Server Manifesto

Data Center Architecture and the Future of Democracy

Niklas Maak

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This Is a Historic Moment Why We Need New Public Spaces to Experiment with and Reclaim Digital Sovereignty for the People

Francesca Bria

Francesca Bria, born 1977 in Rome, is president of the Italian National Innovation Fund, a member of the board of directors of the television broadcaster RAI Uno, professor at University College in London, and chief advisor to the United Nations on digital cities. She initiated the European Union's DECODE project to reclaim collective data sovereignty.

We are still in the midst of a global emergency, which represents an unprecedented economic shock that has forced us to adapt, think in new ways, and act quickly. Decades of economic polarization have increased inequalities, with many people facing debilitating insecurity. The lockdown has led to more economic damage and further economic polarization. Many people consider the economy to be a system to which they do not belong, a system designed to favor others.

The coronavirus pandemic makes radical and future-oriented political action even more urgent. Crises, whether wars or pandemics, can sometimes feed the social imagination. New pacts must be forged and the old rules deeply transformed. This pandemic also triggered a sort of "forced" digitalization of many aspects of our daily lives. Digital infrastructures have proved to be critical infrastructures, on which essential services of society, such as work, healthcare, and education, depend. Access to connectivity-free, public, and accessible ultra-broadband is to be considered a fundamental right of all citizens. Developing technologies such as 5G networks, cloud computing, and artificial intelligence (AI) infrastructures have suddenly become national and global priorities.

However, market dominance has become a real concern. For Big Tech, the pandemic was a positive shock. While all other firms slowed down, tech firms sped up investments and acquisitions: the major digital players have achieved a combined stock market value of over $8 trillion. US tech shares are now more valuable than the entire European stock market. If five companies own the digital economy, can it really work for all of us? We must ensure that the development of digital capitalism does not result in irreversible forms of economic concentration.

Digital platforms are powerful algorithmic institutions that are strongly transforming the labor market and challenging regulations. Automation of labor-intensive sectors such as manufacturing, logistics, and transport has a big impact on the global commodity chain and on job dislocation and destruction. In this digital transformation of society, we must be aware of the long-term political and social challenges that it entails. The rise of digital capitalism brings many challenges—from monopoly power to the need for a new tax for digital platforms, as well as trade regulations, unemployment due to automation, and questions related to civil liberties and democracy.

Furthermore, the public sector, too, is increasingly dependent on the tech industry. Yet, we rarely ask where this power and dependence come from. Why is the immense economic value that such a digital

revolution represents attributed exclusively to technology firms—and not to ordinary citizens or public institutions? And what can we do to ensure that we return some of that value back to citizens, while empowering them to use technology to participate in politics—a process from which they justly feel excluded—as well as to offer better and more affordable public services? It is obvious that we need to re-politicize the question of technology, and that the discussion should be about the redistribution of assets and power, and the management of future welfare services and critical infrastructures.

Accelerating digitalization is not enough. It is also necessary to give it a direction. In my view, what we really need is a new social contract for digital society. We should call it a "smart green new deal" because it is about using digital technologies to attain both social and environmental sustainability.

This digital new deal will be about restoring our digital sovereignty. Digital sovereignty means that as a society we should be able to set the direction of technological progress and put technology and data at the service of the people. This also means directing technological development to solve the most pressing social and environmental issues of our times, starting from the climate emergency, the energy transition, and public healthcare.

Digital sovereignty means that digital technologies can facilitate the transition from today's digital economy of surveillance capitalism—whereby a handful of US- and China-based corporations battle for global digital supremacy—to a people-centric digital future based on better workers and on environmental and citizens' rights, in order to achieve long-term social innovation.

Europe understands the real threats to sovereignty in the hyper-technological twenty-first century, and it is clear that Europe being seen as a "regulatory superpower" is not enough anymore. The European Union needs to remain relevant as a global economic power through its scientific and technological innovation, taking back control of connectivity, data, microprocessors, and 5G. Europe needs to build alternatives to Chinese technology manufacturing monopolies and US-based intellectual property, digital, and payment monopolies. To achieve this goal, we need both ambitious regulation and a digital industrial strategy. This battle is about defending innovation for the public interest, about the data sovereignty of citizens, their autonomy, and their constitutionally guaranteed rights.

This might seem like mission impossible. And yet, there is one bright spot on the horizon: cities. They cannot, of course, solve all of our digital problems—many of them need urgent attention at national and global levels—but cities can become laboratories for democracy and sustainability. They can run smart, data-intensive, algorithmic public transportation, housing, health, and education—all based on a logic of solidarity, social cooperation, and collective rights.

My suggestion is to start from a network of cities promoting ambitious policies to take back the democratic governance of digital technology and data sovereignty. Cities should give power back to citizens through a process of participatory democracy and use the city data to tackle our big environmental and social challenges: climate, sustainable mobility, affordable housing, healthcare, and education. We should seize this historical opportunity. When we talk about urban technology and data, we are dealing with some kind of meta-utility—composed of those very sensors and algorithms—which powers the rest of the city. As cities lose control over the said meta-utility, they find it increasingly difficult to push for non-neoliberal models in supposedly "non-technological" domains such as energy or healthcare.

