibol, Thailand's new King Vajiralongkorn (Rama X) appointed General Dapong Rattanasuwan in 2017 to lead the foundation. Under General Dapong's watch, the foundation reformed its strategy and implemented several significant changes. It shifted from live broadcasting to prerecorded content, and incorporated new technologies such as internet, digital TV, computers, mobile phones, and flash drives. Throughout these adaptations, the foundation remained committed to its core concept of using television as a primary medium for educational content delivery. Yet the expanded portfolio also showed the foundation's willingness to leverage new technologies to improve distribution and accessibility. Modernizing the system,

rather than replacing it, thus became a means to honor the foundation's original mission and the late king's vision. DLTV accordingly endured.

On January 13, 2020, Thailand reported its first COVID-19 case. Public health authorities responded swiftly, implementing strict measures including travel restrictions, quarantine requirements, social distancing, and contact tracing to contain the spread of the virus. The academic calendar was severely disrupted, with term openings delayed to accommodate the changing situation and ensure the safety of students and staff. As remote learning became the "new normal," educators looked for ways to minimize the disruption. Re-enter DLTV.

The Thai government once again turned to satellite television—and to some degree, away from laptops and tablets—to mitigate the pandemic's educational impact. Driving this pivot was DLTV's accessibility. Many students, teachers, and schools did not have the means to acquire laptops or tablets, particularly during the quickly unfolding crisis. In May of 2020, Thailand's Minister of Education, Nataphol Teepsuwan, introduced the *3 Ons* model for education continuity. This approach comprised *Onsite* learning (where there was no COVID-19 outbreak), *Onair* learning (primarily DLTV, targeting eighty percent of students from kindergarten through middle school), and *Online* learning (for high school students with available resources). Nataphol and his team implemented this strategy with the goal that "at least the nation's education will not have to stumble or come to an abrupt halt again."[3]

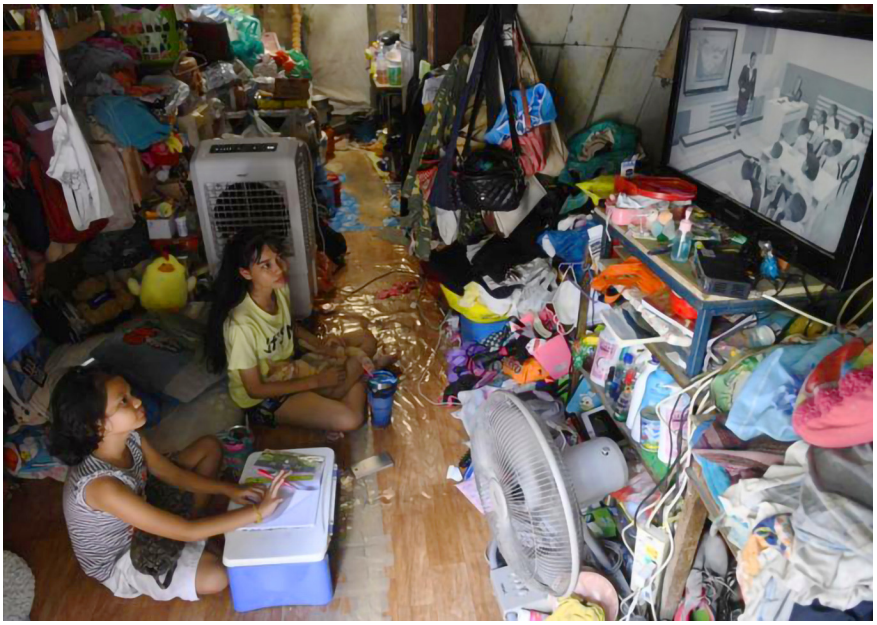
DLTV thus re-emerged as a vital offering of the Thai state. It was not cutting-edge, but there was plenty of educational content available, it was easy to access, and it ran on a steady (if basic) infrastructure. Children across the country—and not just in rural areas like Ko Kret—once again tuned in to an educational system created by the Thai monarchy decades before. DLTV may not have been as innovative as it was during its 1990s inception, but it was there and functional when Thailand needed it—hardly your typical profile of obsolescence. Satellite-based education's uncanny return during the COVID-19 pandemic instead offers a timely challenge to that assumption so common in development policy that newer is better.



↓ The DLTV classroom has a simple setup, with students following along and taking notes on the TV-based teaching. PHOTO BY PANITA CHATIKAVANIJ

As I restarted my research in the wake of the pandemic, my investigations into satellite television led me to Wat Salakul School. Like other schools in Thailand, WSS closed its gates from March 2020 to October 2021. In the interim, WSS emerged as an exemplary user of DLTV. Benjawan, a teacher I interviewed, shared her insights. "Students with personal devices use them to watch DLTV," she explained, "but when access is limited or needed to be shared among siblings, they turn to television for DLTV content. In cases where television isn't an option, DLTV worksheets serve as an alternative learning method."

Benjawan further detailed WSS's comprehensive approach to managing the pandemic's educational disruption. The crisis prompted novel configurations of old and new technology. To complement the use of DLTV, the school



↑ Two children sit on a cluttered floor during the COVID-19 pandemic, focused on a small TV broadcasting DLTV educational content. COURTESY OF *THANYAPORN BUATHONG* [6]

made use of Line, the dominant messaging app in Thailand, as a crucial communication tool. Teachers used Line to contact parents, preparing them for each day's learning activities and ensuring they were equipped to support their children's education at home. This proactive communication strategy helped maintain a strong connection between the school and families during remote learning. Additionally, the school implemented a system for delivering DLTV worksheets to students. These physical materials provided an essential supplement to the televised content, offering students tangible resources for learning and practice. The old-school distribution of worksheets proved especially beneficial for those with limited access to digital devices or internet connectivity.

In unexpected ways then, the COVID-19 pandemic highlighted not only the enduring value of Thailand's satellite television services, but also the importance of everyday technologies such as worksheets and messaging apps. In a crisis, the cutting-edge may not be always—or only—what is needed. At WSS, the dependability and flexibility of satellite infrastructure to accommodate other media has made it a crucial educational resource—never more so than during the onset of COVID-19, when everything else seemed so uncertain. In this isolated temple school on the island of Ko Kret, DLTV was never obsolete. In fact, the reliance of Thailand's underserved communities on this undervalued technology *before* the pandemic helped ensure that DLTV was there for Thailand's more privileged corners *during* the crisis. The national resurgence of this "outdated" technology exposes the shortcomings of elite-driven, urban-centric narratives of obsolescence. It shows how a crisis can shift our perceptions and reveal the continued relevance of technologies elsewhere considered past their prime. In these ways, DLTV sheds important light on the situated nature of technological obsolescence.

As this case study helps us to see, older and more established technologies can be just as crucial as newer ones in ensuring widespread access to learning, especially during challenging times. Be it in Bangkok or Ko Kret, Thailand's use of satellite television during the pandemic underscores the value of maintaining and adapting existing technologies—not replacing them wholesale. In times of crisis, the most valuable solutions may be those that are most accessible and familiar. More broadly, Thailand's experience of DLTV pushes us to think critically about how one defines and responds to the problem of obsolescence, particularly in the context of national infrastructure and crisis preparedness. As we move forward in our rapidly changing world, we must ask ourselves: How can we balance the pursuit of new technologies with the preservation of proven solutions to ensure resilience in the face of unforeseen challenges? ■

↓ **NOTES**

1 Government Saving Bank, *The King and His People: 45 Years of the Royal Palace Dusit Radio Station* (Royal Palace Dusit Radio Station, 1999), 1014.

2 Patawee, "Thaicom—Thailand's First Satellite," *Preaw*, November 25, 1993, 126.

3 "'DLTV' Rescue the National Education Crisis," *Thairath Online*, May 19, 2020, www.thairath.co.th/news/local/1847303.

4 Saowarod Ronnakied, "To Dedicate Merit to the Deceased Queen Grandmother," *Daily Matichon*, sec. Sooksan, August 4, 1995.

5 Borpit Kaodeera, "'Thaicom': Thailand's First Satellite," *Thairath*, sec. Loklaksi, December 9, 1993.

6 Thanyaporn Buathong, "Online Learning: Distance Education in the Pandemic Era and Educational Inequalities," *BBC News Thailand*, May 23, 2020, www.bbc.com/thai/thailand-52766138.

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Opening image on p. 58: Single Satellite Dish. PHOTO BY PANITA CHATIKAVANIJ


maxell
MR-90 NORMAL POSITION
MK 60-3
MADE IN KOREA
90
GoldStar
NORMAL POSITION TYPE I.
JVC
NORMAL POSITION IEC I/TYPE I
COPY
MK·60·6
Made in Japan
SuperEF90
LX
90
SKC
TYPE I NORMAL POSITION
B
N.R. ON OFF
A
C-90
SNC HQ-1
NORMAL POSITION (TYPE I)
NORMAL POSITION
ST C90
1
DOLBY SYSTEM
DOLBY HX PRO
NORMAL POSITION
GoldStar
LIVE
CONCERT
90
NORMAL POSITION/IEC TYPE I
YOKO
YOKO Normal Bias 90

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A Mix for the Ages

As media forms come and go,
why do cassette tapes live on?

Benjamin Duester

Rob Drew

If studying cassettes has taught us anything,

it's that nostalgia is nimble. We've had the privilege of authoring two distinct studies of the premillennial history (Rob) and postmillennial survival (Ben) of a format not long ago dismissed as obsolete.[1] In the process, we've witnessed a growing influx of cassette labels in DIY music scenes worldwide, as musicians and listeners embrace tapes as an inexpensive alternative to vinyl records and a refuge from the overabundance of streaming music.

Trendspotting journalists have trumpeted a "cassette revival," yet in many circles tapes never needed to be revived. Devoted experimental and noise musicians have long used cassettes to manipulate and fabricate sounds and distribute finished works. Religious ministries across the United States and Australia kept duplication plants rolling throughout the 2010s by distributing cassette sermons to their septuagenarian parishioners. Police forces in the United Kingdom used cassettes for interview recordings as late as 2012, citing the format's ease of use as a key reason for postponing the shift to digital recording.[2]

Where there is a resurgence, observers have too often treated it as a short-term fad for urban hipsters, rather than as a genuine, grassroots interaction among music devotees. As both music scholars and enthusiasts, our frustration with the persistence of revivalist sensationalism prompts us to trace the cassette's current cultural and economic significance from two perspectives: one focused on original music distribution on cassette, the other on redistribution through mix taping. Through these respective studies of tapes, we offer a mix to challenge one-dimensional notions of obsolescence.

→ Rob's first mixtape, "Sounds of the City Circa 1972," compiled in 1986. PHOTO BY ROB DREW

HYBRIDITY ON A REEL

In 2018 and 2019, Ben conducted interviews with more than eighty musicians, label owners, shop operators, and collectors in Australia, Japan, and the United States. The vastness of international tape projects is indicated by, for example, the number of cassette releases listed on the music database Discogs, which peaked at over twenty-five thousand new titles in 2021 alone.[3] The impetus for using tapes includes enhanced opportunities for networking and collaboration: for instance, through "split tapes" released by two or more artists who contribute their music to either side of the format.[4] Furthermore, because they do not facilitate immediate skipping between tracks, cassettes encourage mindful listening that circumvents the glut of online music. Some Scottish cassette label heads, for example, refuse to post their music online, "to interrupt the contemporary sense of instantaneous access to *anything*," thereby forcing users to reflect on why certain tracks are liked or disliked in real time.[5] The experience of the tape's slow, linear reel shapes its cultural value. Across DIY music scenes, cassettes are traded as cultural currency where they embody a distinct form of participation and aesthetic identity.