The notion of "sovereignty"—whether of finances or energy—permeates the activities of many urban social movements, including those transitioning into leadership positions in their respective cities. Concepts like energy sovereignty may be easily grasped and capable of mobilizing large sections of the population, but what does energy sovereignty mean once we transition onto the smart grid, and firms like Google offer to cut our energy bills by one third if only we surrender our energy data? Does the struggle for "energy sovereignty" mean anything if it is not intricately tied to the struggle for "technological sovereignty"? Probably not. A fight for digital sovereignty should be coupled with a coherent and ambitious political and economic agenda capable of reversing the damage brought by the neoliberal turn in both urban and national policy. Well-targeted pragmatic interventions can have a big impact.

The right to the city might need reformulation as the right to enjoy rights altogether, as the alternative means risking that digital giants will continue redefining every right. What, for example, does a right to the city mean in a city operated by technology companies and governed by private law, with citizens and social communities unable to freely and unconditionally access key resources like data, connectivity,

computing power, and artificial intelligence, which could allow them to pursue self-management? And to what extent would losing control over the information-powered meta-utility undercut successful remunicipalization campaigns, whether to reclaim energy, transport, or water infrastructure, allowing the utilities in question to transition to their own "smart" consumption model with a new set of private intermediaries?

Ultimately, brave cities that want to deploy key resources and digital infrastructures under a different legal and economic model—one that produces outcomes which would benefit local residents and local industry—must show that the economic models proposed by the likes of Uber, Google, and Airbnb do not deliver the promised results—at least not without causing a considerable amount of damage to the cities in question, from the rise of the speculative economy and gentrification to the precarization of labor in the gig economy, and the immense blockage of social innovation by those without access to data. Many of these alternative experiments to achieve digital sovereign cities must happen with the participation of other like-minded cities and with stronger synergies at national, European, and global levels, as demonstrated by promising projects such as the Cities Alliance for Digital Rights initiated by Barcelona, New York City, and Amsterdam.

A New Deal on Data: City Data Commons

Changing the data ownership regime may be an affordable option, if only because it would not require massive financial commitments and represents an agenda with intuitive popular appeal: cities and citizens, not companies, ought to own the data produced in cities and should be able to use the said data to improve public services and put their policies into action.

In the fourth industrial revolution, data and artificial intelligence are essential digital infrastructures that are critical for political and economic activity. Data has become the most valuable commodity in the world. It is the raw material of the digital economy, and fuels AI. Companies in every industry are counting on artificial intelligence to drive growth over the coming years. Data cannot be controlled by a handful of tech giants. Business models that exploit, manipulate, and monetize personal data to pay for critical infrastructures are broken. We need to democratize data ownership and artificial intelligence, and

move from data extractivism to data commons, understanding data as a public good and a critical public infrastructure, alongside roads, electricity, water, and clean air. It is a meta-utility that will enable us to build future smart public services in transportation, healthcare, and education. However, we should not build a new panopticon. Citizens will set the anonymity level, so that they cannot be identified without explicit consent.

The immense economic value that data represents should be returned to citizens. By helping citizens regain control of their data, we can generate public value, rather than private profits. I have tried to do just that in Barcelona during the past four years, turning municipal data into a common good, co-owned by all citizens, and redefining the smart city to ensure that it serves its people. When I was the Chief Technology and Digital Innovation Officer of the city, Barcelona had been betting on a new approach to data called "city data commons," intending to strike a new social pact on data to make the most of data, while guaranteeing citizens' data sovereignty and privacy.

Barcelona has been socializing data in order to promote new cooperative platforms and democratize innovation. This was the objective of DECODE, a project that developed decentralized technologies (such as blockchains and attribute-based cryptography) to give people better control of their data, in part by setting rules on who can access it, for what purposes, and on which terms. By helping citizens regain control of their data, the city was able to use data to generate public value rather than private profit. This enabled the creation of a "data commons" from data produced by people, sensors, and devices. A data commons is a shared resource that enables citizens to contribute, access, and use data—for instance, on air quality, mobility, or health—as a common good, without restrictions related to intellectual property rights.

The city was also able to use the data shared as a digital commons in order to solve real-world problems, in a very concrete way. DECODE integrates with the participation platform decidim.barcelona, already used by thousands of citizens to shape the city's policy agenda, with over 70 percent of the government actions proposed directly by citizens.

New Public Spaces to Experiment with in the Digital and Green Age

It is often said that the digital revolution is changing everything more radically than has been the case since the onset of industrialization, but these shifts are no longer reflected in the public spaces of cities, and that is why the general public remains unaware of them most of the time. An important element emphasizing the importance of cities driving alternative data democracy experiments is the fact that this would help to make key enabling technologies like data and AI visible and understandable, grounding such knowledge in a new kind of public space. To that end, we need what Niklas Maak calls a "Centre Pompidou for the digital age" (in *Frankfurter Allgemeine Zeitung*, November 22, 2020, and in this book), a data environment where citizens of all ages can learn what is happening in the digital world, how digitalization and artificial intelligence work. To raise the political and ecological awareness of citizens and to make alternatives visible, a new type of hybrid public space can be imagined, made up of a data center, library, and museum of the future, a new educational facility in which schoolchildren, but also politicians, can learn digital skills, where guided tours for school classes and programming courses could be organized to foster awareness of what we can do with data if it is made available for public use. This is about nothing less than the future of government, governance, and our economies, making sure that our institutions are able to work with this data—to improve public services and to make cities greener, while preserving citizens' fundamental rights.

Urban data can be very important for planning the ecological transition by redesigning green spaces, as has been done in Barcelona with the Superilles; and environmental and pollution data can help cities to reach their zero-carbon targets. It could also facilitate the use of digital technologies as a driver for innovation and for ecological transformation, which lies ahead of us. In times of rising public anxiety over the massive concentration of data power, such a new public space for the digital and green age would carry the same symbolic weight as the town hall did against the feudal lord's castle, as Niklas Maak argues.

This approach has immense educational potential. The different projects developed in cities using data commons and democratically governed digital infrastructures and technologies can connect artists, ICT experts, businesses, designers, scientists, and startups in such a place to develop and present prototypes that address sustainability and environmental challenges. Executed strategically, this could have a massive positive spillover effect into the sphere of education,

boosting not only the digital skills but also the ecological awareness of citizens. Coupling data democracy projects of the likes of DECODE with intensive, hands-on, multidisciplinary programs enhances citizens' digital education and unites experts from the fields of culture, science, and technology—explicitly aiming to accelerate the apprehension of digital skills, and thus initiating youngsters into forward-looking technologies and new views, ideas, and concerns around the opportunities, limits, and potential pitfalls of digital technologies. Citizens of all ages, alongside artists and scientists, should be able to explore tools and applications that help make sense of the world around us and build an active, critical, and sustainable attitude toward their environment and technology.

Following the democratic nature of the museum, the library, and the public square, this new institution will be an exceptional but also completely ordinary space, a true treasure trove of the digital age. It will be a place to converse and debate over a cup of coffee, but also to understand digital technology and data as something that we own in common—the true public good that can help us to tackle our big societal challenges, starting with the climate emergency and ecological transition.

Toward Big Democracy: Europe's Path to Our Digital Future

As we ask how we could create a financial sector that serves the real economy, we should be asking how we could create a digital sector that serves the people. We need a new social pact for the digital society that will make the most of new technologies, access to data, and artificial intelligence, while guaranteeing citizens' fundamental rights, workers' rights, environmental standards, and gender equality. It is a matter of democracy, and cities like Barcelona can show the way and open a path for a network of digital sovereign cities reclaiming democratic governance of twenty-first century infrastructures, including data sovereignty and ethical AI for citizens, with new types of public spaces being devoted to spreading political awareness and experimenting with alternative solidarity-based, common digital infrastructures.

Only by coupling a digital transition with a green new deal will we be able to break the binary logic that always and only presents us with two scenarios for the future of the digital: Big State, the Chinese and Orwellian model, or Big Tech, the Silicon Valley surveillance capitalism model. Big State straps people of their individual liberties,

while Big Tech creates data monopolies that will eventually run critical infrastructure such as healthcare or education. Neither is an option for a democratic world. I advocate for a third way: Big Democracy. A democratization of data, citizen participation, and technology at the service of society and the ecological transition.

If we as a people fail to regain digital sovereignty, then we run the risk of becoming part of a digital colony in a sandwich between China and the United States. In the post-pandemic phase, we stand at a historical crossroads: we can take back our technological sovereignty, by advancing a new digital humanism that refuses Big State, Big Tech, and the tech wall between China and the US. In order to make this vision a reality, we need a new movement and new public spaces that can advance an alternative—making technology a right and an opportunity for many, instead of a privilege for the few.

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Niklas Maak

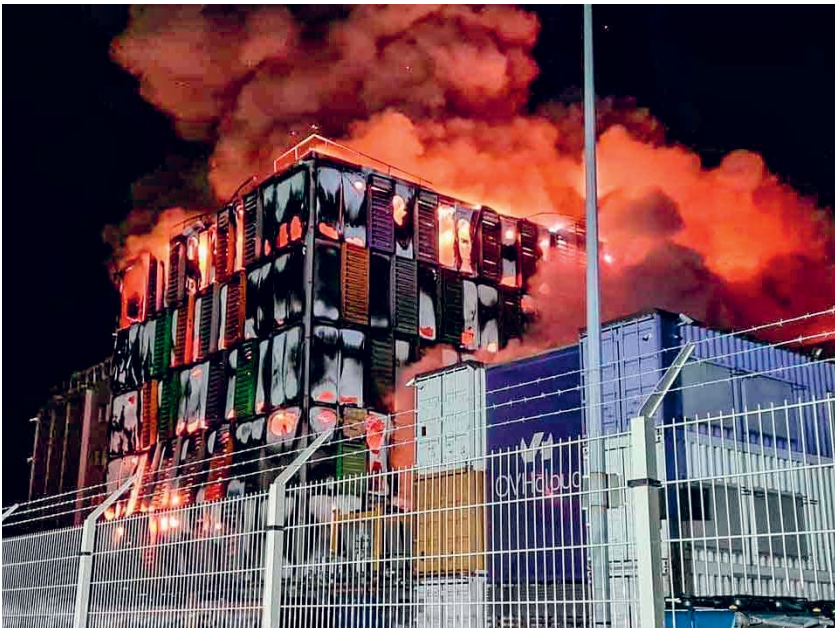
You were already in it before you came in, and
you will still be in it after you have gone.
—Denis Diderot, *Jacques the Fatalist and His Master*