Yet the present ruptures between postmillennial cassette practices and the past are just as notable as the continuities. While some cassette adopters, especially in punk and noise scenes, fervently carry on the coarse Xeroxing aesthetic of their 1980s forbearers, most contemporary labels and artists use slick Photoshop-crafted artwork for their releases, prioritizing the visual qualities of cassettes at least as much as their sound characteristics.

Once synonymous with mobile listening, the postmillennial cassette is now mostly relegated to the home, often functioning as a container for Bandcamp download codes that grant access to more easily portable digital music

↓ Homemade airbrush artwork for Eurythmics's *1984* tape, which Ben's mom crafted in the 1980s. PHOTO BY BENJAMIN DUESTER

files. This championing of the cassette's appearance over its audio capabilities (borne out by a UK market research survey that found a quarter of cassette purchasers had no intention of listening to them) is attributable to several factors.[6]

First, used hi-fi cassette players, once plentiful and easily attainable, have grown scarce. The bottleneck has driven up prices for remaining units and limited the availability of replacement parts for cassette decks, which are notorious for being fiddlier to repair than turntables. Second, new players fall short on build and sound quality, especially when compared to the units that corporations like Sony produced until the early 2000s. New players feature little to no noise reduction. Even worse, the It's OK cassette player, newly advertised in 2019 primarily for its Bluetooth connectivity, only produces a mono signal, thus catapulting the listener back to the earliest incarnation of consumer cassette tech in the mid-1960s. Finally, since running out of stock in the mid-2010s, manufacturers have ceased producing high-grade chromium oxide audiotape, thus diminishing fidelity at the cassette's very core.[7]

Of the handful of US companies still producing blank tapes, the largest is National Audio Company in Springfield, Missouri, which bought unused tape production equipment in the 2000s and recently converted credit card production equipment for magnetic audio tape.[8] The conditions for current cassette production, however, are incomparable to their ubiquity in the late twentieth century. Though National Audio touts their ferric and cobalt oxide tape formulas as the highest grades currently produced, their compatibility with hardware featuring decades-old tape heads and noise reduction systems is now being assessed by cassette enthusiasts worldwide. The jury is still out on these new formulas of new-old technologies, but the fact that the cassette persists despite these precarious circumstances underscores its symbolic heft. Through original recording and rerecording, cassette culture continues to thwart obsolescence by rendering this ostensibly dated format freshly present. Yet there are other pasts in this mix—many of them deeply personal—that need mention.

"Through original recording and rerecording, cassette culture continues to thwart obsolescence ..."

↑ A USB drive packaged to look like a mix tape, just big enough to hold ninety minutes of music; created by the British design firm Suck UK. PHOTO BY BENJAMIN DUESTER

GHOSTS OF THE MIX TAPE

Rob first came to cassette scholarship by studying music fans' rituals of compiling music on mix tapes and compact discs. It was the mid-2000s, when the popularization of CD burners spawned its own brief renaissance in the physical exchange of music. Yet among older interviewees (and even younger ones more susceptible to the charms of analog media), an acute sense of nostalgia for the mix *tape* still held. The mix tape carried a talismanic quality that the mix CD could not touch.

Mixers missed the tactile routines of mix taping and the endless hours spent hunched over stereo equipment cueing up album cuts. Most of all, they missed the relational embeddedness of mix taping; by shepherding songs onto tape in a spirit attentive to a particular listener, mixers seemed to hear the songs afresh and invest them magically with their own interpersonal magnetism. Well into the 2000s, loyalists continued mixing to cassettes, scouring dollar stores and swap meets for increasingly hard-to-find, high-bias blank tapes.

The analog mix tape has shown continued signs of life in a few corners of the internet. At the Instagram account Mixtape Exchange, you can sign up to swap mix tapes with anonymous users based on a questionnaire that matches your interests; mixers as far afield as Serbia, Denmark, Australia, and Japan have participated.[9] Despite such isolated cases, though, few people are talking about a triumphant revival of mix taping. Music streaming and playlists have rendered the practice nearly obsolete. In this age of algorithms and digital content, the mix tape lives on as a symbol. The homegrown practice that first

unhinged songs from albums has become an all-purpose metaphor to invoke the past and ground the daunting flow of digital music.

While personal, the nostalgia has also become commercial. When Starbucks's Hear Music imprint began stocking stores with genre-based CD compilations, CEO Don MacKinnon stated that the coffee chain aspired to be like "that friend in college down the hall who played great music and made great mixes… a lot of us feel we don't have that friend anymore."[10] When Apple added features to its music store that allowed ordinary users to post playlists that could be purchased with one click, tech guru Steven Johnson lauded them for empowering that "unrewarded group [of] people with great taste in music—the ones who made that brilliant mix for you in college that you're still listening to."[11] And when Spotify added its Discover Weekly feature which furnished personalized playlists to each of its millions of users, product manager Matthew Ogle gushed, "We wanted to make something that felt like your best friend making you a mixtape… every single week."[12] By taking on the mantle of the mix tape, vendors of all manner of playlists—physical or virtual, human- or machine-generated—now pass themselves off as surrogates for the mythical friend whose contributions to our musical experience we once implicitly trusted.

Whatever the innovations of music streaming platforms, critics rarely discuss them with the same passion still routinely invested in the mix tape. For all their networked, hypermediated affordances, such platforms seem to covet the mix tape's intimacy.

The social music sites that have come and gone over the last two decades are rarely mourned like the mix tape's modest media of Maxell, Denon, and TDK. And if this is the case, it's partly because the mix tape was so elusive in the first place. Built on stories and fantasies, the mix tape was an object of nostalgia almost from the moment it was named.

OUTRO

Trials and tribulations aside, DIY practitioners continue to embrace cassettes, not merely as collectibles but as a participatory currency of grassroots music distribution and consumption. Raymond Williams famously argued that residual cultural forms often persist not merely as obsolescent vestiges, but as cherished alternatives representing areas of human experience that the dominant culture neglects or undervalues.[13] The cassette is a case in point. Despite the immediacy and convenience of our new media age, the world hasn't yet pulled the plug on tapes and their cohesive, slowly circulating material culture. Whether it functions as a keepsake to reignite memories or as a conduit for participation in creative networks and subcultures, the cassette continues to transcend obsolescence. Spinning on with unmistakable magnetism, the cassette tape demonstrates, once more, that the lifecycles of media are anything but linear. ■

↓ **NOTES**

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Opening image on p. 64: Vintage Audio Cassettes. BY EUGENE GOLOVESOV VIA PEXELS

Strange Abundance

71

Can deconstruction unlock resources abandoned in late industrial cities?

Catherine Fennell

Humans have long built in, on, and with the footprints of their forebearers. During the 1990s, sustainability advocates in the United States rebranded the process of dismantling structures with an eye to recovering reusable components as “deconstruction.”

↓ Brick recovery at the demolished Jacob Riis Public Elementary School, Chicago, 2006. PHOTO BY CATHERINE FENNELL

Committed deconstruction enthusiasts salvage as much as possible, while the more practical focus on materials with expansive market potential.

↓ Wharf piling tips at Southern Pine Company, Savannah, 2016. PHOTO BY CATHERINE FENNELL

Deconstruction proponents in the late industrial American Midwest extol the reuse, aesthetic, and heritage values of old-growth boards, beams, and joists. For them, the pine, maple, and oak that once swathed the Great Lakes region did not disappear with nineteenth-century timber booms and busts.

↓ Flooring stacked and organized at Reclaim Detroit, Detroit, 2011. PHOTO BY CATHERINE FENNELL

Those trees still stand as what they call “the forest behind the walls” or the “bones of ancient forests.” “Detroit is a standing forest that’s been abandoned, with all the roofs coming off,” remarked one Chicago-based architect in 2015, “so harvest [it] before it rots.”

↓ Standing forests—derelict houses in disrepair, Detroit, 2014. PHOTO BY CATHERINE FENNELL

In the years following the subprime mortgage crisis and the Great Recession, government agencies and private philanthropic organizations in the Midwest began supporting deconstruction as an alternative to demolishing abandoned residential structures in neighborhoods decimated by foreclosures—and more broadly by a history of racialized segregation, redlining, and disinvestment.

Proponents sought to save reusable building materials from landfills, thus sparing the natural resources and CO2 expended on producing new ones. They hoped also to generate novel employment opportunities. Phrases like "triple bottom line thinking" and "the circular economy" saturated public and private conversations about deconstruction.

← Public safety demonstration calling for house demolitions, Detroit, 2015. PHOTO BY CATHERINE FENNELL

↓ "Demolition production" organized by the Detroit Building Authority, Detroit, 2014. PHOTO BY CATHERINE FENNELL

Training programs expanded to prepare people with “barriers to employment” for jobs in deconstruction and affiliated building, demolition, and warehouse trades. In local parlance, “barriers” often implies a criminal record. Importantly, deconstruction’s circular economy is neither seamless nor harmless.

↓ A deconstruction laborer’s tools, Chicago, 2018. PHOTO BY CATHERINE FENNELL

→ Pine beam covered in lead paint, Chicago, 2018. PHOTO BY CATHERINE FENNELL

“There’s endless supply,” a reclaimed wood broker in Chicago insisted in 2015, “it’s the getting that’s hard. It’s easier if you have a lot of tools, a truck, you’re strong, and you have people to help you, and if you’re willing to get dirty and breathe some crap into your lungs.”

A team of biologists and computational scientists seeking a picture of "the composition of the world" at a moment of accelerating ecological change recently estimated that in the year 2020, human-made objects outstripped biological mass.[1] For the first time, our planet contains more things *made* by humans—more concrete, more aggregate, more bricks, more asphalt, more glass, more plastic, and more paper—than the entire mass of plants, bacteria, fungi, archaea, protists, and animals.

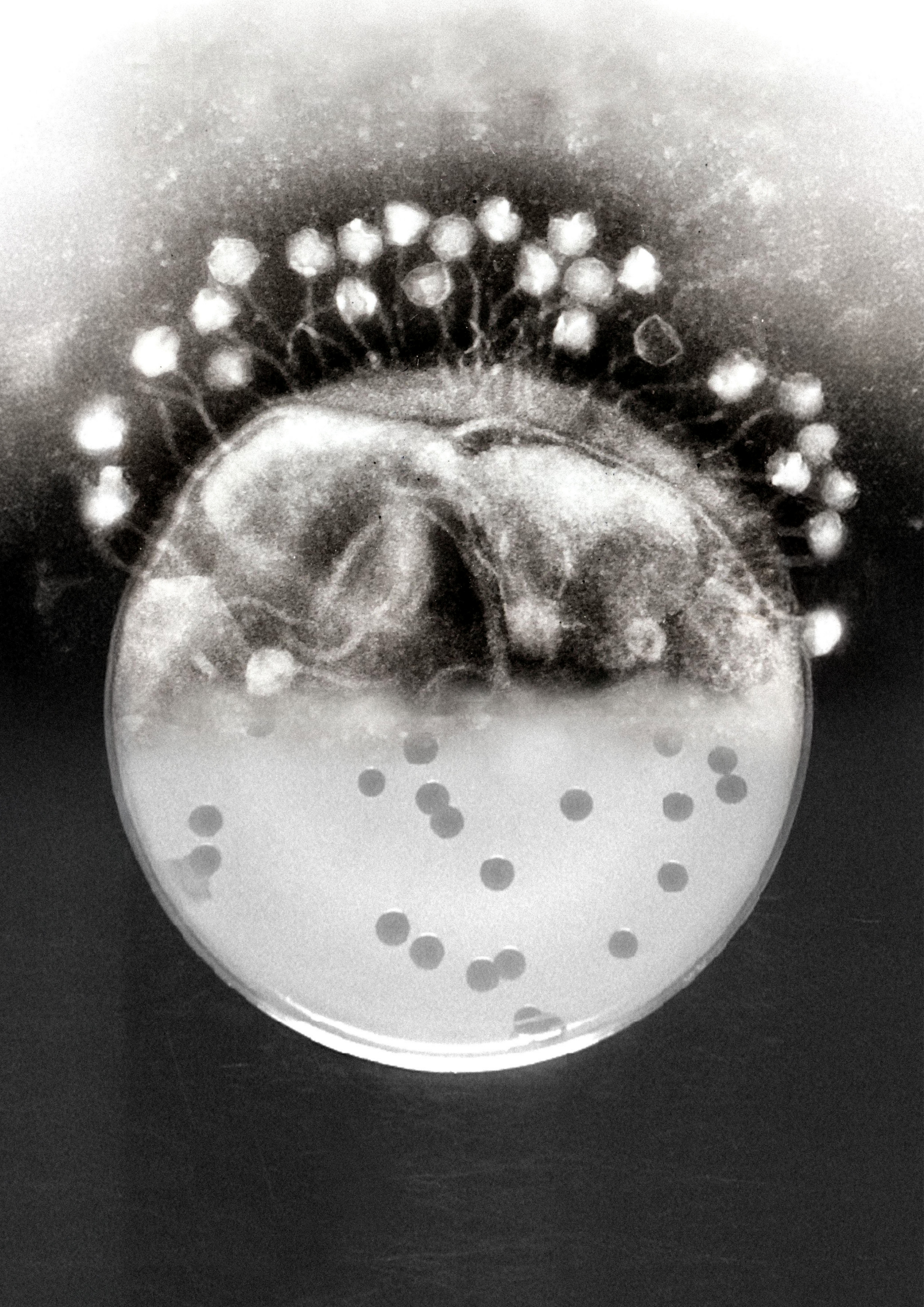
↓ Denailing the harvest, Chicago, 2017.
PHOTO BY CATHERINE FENNELL

1 Emily Elhacham, Liad Ben-Uri, Jonathan Grozovski, Yinon M. Bar-On, and Ron Milo, "Global Human-Made Mass Exceeds All Living Biomas," *Nature 588* (2020): 441–444.

Most of those I spoke with about deconstruction do not think that humans have yet reached the point where we would need to mine what we've already made and cast off, just to fulfill our basic needs. Yet more than a few insist that such a time will soon come. Late industrial life's anthropogenic mass is plentiful; its getting is fraught. Living and working with this strange abundance demands considerable work—and it will be ongoing.

↘ "Forests" awaiting processing, Chicago, 2015.
PHOTO BY CATHERINE FENNELL

CATHERINE FENNELL is an Associate Professor of Anthropology at Columbia University. She has written about public housing reforms in Chicago, and is at work now on a book about the ends of vacant homes in late industrial urban America.



83

Technical Hospitality

Facing a post-antibiotic future, scientists and patients forge new alliances in pursuit of old therapies

Rijul Kochhar

How does one confront the creeping obsolescence of antibiotics? The answer might be at once future-facing and historical.

Antibiotics reveal surprising conjunctures. We live in a time where scientific techniques can reveal in increasingly fine-grained detail the properties of microbial species, some of which are pathogenic to human health. Yet, we are also increasingly incapable of remediating these pathogens with antibiotics due to their growing drug resistance.

Antibiotics, long depended upon as an infrastructure of modern life, now confront obsolescence.[1] Even as they have shown the way to health, they are becoming relegated to a crypt in which reside other moribund forms of therapeutic life. One such artifact is bacteriophage therapy, which deploys viruses that infect bacteria to achieve infection control. Traditionally associated with the Soviet imperium, phage therapy is now making a return in other parts of the world.

The idea of obsolescence permeates these conjunctures. It illuminates the limits of triumphalist knowledge and dominant techniques in the history of science and medicine. This pushes us to delve deeper into the lessons of time. Obsolescence harbors systems of thought that never rose to the level of established paradigms—but which, in time, might do so. Might one conceive of obsolescence also as a mode of revelation?

I

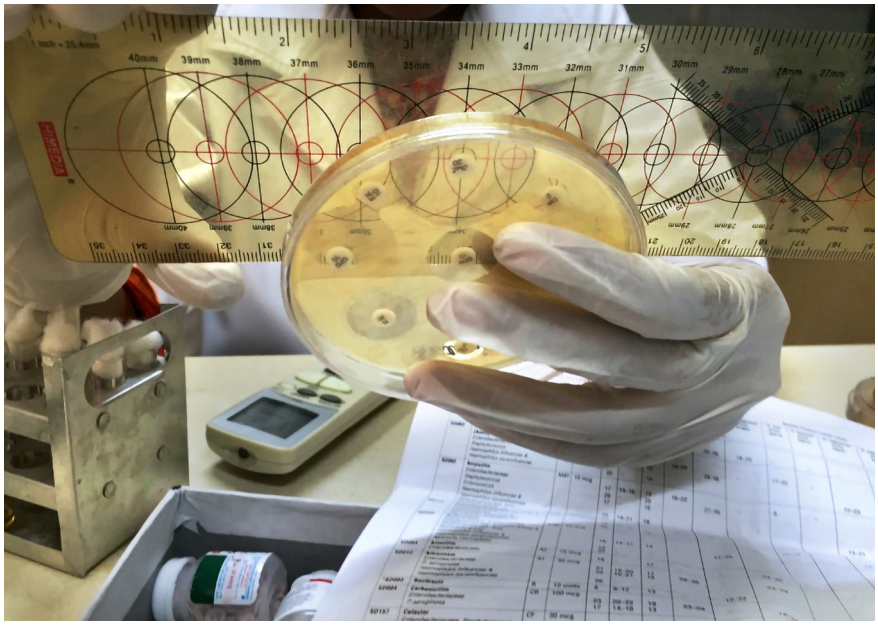
To find out, let's journey to a laboratory in Delhi, where one can find clinical microbiologists on multiple quests to treat infections. Some grapple with manual, labor-intensive methods in which bacterial cultures are painstakingly grown on petri dishes, identified using microscopes and chemical reagents, and subsequently matched with appropriate antibiotics. Processes such as the disk diffusion method, considered gold standards in microbiology, require care and finesse on the part of lab technicians. Human judgment, here, remains key.

↑ GeneXpert and BioFire on a lab bench. Delhi, India. PHOTO BY RIJUL KOCHHAR

Other researchers here marvel at the affordances of tabletop devices such as GeneXpert and BioFire, often imported from the West and serviced locally. The technological prowess of such devices to rapidly *know* a pathogenic condition's microbial etiology—that is, the source of what ails a patient—is belied by their ease of use. Increasingly pitched as "game-changers," such devices—"locked and loaded," as one operator put it to me—are giving stiff competition to older, slower methods.

This microbiology lab finds itself at a critical historical juncture. Today, its capacity to identify pathogens rapidly through automation confronts an increasing inability to address those pathogens with effective antibiotic treatments. On the one hand, the accelerating speed of understanding a microbe in the lab is celebrated. On the other hand, once-viable antibiotic drugs are facing failure at the hands of antibiotic-resistant superbugs. The arrival of advanced devices like GeneXpert and Biofire coincide with a rapidly diminishing medicine cabinet, one that is increasingly devoid of antibiotics that *work*.

What are the possibilities for medicine at a time when diagnostics struggle to translate into cures? For this microbiology lab in Delhi, a search for a more viable curative future manifests itself in journeys both epistemological and physical. This search demands humility and experimentation on the part of diagnosticians and patients alike—a willingness to recognize what is no longer working, to enlist the foreign and strange, to adopt into one's future ideas that have long been discarded.



→ The disk diffusion method of bacterial identification and antibiotic sensitivity testing. Delhi, India. PHOTO BY RIJUL KOCHHAR

II

In response to growing disquiet in the realm of antibiotics, the Delhi lab is building new collaborative exchanges—of equipment, expertise, and experiences—with a unique Soviet-era facility, the Eliava Institute for Bacteriophages, Microbiology, and Virology in Tbilisi, Georgia. Here, the offerings are simultaneously historical and novel. They center on bacteria-devouring bacteriophage viruses, used extensively in the former Soviet Republic of Georgia but rendered moribund elsewhere due to a variety of technopolitical embargos during the Cold War.[2]

At their simplest, bacteriophages (known colloquially as phages) are viral predators of bacteria. Ecologically ubiquitous, these outlandish-looking objects accompanying bacterial hosts are the most widespread biological entities on the planet, and they are responsible for the culling of as much as forty percent of the planet's bacteria *daily*. Invisible except under powerful electron microscopes, they typically measure one-millionth of an inch. Phage action takes place around and within us perpetually—even as you read these words.

If antibiotic resistance posits the end of a miracle that began with events in the early twentieth century—including the development of "magic bullet" drugs like salvarsan/prontosil and penicillin—the antibiotic era is increasingly revealed to be a blip in time: a medical exception.[3] The relations between bacteria and bacteriophages, on the other hand, present a more eternal ecological dance. Staring into the creeping obsolescence of antibiotics thus reveals other national, ecological, and historical orders.

A microbiologist who hosted me in Delhi described her journey to the Eliava Institute as a return—as "bringing in the pre-antibiotic era in the post-antibiotic world." We spoke often in the run-up to her 2019 trip to Georgia. We talked of travel logistics for Tbilisi and the difficulties that travelers, including medical migrants, faced at border control on the fringes of an increasingly xenophobic Europe. I shared places to stay and to eat, what to see while in the country, and where to get joyously lost once there. She reciprocated by offering a selection of scientific papers on contemporary phage therapy. These papers charted the emergence of new alliances in a post-antibiotic era. They also outlined potential perils in the mediation of phage-bacterial coevolution, and in

→ Eliava Institut Prep. A mid-century packaging for oral bacteriophage against S. typhi. The product was manufactured in Tbilisi, Georgia, (Gotua street 3) by the Enterprise for Production of Antibacterial Medicine at the Tbilisi Vaccine and Serums Science and Research Institute, a facility of the Ministry of Health of the USSR, which was subsequently renamed the Eliava Institute for Bacteriophages, Microbiology, and Virology. commons.wikimedia.org/w/index.php?curid=79906112.

the transference of novel resistance mechanisms between bacterial species. In one paper, my host had underlined the phrase: "Phage therapy is experiencing a well-deserved rebirth."