Our storage systems are vaults for data.
And data is the gold of the twenty-first century.
—Roger Süess, CEO of Green Datacenter

I. The Cloud Is Burning

On Wednesday, March 10, 2021, at two in the morning, a gigantic black cloud of soot was seen rising into the air near Strasbourg. The building, which was completely destroyed that night, housed what is known as the "cloud." Two of the four data centers of Europe's largest hosting provider OVH were destroyed; both contained large amounts of data from government organizations. The city of Colmar's website crashed, and 3.6 million websites went offline, including those of banks, news channels, state portals, and the government site data.gouv.fr. The cloud burned, and the data went up in flames.

The fire could have been dismissed as a spectacular accident without fundamental consequences if the data had actually been stored elsewhere and could still be accessed via other data centers, which would have been technically possible—but apparently quite a few OVH customers had foregone synchronization for reasons of cost: they would have had to pay for it. Data physically went up in smoke that night, and with it the reassuring idea that it is stored in a "cloud," secured in an almost celestial way, ascending to eternal knowledge where it floats, placeless, unassailable, indelible, in global space. In



Major fire at the data center cluster OHV in Strasbourg, France, on March 10, 2021

reality, contrary to what the cloudy rhetoric of the providers suggests, the cloud is just a building, in this case with space for 12,000 servers, that can burn down just like any other building.

The burning server farm looked like a Valhalla of the digital age: that night in Strasbourg revealed above all the physicality and vulnerability of data storage technology, and of the Internet in general, which has been rhetorically elevated to the status of an unassailable force of nature. At a moment when it is becoming increasingly clear that "data is the new gold," and that the functioning of the state depends on access to it, the airy "cloud" turned into a column of smoke, a symbolic image of an epochal break—of the difficult transition from the culture of combustion to the digital age, from the fossil to the immaterial, from the sooty grime of printer's ink and exhaust pipes, the dirty warmth of chimneys and cigarettes to the icy glow of cold, smooth screens and data storage.

Server farms are the most important new building typology of the twenty-first century. They are to the digital world what castles used to be in medieval times: the seat of power. They are the largest buildings of the present—the Citadel Campus in Nevada, one of the largest server farms in the world, operated by Switch, is 66 hectares in

Google data center, Georgia, USA

size—yet, at the same time, architecture generally plays little role in their design. The spectacular interiors of data centers, with their endless racks of flashing lights reminiscent of a metropolis at night, are contrasted, in most cases, by an utterly bland exterior. Most server farms manage the considerable feat of being huge, on the one hand, and virtually invisible on the other.

II. The Server Farm Is the Most Momentous New Building Typology of Our Time— But Also the Most Invisible

For a very long time, and actually until quite recently, you only had to take a quick look at a city to understand where the power was: the great town halls of free cities were symbols of civic pride and a counterweight to the castles of the feudal lords who controlled the land. In modern consumer society, it was the office towers of large corporations; the skyscrapers of Woolworth and Chrysler were visible for miles around the city, like built exclamation marks announcing who was in charge under capitalism. Today, the digital revolution is changing everything more radically than at any time since the beginning of industrialization; the influence of tech companies on the economy and politics is obvious—but these shifts are no longer reflected in the cities. In fact, in recent times no demonstrations of power were to be found at all; even the state refrains from constructing buildings that proudly depict a functioning bureaucracy; city centers are becoming idyllic, green, low-traffic zones or systems of meandering walkways. On closer inspection, the measures sold as green "city improvement" are also disciplinary measures: the squares, barricaded with countless seating areas, booths, fences, vegetation, and playground equipment, ensure that no mass gatherings, protest marches, or demonstrations can take place there. The new ideal is the strolling, contemplating, relaxed citizen, not the politicized, protesting one.

If anything big is built into these ruralized idylls of calm, it is concert halls or museums, or replicas of castles that serve as museums. New typologies might be produced by the digital age—just as the nineteenth century gave the city the train station, or the twentieth century gave it the TV tower and the parking garage—but they are not to be found in city centers. There is no Googlescraper in the form of a

futuristic architectural search engine, no giant cardboard-box-shaped Amazon Theatre, and no Facebook Tower in the form of a gigantic blue thumb. On the contrary, Frank Gehry has designed an enormous flat hall for Facebook's headquarters with a roof so green that, seen from above, it looks like part of the Bay Area marshlands. The new technological force has become invisible for a reason.