For the lab in Delhi, forays into phage therapy represent an unfolding experiment. The hope, as my host put it, is that "traveling new paths will yield unusual miracles." Bacteriophage diagnostics require testing a patient's bacterial infection using the same culturing techniques that her lab in Delhi routinely conducts. Through these established diagnostic methods, the Delhi lab can forge fresh alliances—sensitivity patterns between a pathogen and its viral predator—to instantiate anew a cycle of human deliverance.

While my host was in Georgia, I received dispatches: images of her handling familiar equipment in novel ways, of electron microscopes, and of petri dishes demonstrating bacteriophage activity on lawns of antibiotic-resistant bacteria. There were images of the Eliava Institute's old-timers as well as new recruits—managers and stewards of infection-control strategies after the Soviet era. There were pictures of my host bearing the weight of scientific heritage: there she was outside the institute's columned archway, built in the tradition of Soviet high modernism that survived the collapse of the USSR; there she was next to Giorgi Eliava's bust, built in memory of his scientific life and his death in the Stalinist purges. Accompanying these images was a letter confirming the institute's invitation to this journey, physical, epistemological, and otherwise: ephemera of a nascent and potentially vital hospitality.

"The forging of this technical hospitality between ex-Soviet Tbilisi and contemporary Delhi tells a story of redressing past and future forms of obsolescence."

Yet, what kind of hospitality is this? In his famous lectures delivered toward the end of his life, Jacques Derrida offered a typology of hospitality. On the one hand is the unconditional and unlimited reception of the stranger—radical and total openness. On the other is the "conditional law of hospitality," where terms of conduct and conditions limit "radical heterogeneity." Derrida's point was that an ethic of responsibility demands continuous negotiations between the unconditional and the conditional, the open and the closed, heterogeneity and homogeneity; "One calls forth, involves, or prescribes the other."[4] The transgression of the conditional imperative of restriction and reciprocity determines the classification of the stranger no longer as a guest, but as an entity subject to removal. Yet, between the conditional and the unconditional there remains the *negotiative* realm: the realm of the necessary, that which *must* be done in order to live on.

III

Emergent forms of life, such as antibiotic-resistant superbugs, summon technical hospitality. This is the sphere of experimentation, and of reconsidering practices once cast aside. It is a reversal of old obsolescences, and a recognition of potential new ones. A future without viable antibiotics will bring many trials and tribulations, along with the usual challenges of scientific knowledge (and profit) production.

As they adopt the old-but-new paradigms of phage therapy, microbiologists, doctors, and patients will have to work through questions of legal ownership, scientific licensing, and biomedical regulatory approval. These hurdles may well strain the nascent hospitality emerging on this medical frontier. On the other hand, these pioneers all share in the pursuit of scientific knowledge for the sake of curiosity, bodily autonomy, and well-being.

My microbiologist host, bearing technical gifts, is a harbinger of a potential scientific return. Once characterized by diagnostic certitude and later by disquiet in the face of antibiotic failure, she and her colleagues have undertaken leaps of faith in pursuit of the bacteriophage. Working through this complex amalgam of obsolescences has required "a colossal working on oneself, with new experiences of the body, of movement, of being-together."[5]

The forging of this technical hospitality between ex-Soviet Tbilisi and contemporary Delhi tells a story of redressing past and future forms of obsolescence. As the pendulum swings from the once-miraculous antibiotics back to the moribund phage, approaching one obsolescence means exiting another. Against fatalism and disquiet, technical hospitality demands journeys through peril—arduous inquiries into epistemology and embodiment that posit a space-time of a certain xenophilia: the love of the stranger, the guest, a virus that *might* just be a friend. ■

↓ **NOTES**

1 Amid an array of news items in the popular press describing an incoming "antibiotic apocalypse," see more process-oriented descriptions of the phenomenon in "Series on Antimicrobial Resistance: The Need for Sustainable Access to Effective Antibiotics," *Lancet*, May 23, 2024, thelancet.com/series/antibiotic-resistance?; see also Kathryn M. Orzech and Mark Nichter, "From Resilience to Resistance: Political Ecological Lessons from Antibiotic and Pesticide Resistance," *Annual Review of Anthropology* 37 (2008): 267–282.

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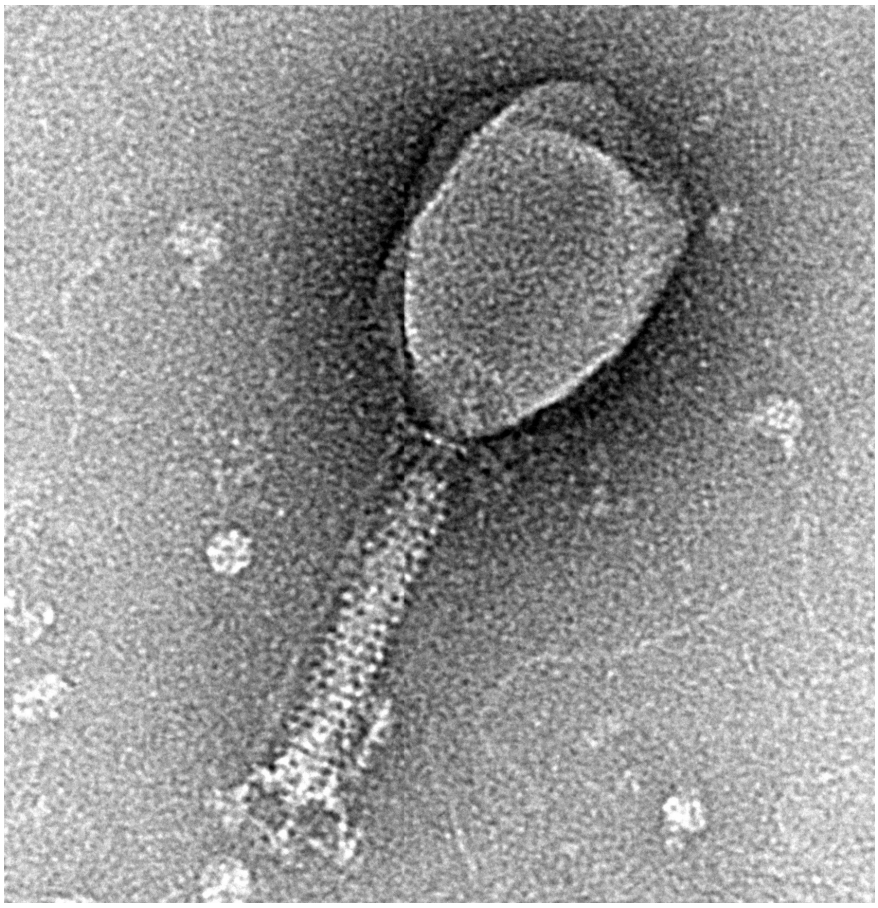
4 Jacques Derrida, *Of Hospitality* (Stanford University Press, 2000), 147.

5 Achille Mbembe, *Necropolitics* (Duke University Press, 2019), 5.



→ Bacteriophage T2, a member of the Myoviridae due to its contractile tail, 2022. commons.wikimedia.org/wiki/File:Enterobacteria_phage_T2_transmission_electron_micrograph.jpg. CREATIVE COMMONS LICENSE (CC BY-SA 4.0). COURTESY OF SNAXMIKN

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Opening image on p. 82: Bacteriophages at different levels of magnification (attached to bacterial cell wall/in petri dish), 2020. commons.wikimedia.org/wiki/File:Bacteriophages_at_work.jpg. CREATIVE COMMONS LICENSE (CC BY-SA 4.0). COURTESY OF EMILY.ANGHARAD


Entebbe
Busabala
Kibiri Road
GUEST HOUSE
50
LANE
CLOSED
GOVERNMENT OF THE REPUBLIC OF UGANDA
PROJECT
SECTION 2
FUNDER
THE GOVERNMENT OF UGANDA
EMPLOYER
ENGINEER
CONTRACTOR
SGCC

89

Expressway Trajectories

On the road to Uganda's future

Prince Guma

Joel Ongwech

↑ The Entebbe-Kampala Expressway has remained incomplete since its opening in 2018.
PHOTO BY JOEL ONGWECH

Even when large-scale infrastructure projects remain unfinished, people find ways to use them and live with them. Consider Uganda's Entebbe-Kampala Expressway, which has sparked significant public debate for nearly fifteen years. Since construction began in November 2012, the four-lane, fifty-one-kilometer toll road connecting Kampala, Uganda's capital, to Entebbe, the site of Uganda's main airport, has been a major point of contention. Funded by the government of Uganda and the Export-Import Bank of China, the highway opened to traffic in June of 2018. According to official figures, the highway incurred a total cost of USD 476 million, more than five times what it should have cost,[1] leading to claims that it's "the world's most expensive road."[2] State officials attributed the exorbitant cost to difficult terrain, to the absence of competitive bidding, to land acquisition challenges, and to redundant consultancy services marred by copious kickbacks and corruption.

The highway was expected to spur economic growth, foster social transformation, and decongest the Greater Kampala Metropolitan Area. With an aspirational and capitalist agenda, it was envisioned as a "new standard"[3] for Uganda in its progression toward middle-income status. As the first toll road in the country, it introduced innovative technologies for automated toll collection such as smart cards,[4] which can be reloaded via mobile payments or through bank transfers.

Six years after its opening, the highway does not live up to its aspirations, and it receives mixed reviews as a project that fails to meet its stated objectives. Several of its intersections remain incomplete or under construction, even as

↑ Repair kiosks and shops have sprouted along the highway. PHOTO BY JOEL ONGWECH

astronomical sums have been invested already. The road's drainage, sidewalks, and crosswalks must be frequently renovated and repaired to accommodate a broader spectrum of the population, since the original designs disregarded local contexts and informal use. And due to the tolls, using the road is prohibitively expensive, so much so that the majority of Ugandans will never use it as a primary route. This has prompted questions in the public domain about how exactly the highway is expected to address growth, social transformation, or decongestion.

Accordingly, users constantly devise creative ways of repurposing the highway, leading to its own continuous decay. Since its inception, the road has been a continuous work in progress requiring attention and updating and repair. In many ways, this is the fate of all roads. But the Entebbe-Kampala Expressway merits a deeper reading—particularly regarding broader reckonings of obsolescence. The road is incomplete, but not in the sense that it is missing or lacking something. Indeed, part of the perceived problem is that it has taken on life in excess of its original designs. The reality of the road is that it is constantly in the making—but not according to plan. Instead, the road is evolving in ways that challenge capitalist and aspirational concepts of technological determinism.

The highway's incompleteness raises fears of obsolescence among urban elites in particular: If the highway is not built according to plan, will Uganda fall off the trajectory of progress? Yet this incompleteness also opens the infrastructure up for marginalized populations who may not share these expectations. Obsolescence appears very different to the people who are not whizzing past in their sedans. For those who live and work here, this space could become obsolete if construction were to restart, and these people would have no place in it anymore.

↑ Along the roadside, there is a broad range of economic activity. PHOTO BY JOEL ONGWECH

DECOMPOSITION AND RECOMPOSITION

The highway is marked by erosion and wear-and-tear in some sections, giving the road a material life of its own. Elsewhere it seems as if sabotaged, destroyed, and purposely manipulated. In many sections, the absence of proper road signs, some of which have been stolen or destroyed, has led to confusion and misuse. Unclear and frequently changing information about speed limits[5] has resulted in motorists being flagged down at exit points for exceeding 100 kilometers per hour. This speed limit has sparked reactions from motorists who question the relevance of the expressway concept.[6] Certain sections of the road are also prone to flooding during rain and storms, and it is clear that some areas still lack properly functioning streetlights in the evening and other essential facilities such as pavement and pedestrian crossings.

Yet in its irregularities, a variety of makeshift constructions have emerged. New markets have been constructed by the roadside, with vendors peddling their wares from ramshackle stalls. Enterprising individuals use umbrellas, kiosks, or motor vehicles to strategically position businesses such as food shops, repair stalls, car washes, and garages. Residents now travel the road on *boda bodas* (motorcycle taxis), which were originally prohibited. It is common to find people jogging or walking animals along and sometimes on the road—this was also not in the plans. One can observe goats, stray dogs, or herds of cattle crossing some intersections, soiling the pavement and trampling any pretense of separation from the agrarian surroundings.

This process of material and technological decomposition and recomposition gives the highway an ambivalent character. It invokes aspirations of progress, but also raises fears among urban elites of a Uganda that doesn't quite fit the bill. It gives rise to new forms of business and life along the road—but

↑ Scrap and repair stalls have been strategically placed by the highway. PHOTO BY JOEL ONGWECH

these are precarious at best, dogged by the threat of being ripped away by planners' allegiance to their plans. These specters of obsolescence sit awkwardly beside one another on the Entebbe-Kampala Expressway. Obsolescence here is a matter of heterogeneity, shaped by both technical demands and social circumstances. If incompleteness renders the highway obsolete as an ideal, it also opens the road to new uses and meaning—thus making it something other than obsolete.

The highway's human and non-human occupants embody a multitude of different possibilities, rendering this infrastructure as dynamic and unpredictable. Indeed, many residents harbor an inclination to keep things incomplete. Some employ tactics derived from their own more situated ways of life to make this space more heterogeneous. The highway, then, underscores urban populations' potential to foster diverse ideals—ideals that might otherwise go unnoticed through blind faith in progress, innovation, and modernity. Thus, the highway, primarily designed to cater to middle- and upper-class urban elites, must travel along variegated, intricate, and splintering trajectories.

"On the real Entebbe-Kampala Expressway—not on the plans—innovation follows multiple trajectories, as do its accompanying threats of obsolescence."

MULTIPLE TRAJECTORIES

The highway has received criticism from urban elites with the subtle expectation that modern infrastructures must evolve in a certain way, following a specific trajectory of technological determinism. Yet, infrastructure is a sociotechnical constellation supported by diverse actors with diverse agendas. This highway's transformation has been shaped by foreign investors expanding their portfolios, officials maximizing profits, political elites accumulating wealth, city planners seizing redevelopment opportunities, private entrepreneurs speculating on new markets, individual sojourners seeking personal gain, protesters

↑ The road has been repurposed in its unfinished state. PHOTO BY JOEL ONGWECH

staging various forms of resistance, and residents navigating hurdles both expected and unexpected. The highway is a site that many actors—state and private, local and international, democratic and non-democratic, pragmatic and speculative, expert and novice—have engaged with and shaped, through various forms of profiteering, speculation, extortion, wealth accumulation, and resistance.

As a result, the road takes on multiple forms and trajectories. To some, it is incongruous, approaching obsolescence without the maintenance that it needs to measure up to aesthetic and functional ideals. With the highway failing to conform to the logic of technological determinism, they argue that it is now defective, inadequate, and divergent. News reports frequently highlight setbacks in the road's development in order to emphasize the project's failure to meet its stated goals. This includes reports of government shortfalls in meeting monthly toll collection targets, legal cases from road users concerning incomplete construction, damaged or ruined structures, and similar issues.

It is important to consider the fact that the highway itself is not removed from what happens or exists around it; in fact, it could be argued that the highway helps to constitute particular geographies of obsolescence—geographies where the material configuration must embody informality, makeshift urbanism, and temporal incompleteness. Clearly, technological innovation should not be expected to follow a single trajectory or linear progression. On the real Entebbe-Kampala Expressway—not on the plans—innovation follows multiple trajectories, as do its accompanying threats of obsolescence.

The Entebbe-Kampala Expressway may not neatly align with its preconceived technocratic design, but it reminds us of the possibilities within the incomplete technological and infrastructural forms of our contemporary

↑ People from various walks of life now live and work along the highway. PHOTO BY JOEL ONGWECH

world. Going forward, Ugandans across a wide socioeconomic spectrum will most certainly reshape the highway's trajectories, and they will push beyond its initial design in ways that defy its intentions. It is important to open up to different ways of theorizing decomposition and recomposition, beyond linear and singular presumptions of development, and beyond normative ideals of impact and success, to better understand the nature and dynamics of infrastructures in transition. ■

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Portions of this research were supported by a British Academy grant (TGC\200365).

Opening image on p. 88: Detail of the Entebbe-Kampala Expressway has remained incomplete since its opening in 2018. PHOTO BY JOEL ONGWECH

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Dont miss me

97

When Does a Car Die?

Mumbai's discarded taxis are an archive of the city

Tarini Bedi

Cars, like many material objects, seem to face an inherent obsolescence.

We are told that they begin to lose value the minute they leave the factory. But what happens to a car that has been retired, abandoned, and rendered useless? In conducting research on Mumbai's taxi trade, I was struck by how widely discussions of phaseout, upgrade, and replacement—of both cars and trade practices—permeated the taxi industry. I was also surprised by the unexpected afterlives of the vehicles in question. I rode around in taxis, but I also observed ruined, phased out, and dead taxis resting in place. In the 1990s the government mandated that the life of a taxi would not exceed twenty years. However, like ruins of other kinds, these phased out, obsolete vehicles didn't simply disappear after twenty years. They fell out of use as taxis, but they remained visible, and became a useful and lively part of the landscape throughout the side streets, gullies, and junkyards of Mumbai.

↑ Dusty Padmini discarded by the side of the road. PHOTO BY TARINI BEDI

Under a shroud of dust, rust, corrosion, smashed headlights, and years of accumulated pigeon droppings, this car, once a working taxi, sits alongside a busy artery in central Mumbai. Soon it will be beaten upon by monsoons. The dust will turn to slime and, perhaps, wash away to show off the colors of the *kaalipeeli* (black and yellow) taxi that it once was. The life of this dusty Padmini probably began in about 2000, when the last Padmini was manufactured—before the factory closed due to decades of falling sales, disputes over the government's passenger car policies, and violent labor struggles. Probably by 2020, this Padmini was left for dead on the roadside in this busy commercial area due to government mandates restricting how long taxis can operate.

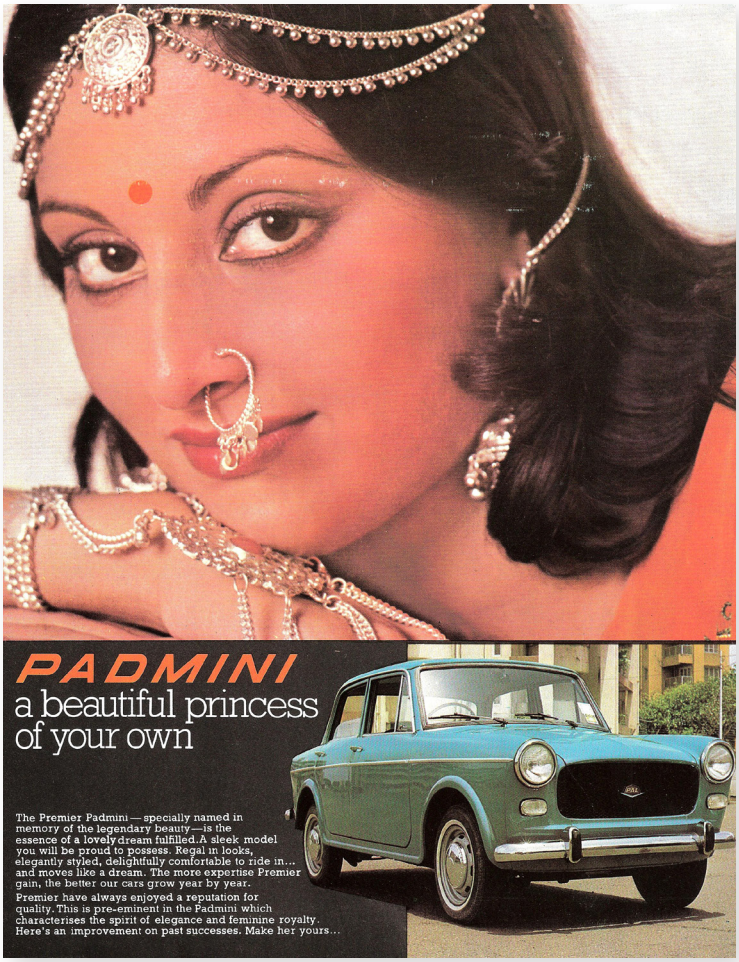
At first glance, Padminis like this one, with their massacred seats and dismembered doors, look abandoned and uncared for. Left for dead, these cars inspire spirited debates over how seemingly useless objects occupy public space, encroach on parking, attract rodent colonies, and provide a public canvas for the disclosure of neighborhood love affairs, carved into window dust—Raj Meera. And yet, the battery of formal complaints to the municipality and to neighborhood resident societies has not deterred people from salvaging parts for use elsewhere, or from resting on hoods while they wait at nearby bus stops.

Dusty Padminis are obsolete in one sense, but far from abandoned in another. To address complaints, the municipality moves discarded cars from place to place. Often, cars dumped in new places morph into other forms along

the way, such as when a door is captured for sheet metal, or plastic from the seats is removed for recycling. The gradual changes in material form over time and space suggest a distinct contrast between *fast* and *slow* obsolescence. The former is led by official policies that discard taxis quickly and on mandated timelines; the latter by everyday practices of breaking, tearing, and repurposing.

The Premier Padmini was the iconic Mumbai taxi for over four decades. Manufactured by one of India's first car companies, Premier Automobiles Limited (PAL), through a partnership with the Italian automaker Fiat, when it was introduced in 1964 it was hailed as one of the first indigenous Indian passenger cars—at once modern and definitively Indian. The smartly engineered car reflected the aspirations of India's industrial and political elite—class mobility, industrial modernity, and professional success. It was marketed to Indian consumers as a luxury car, with early advertisements proclaiming that the car would propel ambitious go-getters into a desired future. But it also had generational flair. In the words of PAL executives, Padminis "were perceived as the differentiator between the young and cool and the old and fuddy-duddy."[1]

The once-innovative Padmini had to fight for its life as the decades passed. As sales fell in the 1960s, PAL struck deals with Mumbai's taxi unions and associations. These agreements provided incentives for taxi permit holders and independent operators to purchase Padminis as taxis. However, once the car became a working-class vehicle, it diminished in consumer value. The aspirational public no longer thought of it as a symbol of upward mobility. Company executives attributed falling sales to state neglect of the small passenger-car industry. In the words of an executive who runs Premier today, "The government *killed* our car and our business."