It is no coincidence that the tech industry is assuming a form that looks as if it had always been a part of the human ecosystem. The Facebook campus achieves a new form of non-statement architecture, elucidating the fact the new power that is shaping the early twenty-first century is marked by a new relation of invisibility and omnipresence; even at night, the Internet of Things extracts data on heart and breathing rates from its users with sleep trackers and smart wristbands. The new typologies of the twenty-first century, built by corporations like Amazon, DHL, or Google, lie like fallen skyscrapers in the landscape between highway intersections, business parks, and industrial areas. No architectural detail—at most a logo here and there—reveals what is going on inside. They are meant to be the opposite of architecture: saying nothing, betraying nothing, offering no surface for attack. The fact that data centers, which after all store one of the greatest treasures of the information age, worth billions, are housed in these immense, faceless hangars outside the city limits is no coincidence. Indeed, what we call "architecture" today and honor with prizes is mostly an attempt to repair and keep alive what is simultaneously being destroyed by what takes place within the non-architecture of the package warehouse and the server farm: the classic city, with its shopping streets and cinemas and offices.

Digitalization Is Turning the City into a Park of Ruins

Digitalization is driving the city into an elementary structural crisis. As a result of the technological revolution and its consequences, cities are heading for the largest production of ruins in history: countless post offices, shopping centers, parking garages, and office buildings could soon stand empty, if only because the transfer of large amounts of work to home offices and robotized, decentralized production facilities is too economically tempting for their operators. But if the central typologies that defined the idea of the city for centuries gradually disappear, then many cities could soon resemble a version of late antique Rome, a modern park of ruins filled with collapsing

Digitalization is turning the city, its office towers and shopping malls, into a park of ruins.

shopping arcades, overgrown post offices, and crumbling office complexes.

Meanwhile, the typology of data centers—or, rather idyllically (as if a server rack were something like a digital cow), "server farms"—is experiencing rapid growth. This growth is a direct result of the demise of the old giants: when millions of employees are expected to go mobile from one day to the next, when representatives no longer meet at conference hotel bars but on Zoom, and when purchases are ordered online, then you need a powerful data infrastructure—that is, data centers that rent out server power to store and process data.

The social problems that data centers cause simply by their sheer size can be seen on the edges of the city. With their space requirements, these data centers are squeezing the already sparsely sown commercial areas—land prices are rising, and the small businesses so important to a thriving city are being squeezed out. What does the transformation of business parks into giant data centers mean; and what role might not only the data itself, but also the places where it is stored, play for cities and society?

This book is not intended to provide blueprints for the most beautiful or ecological server farm, nor is it a comprehensive cultural history of the data center; that history is being researched by various universities and research chairs.

Rather, it brings together thoughts, designs, and ideas that emerged in various seminars at the Harvard Graduate School of Design and at the Städelschule in Frankfurt am Main. They all address the question of why most server farms are concealed so invisibly on the outskirts of cities, why their placement and architecture do not display the fact that the ownership of data in a digital society translates into extreme economic and political power.

They argue that, just as the server farm is the place where the Internet becomes a physical reality, there needs to be a physical place where every visitor can understand and see what a digital society could do with the data it collectively generates, if it did not give it away to private corporations and platforms. Could such a visible place—a hybrid of city hall, park, open space, exhibition rooms, research facilities, and public server farm—literally drag the question of who owns data, and who is allowed to work with it under what conditions, into the very center of society?

III. Digitalization Is Not as Clean as It Claims to Be

Besides the mega-buildings for warehouses and logistic or fulfillment centers[1] sprouting up across the countryside and stretching for hundreds of feet along highways, data centers are the most successful new building typology of the twenty-first century. In 2019, there were well over 3 million data centers in the United States alone, and over 500 hyperscalers, which are extremely large data centers.[2] The biggest data center in the world, operated by China Telecom, sprawls over 25 square kilometers near the capital of Inner Mongolia—a billion-dollar facility with hundreds of thousands of racks, space for up to 1.2 million servers, and its own residential district for employees. Until now, data centers have rarely turned up in public awareness, even though they surpass any spectacular high-rise building in terms of building mass alone. This is also a factor of their architectural form. The operator China Mobile had two crystalline towers placed in front

of its Hohhot Data Center. Otherwise, the design effort from the outside is very limited: data centers—like Amazon's fulfillment centers—need nothing more than a neutral shell. There are several reasons for this restraint. One is emissions.