↓ Premier Padmini. flickr.com/photos/hugo90/3320274881/. CREATIVE COMMONS LICENSE (CC BY 2.0). COURTESY OF SENSEIALAN

It is difficult to say when exactly a Padmini is born or killed. Early Indian cars were often built incomplete due to complex import duties that restricted availability of materials and parts. Local engineers and drivers adapted by using spare parts from other machines. In this sense, these cars were quintessential "fluid technologies."[2] Taxi drivers developed engineering expertise as part of their trade; driving a Padmini often required fixing a Padmini. Moreover, it was common for taxi drivers to resist government efforts at phasing out their cars by pegging the age of their vehicles to certain newer parts (but not others).[3] Like most urban infrastructure, cars too can be dated to several eras. As Michel Serres notes, cars draw from the obsolete, the contemporary, and the futuristic.[4]

While individual cars are discarded along Mumbai's roads, they also gather in the compounds of government transportation and licensing institutions such as the RTO (Regional Transport Office). Transportation officials refer to these as *joona* (old),[5] *kabara* (ruins, junk), *khatara* (slang for tired, but also explained to me to as an auditory feature that describes the rattling sound of old metallic objects—*khat-khat-khatara*). These different ways of talking about old cars suggests how obsolescence gets rendered through vernacular terms, practices, and temporalities.

↑ Khatara/kabara cars in a makeshift junkyard.. PHOTO BY TARINI BEDI

↗ Shade for people waiting for appointments at the Regional Transport Office. PHOTO BY TARINI BEDI

Here, discarded cars sit alongside discarded trucks and cranes, paper or plastic scrap, and food or fabric waste. It's common to see scrappers and ragpickers working through these menageries of waste. One of the reasons that cars are frequently left in public places is because there's a collective understanding that, while obsolete, they continue to offer something of value to the public.

The discarded cars that collect at the Regional Transport Office can be read as an archive of shifts in India's taxi trade over the past twenty-five years. Some taxis were driven off the road and landed here due to government mandates that they be phased out rather than repaired. If RTOs are where the business of transport takes place, clearly this involves more than the issuance of driving licenses, transport permits, driving tests, and approval certificates for commercial vehicles. As this rusting fleet of taxis illustrates, it is also a place of discard and demolition—a graveyard of vehicles *made* obsolete by policy, not because they were useless.

A young man sits in a discarded Padmini to escape the searing afternoon heat as he waits for a friend to finish his driving test. He lounges lazily in the back seat, watching YouTube videos on his mobile phone. Soon, another man comes along and uses the car's hood to spread out and organize his licensing paperwork.

On the other side of the field lie discarded cars from the fleet company TabCab. Fleet taxis were introduced in Mumbai in the mid-2000s.[6] They were owned by large investors who sought to replace the independent-operator taxi industry. Today, however, one finds fleet taxis discarded and abandoned collectively, the fleet industry in Mumbai having all but died at the hands of ride-share apps. Here, TabCab fleet taxis serve as dustbins where bureaucrats working at the RTO toss their garbage after lunch.

In the far corner of the field is a kaalipeeli, manufactured by Maruti, an Indian company that benefited from significant government patronage and surpassed other Indian car manufacturers in the 1980s. Maruti cars made their way into the taxi industry following the obsolescence of Padminis, but many of their models were also eventually phased out.

A young recycler scrapes around and under the kaalipeeli, looking for anything of value. He is sure he can find something there that can give life to something else. This ruined kaalipeeli has a sticker on its side window that cheerfully declares, "*Chalo Haji Ali*" ("Let's go to Haji Ali"). It's reminiscent of

↑ Dustbin in the trunk of a fleet taxi. The surroundings have also become a place for garbage. PHOTO BY TARINI BEDI

↗ Chalo Haji Ali on a taxi window promises travel to a major tourist spot. PHOTO BY TARINI BEDI

a more hopeful time, when the taxi probably traveled to one of the most visited tourist attractions in Mumbai, the shrine of the Sufi saint Haji Ali.

All these cars have been rendered obsolete by particular changes in the taxi industry. While they have ceased to be what they were meant to be, they have been incorporated into new social and material worlds as something else—a garbage receptacle, a washing sink, a source of raw material. More than that, they have melded into the urban landscape itself. Many become landmarks. Scrap-seekers, RTO bureaucrats, and everyday citizens looking for shade depend on these objects, use them, and orient to them.

Seen in this way, obsolescence might be a useful category for those who see these objects as only cars, but for those who use them differently, they have remained alive. The once-lauded Padmini and Mumbai's other, less iconic taxis may have been forcibly rendered obsolete. As vehicles, they may have been left for dead. But as a part of the city, they have not entirely died. They remain integral to life in contemporary Mumbai, and they make it difficult to point to when and if a car ever dies in the city. ■

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Opening image on p. 96: I won't go where you wanna go. commons.wikimedia.org/wiki/File:I_won%27t_go_where_you_wanna_go_(5093262288).jpg. CREATIVE COMMONS LICENSE (CC BY SA 2.0). BY SATISH KRISHNAMURTHY

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Dust, Foam, Waste

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Traces on the sea

Laleh Khalili

The accumulation of capital depends on the ever-contracting time it takes for the objects we consume to become obsolete. Think of how frequently you have to replace your electronics before the software they use ceases to be interoperable. The constant and expanding production of stuff, the constant accrual of capital in the hands of few, depends on the obsolescence of so many of the things we use.

Eighty to ninety percent of this ever-ballooning mountain of goods travels by sea from factory to consumer. The often invisible machinery of circulation is itself subject to obsolescence, as new transportation technologies replace older modes of moving goods. Think of the standardized intermodal container. Or the cranes that move containers from ship to shore. Or the machinery, whether automated or manually operated, lifting and transporting them on land.

Both production and circulation depend on the exploitation of labor. Both produce waste, onshore, offshore, and near the shorelines. And in the interstices of both processes, there are humans on the move—workers, migrants, survivors—struggling to carve meaningful lives out of so much destruction, so much obsolescence.

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The photographs here were taken on freighter journeys funded by the Economic and Social Research Grant of the UK (ES/L002833/1).

DOI.ORG/10.70312/RPQI

“Migration is a universal right.” Marsaxlokk, Malta.

Container locking systems. Marsaxlokk, Malta.

A view from a porthole. Marsaxlokk, Malta.

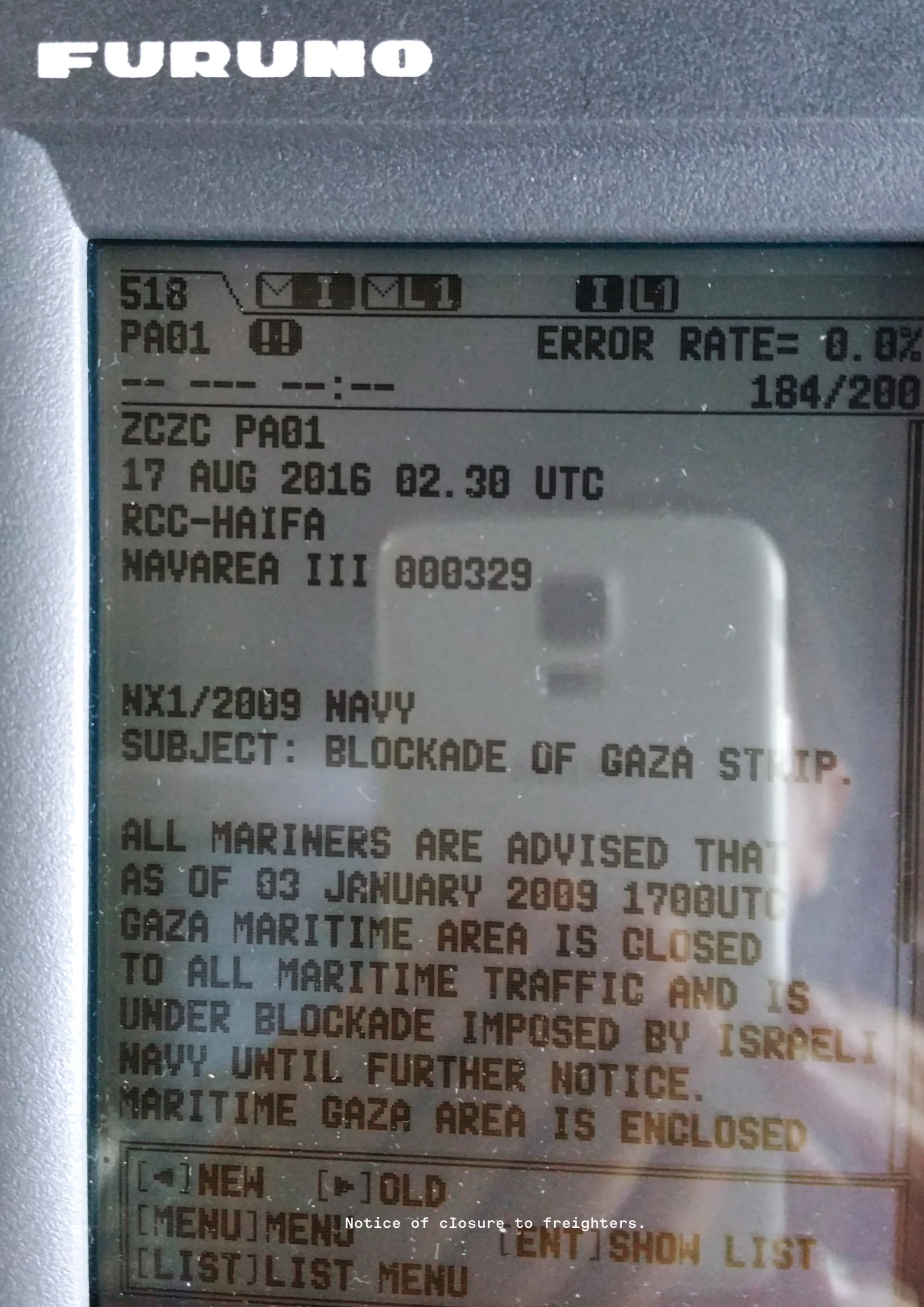
Anchor chain. Marsaxlokk, Malta.

Oil dumped in the sea from a preceding ship, somewhere in the Indian Ocean.

Ship grounded near Damietta, Egypt.

Work gloves. Khor Fakkan, UAE.

Grain silos at the port of Beirut, Lebanon,
destroyed in the August 2020 explosion.



Notice of closure to freighters.

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Deprecating Death

Can the war on life be rendered obsolete?

Raj Patel

Men are nothing in modern war unless they are equipped with the most effective devices for killing and maiming the enemy's soldiers and thoroughly trained in the use of such implements. History proves that an effective implement of war has never been discarded until it becomes obsolete. — William L. Sibert, first director of the US Chemical Warfare Service, 1921 [1]

For something so inescapable, there's a great deal of creativity in death.

New ways of killing are being invented all the time. At the frontier of this invention—and its accompanying forms of obsolescence—is the pesticide industry. The industry's typical cycle of innovation and obsolescence begins with the application of something that kills a pest within an agricultural monoculture in which its natural predators have been removed. At first, the pesticide works. A generation of pests is largely exterminated. But the survivors have a predator-free source of food available, if they're able to adapt. Evolutionary pressures drive pests to develop resistance, and soon, farmers find themselves needing to apply more and more pesticide to achieve the same level of pest control, until new products emerge to reset the balance of forces, and the game begins again.

It's tempting to normalize this cycle, to imagine that obsolescence emerges as a pure function of ecology: following the natural logic of evolution, the pest develops resistance, and then the compound to which it is immune is declared obsolete. This thinking, however, overlooks other forces in play. To see why, it's worth looking at a field that has matured alongside the pesticide industry: the arms industry. First though, a literary interlude.

Written in 1989, J. G. Ballard's "War Fever" is a short story set in a conflict-riven Beirut. Blue-helmeted UN soldiers tend to the wounded, arrange for the orphaned to be fostered, and debrief and photograph the survivors of atrocities "like prurient priests at confession." Amid the suffering, one militant wonders:

> *What if the living were to lay down their weapons? Suppose that all over Beirut the rival soldiers were to place their rifles at their feet, along with their identity tags and the photographs of their sisters and sweethearts, each a modest shrine to a ceasefire?*[2]

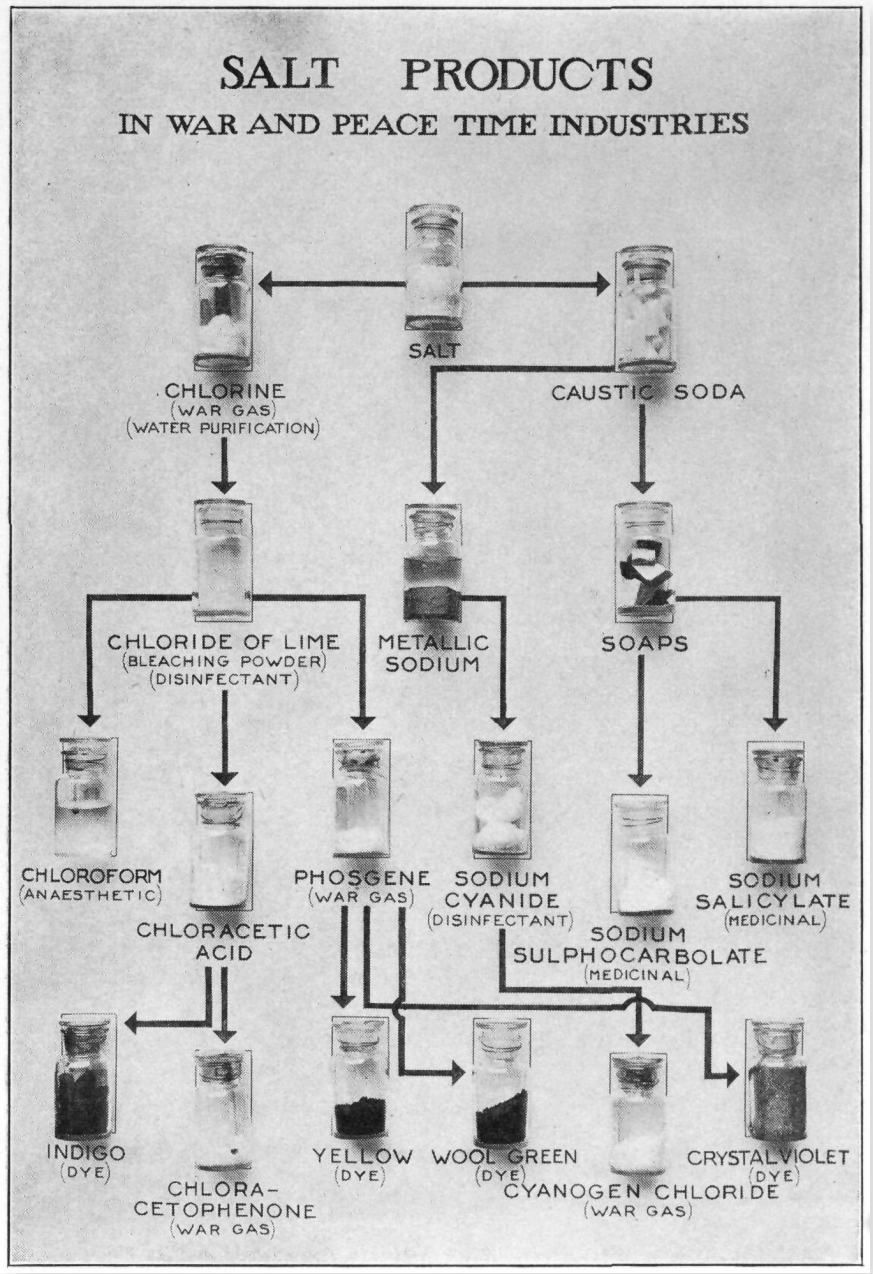
Eventually, it emerges that this Beirut is not what it seems. War on Earth is over because, in just the same way as smallpox has been eradicated (the World Health Organization "deliberately allowed smallpox to flourish in a remote corner of a third-world country, so that it could keep an eye on how the virus was evolving."), so too the UN has kept a small laboratory for hate and conflict in the Middle East, so that the rest of the world could be free from war. In this laboratory, ceasefires have broken out. They are resolved by removing the peacemakers and rekindling the conflict. Ballard's story ends with war finally breaching the safety zone, ready to infect a world immunologically naive to its horrors.

→ Man [and Chemicals] Working in a Rice Field. BY FERDOUS HASAN VIA PEXELS

In Ballard's fictional universe, the forces that decide whether participants have developed a resistance to conflict are those "prurient priests," the UN, who need a permanent war as insurance for a perpetual peace. They're there merely to keep Darwinian forces in motion. In this task they prove too successful. Violence pierces the UN perimeter, in what we come to understand is the world's final lab leak. This science-for-science's-sake approach to war ultimately provides a clue to understanding obsolescence. But unlike Ballard's Beirut, the real world has capitalism, and capitalism makes all the difference.

In the real Middle East, one sees clear intersections of capitalist interests and emerging technologies of death in Gaza, where the Israeli arms industry continues to pioneer and field-test weapons. A recent report by Al Jazeera, a news agency banned in Israel, quotes Antony Loewenstein, who observes that "in every war against Gaza a range of weapons and surveillance tech has been deployed against the Palestinians which is then marketed and sold to huge amounts of nations around the world." Loewenstein arrives at this observation through meticulously documented research in his award-winning study of the Israeli defense industry, its international schools for police, and its cyber warfare tools. The title of his book: *The Palestine Laboratory*.[3]

"In these cycles where resistance begets obsolescence begets innovation, war is, necessarily, a permanent state of crisis and fixing and profit maximization."



→ Killing salts—uses of salt products in war and peace. 1922. IMAGE BY UNITED STATES CHEMICAL WARFARE SERVICE [10]

The divergence between "War Fever" and *The Palestine Laboratory* presents an opening for understanding obsolescence. Obsolescence figures not as some inflection point within the calculus of natural selection; ecological resistance matters less than economics. It's worth remembering that both the arms and pesticide industries are *industrial* concerns. They've often been one and the same.

The manufacturers that produced chemical weapons during World War I were also in the business of producing pesticides. The development of one application often begot the other. The pursuit of explosives and deadly gases birthed the world's first synthetic organic pesticide, paradichlorobenzene.[4] Early chemical weapons were tested on insects, and during WWI fumigants used in the French fruit industry, like hydrocyanic acid, were tested on humans.[5] As insecticides morphed into chemical weapons and vice versa, the consequences of WWI on the pesticide industry were seismic—not least in transforming the sleepy American dye manufacturing industry into a global powerhouse dominated by two firms, National Aniline & Chemical, and DuPont. Both of these companies sought profits that might approach the scale of Germany's

chemical giant IG Farben, which in the interwar years became Europe's largest corporation, and a direct backer of the incipient Nazi war machine.[6] History has thus rendered the respective industries of killing humans and killing pests not just analogous, but also homologous.

In these cycles where resistance begets obsolescence begets innovation, war is, necessarily, a permanent state of crisis and fixing and profit maximization. Flipping through pesticide industry archives reveals names like Javelin, Bravo, Captain, Ammo, Boomerang, Warrior and, when that became obsolete, Warrior II with Zeon Technology®. To combat resistance, new pesticide technologies are marketed. Just as in the arms industry, obsolescence happens not only in the field, but also in the product catalogue.

The pace is quickening. At the beginning of the twentieth century, the lifespan of a commercial pesticide was around forty years. Very few pests were observed to develop resistance to the arsenal of toxins produced through agricultural chemistry. But early chemical salt pesticides were problematic, both because they were universally lethal to animals and because so much was applied that it was hard for humans to avoid getting poisoned too. The advent of synthetic pesticides like DDT promised far lower rates of application, but caused resistance to soar. With higher resistance came more market opportunities to declare a pesticide obsolete. One observer notes that "prior to 1946, a new resistant species emerged every two to five years. Between 1946 (one year after the introduction of DDT) and 1954, the rate rose to an average of one to two species annually; between 1954 and 1960 the rate was 17 per year."[7]

↓ "DDT is good for me-e-e!" 1947.
COURTESY OF SCIENCE HISTORY INSTITUTE

Pesticide inventors have found creative paths to manufacture new kinds of obsolescence. Back at the beginning of the discovery of pesticide resistance, a novel idea was proposed to deal with the problem of the resistant San Jose scale, an invasive insect wreaking havoc on North American agriculture. Rather than change the weapon, it might be necessary to transform the victim. In a 1908 paper, one author proposed inducing an ordinary "scale to cross with the immunes and thus return to the normal susceptible population."[8] The release of modified insects in the twenty-first century, notably mosquitoes that are either sterile or contain a genetic modification that causes the insect to die before it reaches adulthood, is the latest iteration of this idea.

"Since industrial pesticide manufacture is a war without end, the only logical way to stop cycles of innovation and obsolescence is an agroecological armistice..."

Pioneering this new frontier of profitability, the pesticide business has become the "crop protection industry." A decade ago, its profit center moved from the manufacture of new killer chemicals toward the licensing of plants that can themselves manufacture pesticides. Cotton, for instance, was genetically modified to exude *Bacillus thuringiensis* toxins to ward off predatory insects. Inevitably, these pests developed resistance. The next generation of these plants are now being engineered to also produce specific RNA inhibitors, configured to disrupt the juvenile stage of a target insect.

The pesticide industry can see the big picture. Just as with the arms industry, where bullets and guns are a reliable but not terribly profitable source of income, the money now is in data, surveillance, and cyber warfare. Insects will always develop resistance, but the long-term royalties come from plant platforms that can be updated yearly with the latest cassettes of genetic information. The problem for the pesticide industry is that plant varieties are subject to law that predates the digital era. You can study this complaint in a paper aptly entitled *Obsolescence in Intellectual Property Regimes*, penned by a University of Iowa law professor and a research fellow at Pioneer Hi-Bred (a subsidiary of Corteva, the agricultural spin-off of DowDuPont).[9] Plant varieties can be protected as intellectual property and subject to experimentation by farmers. But, the authors offer, "'variety' is an artificial construct that developed as a pragmatic response to marketplace needs, and as a convenient legal construct to facilitate consensus on intellectual property rules." The protection of varieties inhibits innovation, they argue, because it allows farmers to tinker and develop their own, rendering the industry's huge investments in genetics far less lucrative. Instead of protecting varieties, industry representatives sketch an intellectual property regime that understands plants less as stable beings, and more as living data sets.