It is fair to say that the seemingly virtual, environmentally friendly Internet actually reeks of exhaust fumes—and not just because the emergency generators at many data centers run on diesel. Data centers still consume horrendous amounts of energy, despite all the efforts to achieve climate neutrality in the near future. Every text message, every cat video, every tweet starts up a computer somewhere; every online bank transfer, every Instagram photo, every Facebook post, every Google search requires storage space, and data storage requires enormous amounts of energy. The cloud has a pretty big exhaust pipe. The need for places to store and process the volumes of data is growing dramatically. Every day, more than a billion people google something, upload something to Facebook, and, according to a statement from the social network site, leave 5.8 billion likes. It stayed unmentioned how much energy each of them consumes, but it is no secret that the Internet is growing into one of the world's biggest energy guzzlers—it already damages the environment more than the total of all air travel. If it were a country, it would rank right after the United States and China in the disciplines of electricity consumption and greenhouse gas emissions. Digitalization is not as clean as it claims to be: streaming Netflix, YouTube, and other providers alone consumed no less than 200 billion kilowatt hours in 2018—an amount of electricity that could power all private households in Germany, Italy, and Poland combined for a year, according to a calculation by the energy company Eon. Servers and data centers in particular consume vast amounts: their energy demand in Europe has increased by 55 percent to 87 terawatt hours between 2010 and 2020—about 2.7 percent of total electricity consumption in Europe. Server farms account for 2 percent of all global greenhouse gas emissions alone.[3] Anyone who invests in Bitcoins, googles a lot, posts photos of their food on Instagram, and likes to watch movies on Facebook is not much better in terms of their ecological balance than a commuter who fills the air with diesel on the highway in their SUV. The Internet of Things needs more electricity than Germany currently generates with wind and solar power; in the server farm, the cloud becomes a cloud of exhaust. The lack of awareness of what should be called online environmental pollution can only be explained psychologically—no one who sends someone a photo via WhatsApp thinks about the fact that this action starts up computers

Tahoe Reno Industrial Center (TRIC), Nevada, USA

somewhere and causes power plants to belch soot. Around 8 percent of the electricity produced worldwide is used to transport data to end devices, but also to power the gigantic data centers whose halls now far exceed the size of factory farms. According to Frankfurt's climate protection report, the city will not reach its energy target for the year 2050 because of the electricity demand of its servers. In 2020, they consumed 1,600 gigawatt hours of electricity, 60 percent more than the consumption of a good 400,000 Frankfurt households. After all, according to the Datacenter Heat business initiative, the entire heat requirement of all private households and office buildings in Frankfurt could theoretically be covered by waste heat from the data centers located there in 2030.[4]

In response to their apocalyptic consumption, states like Singapore want to ban the construction of new data centers; the pressure on operators to become more ecologically compatible is growing. Apple now builds its own solar parks and runs its data centers on green electricity. Data centers often have to be air-conditioned, especially if they are located in strategically important but overheated deserts, such as in Reno, Nevada; a large part of the energy—up to 40 percent—is used for cooling. Microsoft therefore packed twelve racks with 864

servers and 27.6 petabytes of storage into a metal cylinder about the size of a concrete mixer and then sank it off the coast of northern Scotland. A submarine cable conducts electricity into the data U-boat and transmits the data.[5] For up to five years, Microsoft wants to let its servers work independently on the ocean floor, without direct human supervision, an inaccessibility that has almost something romantic about it: down there in the shimmering blue depths lie our text messages and films, family photos, short and long messages; there, glowing blue and indistinct under the glitter of the waves, is a part of our outsourced brain . . .

IV. What Happens in Server Farms Is a Problem for Democracy

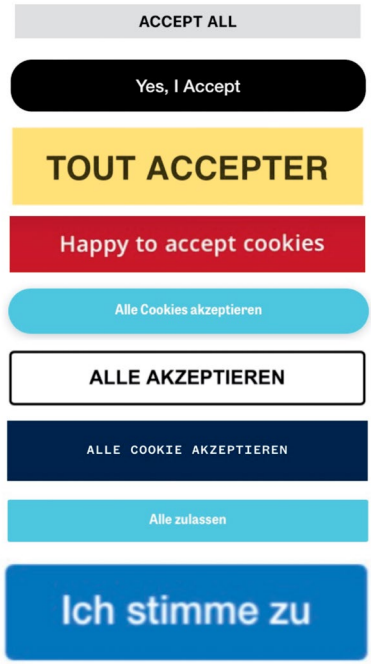
The real problem of server farms does not lie in its energy consumption. The larger the data sets required for Big Data, cloud computing, and artificial intelligence, the more gigantic the storage requirements. More and more small- and medium-sized companies are outsourcing their data—and the large ones are building their own hardware. The biggest "hyperscaler" is Amazon Web Services (AWS). The cloud business—using IT computing power and services from third-party providers—is a major contributor to Amazon's operating profit: AWS accounts for about US$1,000 of Amazon's $1,600 billion total market capitalization, according to analysts. The second largest hyperscaler is Azure (Microsoft), with Google following in third place.

Tech companies not only collect their users' data; they also build the refineries in which the data is stored and analyzed—and treated as private property. Such data centers are also places to predict, manipulate, and control the behavior of citizens. Given the fact that all of these companies are based in the United States or China, it becomes clear that not only Europe's technological future is at stake, but also its political and economic sovereignty.

Stolen Data

Data centers are hardly recognizable from the outside, much like warehouses for stolen goods—which they often are: storage for data taken from citizens without their knowledge. Of course, there are many data centers that merely provide computing services for complex industrial robots. Such data centers are an ecological problem at best. But the opacity of data storage also means that in many of these digital warehouses personal data is analyzed and sold in a completely opaque manner. The global Big Data and business analytics market alone is valued at over $200 billion.[6] For the first time, US tech stocks are more valuable than the entire European stock market combined.