If this enclosure of knowledge marks another expansion of capitalist frontiers, it also entails a discernable management of obsolescence. Insects may develop resistance to the latest advances in "crop protection." Individual pesticides may become obsolete at the moment their replacement is brought to market. But the product line can live forever.

A happy ending here would be (recalling Ballard) an end to the war on the web of life. Since industrial pesticide manufacture is a war without end, the only logical way to stop cycles of innovation and obsolescence is an agroecological armistice, in which biodiverse ecosystems are nurtured and insect populations managed not through annihilation but through ecological balance under a postcapitalist society.

Unfortunately, the chemical industry has behind it the awesome power of the state, finance, and philanthropy. With that backing, it remains remarkably adept at escaping regulatory control. Given recent successes by the pesticide industry to evade even the lightest attempts to restrict its use in Europe, as well as the growth of the industry through Chinese capital, and Bill Gates's deep pockets bringing the Green Revolution to Africa, experiments to generate profit from death are constantly being expanded. As a result, we will continue to enjoy new ways of dying for many years to come. ■

RAJ PATEL is a Research Professor at the Lyndon B. Johnson School of Public Affair at the University of Texas at Austin. He is the co-author of *A History of the World in Seven Cheap Things* (University of California Press, 2018)

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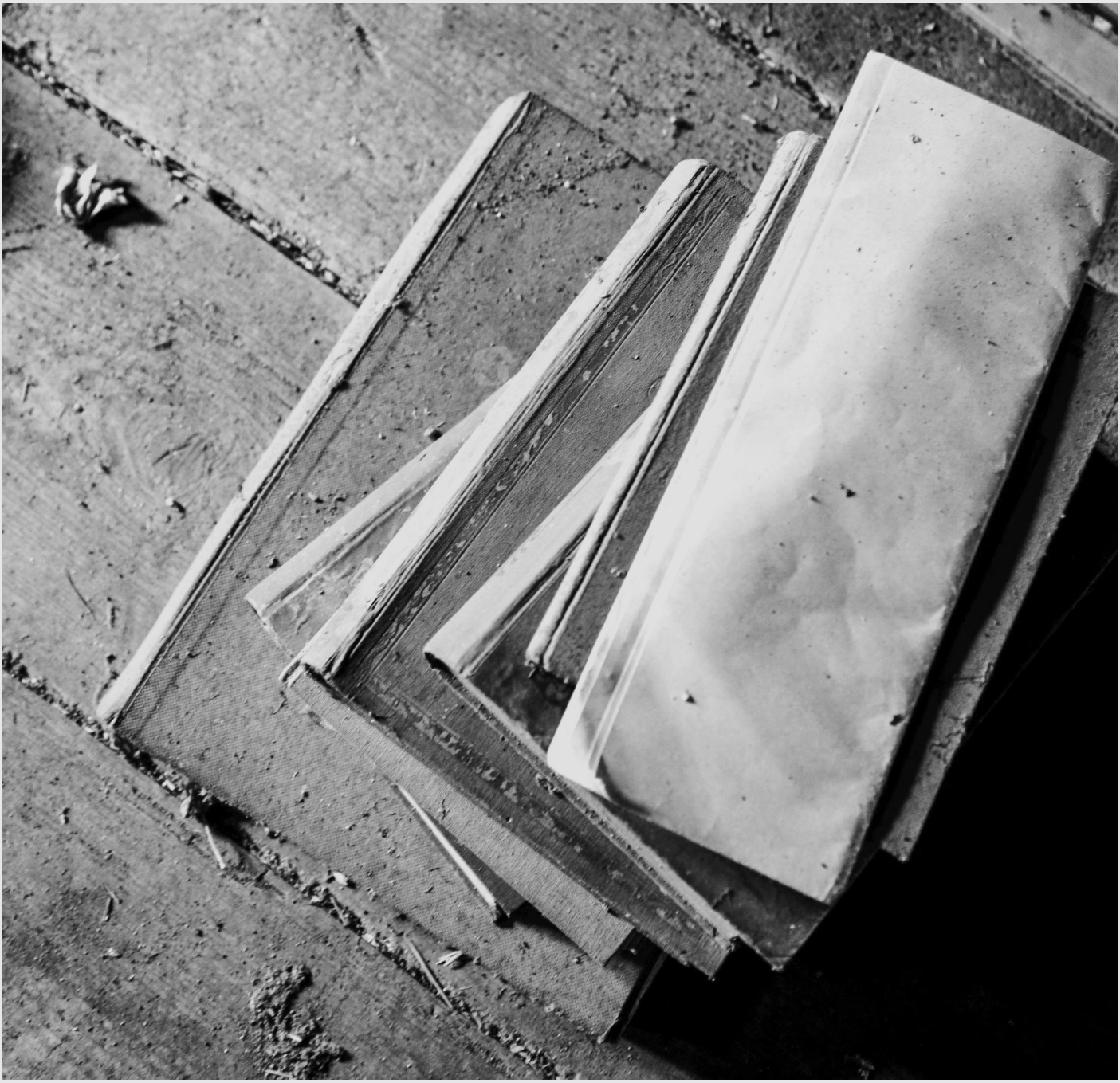
Opening image on p. 114: Close up of a Vine Weevil. BY RUBEN BOEKELOO VIA PEXELS

Is Limn Obsolete?



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The founding editors reflect on the journal's origins

Christopher M. Kelty

Stephen J. Collier

Andrew Lakoff

Is *Limn* obsolete? Or is it a replacement for something that is—or should become—obsolete? With the launch of this issue and the transition to a new set of voices and ideas, the former is clearly not the case. *Limn* is set to be more vibrant than ever, the editors firmly committed to the innovative, the untried, but also the careful, the reparative aspects of maintaining something. If the latter, though, what might *Limn* displace, repair, or supersede?

When *Limn* started in 2010, it emerged out of two puzzles of obsolescence. On the one hand, it was a puzzle why existing modes of research and writing in the interpretive social sciences remained committed to models and methods that seemed mismatched with contemporary problems. On the other hand, it responded to an obsolete publishing model by means of the technical and practical possibilities then emerging.

"When *Limn* started in 2010, it emerged out of two puzzles of obsolescence."

In addressing the first puzzle, *Limn* was created as a vehicle for new forms of concept work and collaboration. As founding editors, we came from disciplines, particularly anthropology, that valorized individualized research and virtuosic interpretation, with long time horizons for research and publication. By the early 2000s, this practice seemed increasingly insufficient for engaging with emergent phenomena in domains like science, technology, global health, governance, and planning. *Limn* was an experiment in a different model of writing and publication. It responded to rapidly unfolding situations such as pandemic outbreaks, industrial accidents, and cybersecurity breaches by framing them genealogically and placing them in the context of other events that raised similar problems. It asked contributors to quickly generate reflections on such events that would be accessible to a wide range of readers. The magazine's title refers to illuminating the space around an event or problem in order to make it intelligible, rather than simply reporting on or critiquing it.

While *Limn* aimed to experiment, it also sought to conserve and reinvent certain practices that were, at the time, seen as obsolescent by many of our colleagues. It ran against the grain of siloed research practices, and against a methodological orientation to particularization and difference. It insisted on the importance of identifying shared problems, conducting inquiry into common or overlapping empirical objects, and creating venues for shared collaborative work. We were inspired by the notion of curation: the conceptually motivated juxtaposition of specific sites and topics to bring them into a conversation with one another, in the hope of generating surprise for readers, contributors, and ourselves.

At times, this meant crafting and testing concepts against different cases and ongoing research—clouds and crowds (Issue 2), public infrastructures and infrastructural publics (Issue 7)—that could make new sense of salient contemporary problems. In other cases, it involved identifying concepts that experts, policymakers, and advocates were defining and contesting, such as systemic risk (Issue 1) and disease ecologies (Issue 5). *Limn* extended such concepts beyond their expert usage to bring contemporary problems to light and to clarify their stakes. It was thus both a reaction to the fading utility of predominant models of knowledge production, and an effort to recapture and reinvent obsolescent forms. The proof of such a proposal is in the first ten issues of *Limn*—issues that captured this collaborative inquiry process in a series of snapshots distinct from the established model it responded to.

The second puzzle that *Limn* addressed was the state of scholarly publishing. For decades now, an enthusiasm for the digital has rendered old modes obsolete, often for no particularly good reason. By 2010, the digitization of the publishing industry had been underway for a long time. Still, it was at this moment that a range of new technologies suddenly made publishing much

more accessible and immediate. Not only had it become possible to easily and quickly publish on the web, but it had also become much cheaper and easier to print and distribute physical books and magazines as a generation of start-ups experimented with "disrupting" publication.

Part of the puzzle of this moment was that the intense fever for digitizing everything actually opened up new ways of relating to the printed volume. Early discussions around *Limn* assumed it would be an online, blog-like publication—this was essential to its identity as timely, in contrast to traditionally slow scholarship in printed books and journals. But the apparent rapid obsolescence of printed books and journals instead created a renewed desire for them, and a new appreciation for the role of design and the care involved in crafting such things.

The decision to go with a printed volume was given momentum by a chance meeting with Martin Høyem. Høyem had been publishing an online magazine called *American Ethnography*, but he is also an artist producing various material objects, mail art, and woodcuts. His own engagement with the magazine as a form was instrumental to the shape that *Limn* eventually took, which was unlike most print versions of existing scholarly journals. With Martin's help we enjoyed (and sometimes were exasperated by) the atavisms that the form could throw our way.

In 2010, open access to scholarly publications was still an untested and poorly understood idea. One of us had been experimenting with such forms for several years as part of research on open-source software and its derivatives, but also in one of the first scholarly blogs of the era, *Savage Minds*. Still, it was far from clear how to make it work for *Limn*. Many changes were on the horizon: social media, the proliferation of smartphones and tablets, and the first stirrings of a backlash in Edward Snowden's revelations. One digital era seemed to be going obsolete even as another one emerged.

The commitment to open access was from the beginning, however, a question of money. Or to be more precise, the lack of it. Well before debates about open access spread widely into academia, it was clear that there was no viable financial model for an open-access scholarly magazine. Crowdfunding and novel subscription models for digital content (e.g., "pay what you want") were in their infancy and, at the time, it was hard for anyone to imagine why they would pay for something they could freely access online. Thus, a print version seemed to hold out the possibility of a revenue stream—*Limn* was "free, but also for sale." More importantly, it gave *Limn* a sense of permanence, an ironic bid at mediating between the timeliness of getting things published and into debate quickly, and the anxiety about having them obsolesce too quickly.

While the print version sold a reasonable number of copies, it was never quite enough to cover the significant design and labor costs associated with the magazine. Over the years, we negotiated with university presses, journal publishers, foundations, and our own universities. None were interested in funding a bespoke, expensive-to-produce scholarly magazine. But this, too, started to reveal an obsolete practice that we were embracing: the careful and passionate crafting of work in a small community of like-minded people, a labor of love. This small-scale form of care for the medium resonated and still resonates with many people.

Did we solve either puzzle? Maybe a bit? We are grateful for the attention, community, and support the project has received, and it is with honest enthusiasm that we hand it off to others who want to do more. Will the new incarnation of *Limn* address the same puzzles of obsolescence, or are the problems we face today in need of a different approach? Who knows? *Limn* is obsolete; long live *Limn.* ■

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Opening image on p. 122: Books, Dirty. BY MARKUS SPISKE VIA PEXELS

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