Nevertheless, there is a general feeling that no great harm will come from giving away personal data. The fact that data is the fuel as well as the greatest economic treasure of the digital information age stands in stark contrast to the naivete with which everybody presses the "accept all" button out of sheer convenience. Most users (and politicians) have little or no understanding, even from a purely technical point of view, of what happens to their data in the halls of cloud operators. And it is hard to imagine what you could possibly do with the knowledge of



what time people get up each day, where they go with whom, and what they look at on the Internet, other than run a few lousy, easy-to-see ads for things you might have bought anyway?! Can it really be true that skimming behavioral data generates more money than, say, building 10 million cars a year? If there has not already been an uprising against the untransparent exploitation of private data and the silent but massive loss of self-determination and freedom, it is because hardly anyone knows what is happening there technically. No one who keeps clicking "accept all" out of convenience—the central gateway of behaviorist-trained manipulators of the tech industry—will imagine that the veritable future of governance, governability, national economies, jobs, and billions of dollars are at stake. How one can be spied on, manipulated, cheated out of better alternatives on the basis of one's data is something one only notices later—or never. This lack of concern is already the first success in the manipulation of consciousness by surveillance capitalism, which, promising comfort, undermines the central rights of freedom and self-determination.

The market value of the major tech companies, which currently totals $6 trillion, evidences what's in it financially for those who master the game of molding the most precisely predictable human being. Since 2009, Google's revenues have increased by more than 3,500 percent. Shoshana Zuboff, author of the seminal work *The Age of Surveillance Capitalism*, speaks of a "surveillance dividend, because it is based largely on the systematic exploitation of personal data. This dividend has become almost irresistibly attractive to investors. Anyone who does not offer a surveillance dividend has little chance in the market. That's why other industries, such as car manufacturing, are now aligning themselves with this business model. The monitoring dividend is also incredibly profitable. You don't need production facilities for it, and hardly any employees."[7] It would still be possible to build cars or smart homes without monitoring technology—but both only become really lucrative when they are designed as data suppliers. That's why cars and homes only look the same as they used to, while they have fundamentally changed their character, from protective cells in which people were safe from stalking and spying to the exact opposite: robots that tirelessly collect and forward their occupants' behavioral data. The user of a digitally connected car or fitness bracelet, of smart thermostats and other tech gremlins that the digital age has spawned, is actually a kind of hamster in a digital wheel designed primarily to produce data: "When you install a thermostat from the Google subsidiary Nest at home, you

implicitly sign at least a thousand privacy-related contracts without knowing it."[8]

The invisibility of the server, and the rhetorical dissolution of manifest political and economic power apparatuses in the "cloud," makes us almost forget about some urgent questions: Where will the trillions go that can be made from selling and mining citizens' data? Who will set the rules for how it is analyzed? Could reclaiming ownership over our data recalibrate the economic basis of a society that does not delegate civic rights to private parties anymore and is more oriented toward solidarity?

The Erosion of Democracy: Civil Rights as Commodities

The healthcare sector shows how digital companies are currently able to penetrate central areas of governmental and political organization. According to the periodical *Medicine and Health*, there are already around 318,000 health apps available on the market today. The global market value of products that can privatize and digitalize healthcare by 2025 is estimated at well over $500 billion. The coronavirus pandemic has shown that the privatization and economization of services of general interest, the transformation of hospitals into high-yield assets, and the exploitation of nursing staff do not lead to medical progress and greater efficiency: the countless deaths during the first virus wave of 2020 in Italy were also a tragic consequence of the economization of hospitals to the breaking point and, as a result, a collapsing healthcare system. The persistent claim that the provider's self-interest is also the customer's benefit was proven horribly wrong.

Many researchers and theorists of the Internet[9] have impressively described how, based on the analysis of behavioral data, people can be manipulated, and how algorithms perpetuate racial prejudice and social inequality and help spread misinformation; how certain views, because they come far ahead of others in search engines, are imposed as the prevailing opinion. The election of Donald Trump came as a shock to all those who believed that high-impact, large-scale manipulation of voters was no longer possible in modern democracies. The case of Cambridge Analytica proved the opposite: the personal data of 87 million Facebook users and their friends had been collected and analyzed via the app called This is Your Digital Life; the results were used to develop a psychologically tailored campaign for the Republican presidential candidates Ted Cruz and Donald Trump.

Data-Driven Racism

In a research paper titled "Dirty Data, Bad Predictions," Rashida Richardson explains that, in the United States, police departments where "racially biased or otherwise illegal" practices have been identified also continue to provide data for the development of new automated systems to help officers make police decisions.[10] "The goal of predictive policing tools is to send officers to the scene of a crime before it happens," writes Deborah Raji.[11] The assumption here, she adds, is "that locations where individuals have been previously arrested correlate with the likelihood of future illegal activity." The server farm becomes an ideological arsenal: if the methods of evaluating what information is stored on the servers cannot, or need not, be exposed to public debate because they, like the location of the computers, are opaque, then the digital society produces axioms that are all the more difficult to question because they are difficult to trace, and wear the halo of technological objectivity.

Another case occurred in the United Kingdom: because the 2020 lockdown prevented the 2020 A-levels and other examinations from taking place as planned, teachers calculated the final grades from the average of the results achieved so far—they turned out slightly better than in the previous year. The Ministry of Education then had the grades corrected by an algorithm that calculated the likely final grades for the class of 2020 based on the average final grades of previous classes. The result: 280,000 students, almost 40 percent of the class, received lower grades. While expensive private schools were hardly affected by these downgrades, the devaluations hit public schools particularly hard.

Subject Perception and "Human Nature"

It may be that algorithms are becoming more and more perfect, but it is still humans who have to feed the computer at the beginning with axiomatic assumptions about so-called human nature. The volumes of data that people leave behind on the Internet were used to predict their behavior by assuming continuity rather than change. It quickly became clear that behind the seemingly objective algorithms was a problematic proposition about the nature of human beings—for example, that it was highly unlikely that students would have tried harder than their predecessors from the same milieu. Algorithms programmed in this way can only represent the future as a continuation of the past.

California, the current epicenter of digital Western culture, supplies us with two essentially differing narratives about "human nature." Hollywood, the myth-machine of the twentieth century, has repeatedly told the story of people who, through enormous effort, create the unexpected, the improbable, stating that people can do things that no one thought they could. Silicon Valley, on the other hand, the myth-machine of the twenty-first century, masks itself in the cloudy rhetoric of "making the world a better place," while the programmers of its algorithms seem to cultivate a rather gloomy image of humanity: viewing people as potential delinquents, wanting to predict and prevent them from committing transgressions or becoming weak. In this narrative, progress can lead to little more than a sense of increased security and predictability.

The Algorithm Is Always Right: The Reversal of the Burden of Proof

New cars even have cameras in the dashboard that monitor the interior and the driver's eye movements; an algorithm decides whether the driver is still capable of driving. If the car reports to its driver that it has "detected fatigue," and the driver continues driving and is involved in an accident, then his own car could turn against him and become a witness for the prosecution: after all, it had told him he was tired—why did he ignore the order to take a break in driving? The situation is Kafkaesque: it is not known who programmed the algorithm that interprets the driver's eye movements and driving behavior as indicating fatigue, but the consequences are dramatic. Human life experience, self-perception, and self-assessment are valued less in court than what the computer has calculated as the truth on the basis of opaque programming decisions. Whereas it used to be necessary to prove that the driver of a car was overtired, he must now prove that the algorithm was mistaken in its assessment.

Here, too, the basic assumption is that the imperfect human being should be monitored for his or her own good, that the machine should make decisions for him or her as far as possible and correct faulty self-perception. The built-in negative view of the human being is often the initial calculation error, which leads to the wrong result at the end of many correct individual steps. The tragic airplane disasters involving the Boeing 737 Max and its impossible-to-override steering system evidenced the deadly consequences of this naive belief in technology.[12]

In the end, the London "fuck the algorithm" protests were so massive that the Department of Education eventually, and grudgingly, withdrew the demotion. It is a good sign when a new generation understands what algorithms are doing to them: that algorithms are trying to make them what their predecessors were, not what they could be instead. "We have to remember that the big idea of this digital century was the democratization of knowledge," Zuboff says. "Surveillance capitalism has usurped it by declaring our private experience a free commodity, open to exploitation. It is largely based on stolen goods. This must be made clear—and it must be changed. Also, profit under surveillance capitalism goes only to a small group of investors, which contributes enormously to the economic division of society. We need to return to the initial promise of the digital era."[13]

The Smart City as Data Supplier

What's at stake can also be seen in the far-reaching plans that Big Tech companies have developed for the cities of the future. "If you were able to build a city from scratch, you could also completely reinvent existing concepts of social policy and political leadership, and test entirely new ideas of data-driven management," said Dan Doctoroff, the CEO of Sidewalk Labs, the sister company of Google that focuses on building smart cities. "Cities are hard," Doctoroff further stated. "You have people with vested interest, politics, physical space . . . But the technology ultimately cannot be stopped."[14]

Doctoroff's statement shows that tech companies don't just want to help an existing democratic government make faster or more efficient decisions with artificial intelligence and analysis of citizen data. What might be meant by the somewhat disturbing phrase that political leadership is to be completely reinvented could be inferred from Sidewalk Labs' plans for Toronto. There, Google's sister company was to plan an entirely new district, and not only to take over urban planning, but to build fully networked houses with "intelligent" electricity, water, and waste management, and to provide residents with health insurance via Google's sister companies. The corporation sought to organize central tasks that are traditionally the responsibility of the state, in a smarter way—and to privatize them. What is known as "degeneration into a mere information object" in the language of constitutional jurisprudence can already be seen in many subareas of the smart city permeated by the Internet of Things. The citizens of

Toronto, however, were not persuaded by the project. In 2020, Sidewalk Labs stopped working with the city.

If the project had been continued, it would have initiated a fundamental break. Programmed by a tech company that sees in a population above all a critical number of suppliers of data, town planning would have been no longer concerned with the common good, but rather with the group's pursuit of profit and its shareholder value.

It is perhaps no coincidence that the story of the server farm, which is the brain and the actual epicenter of all smart cities, is a story of the state's retreat from shaping the digital future.

V. The State Has Given Up on Building a Digital Society

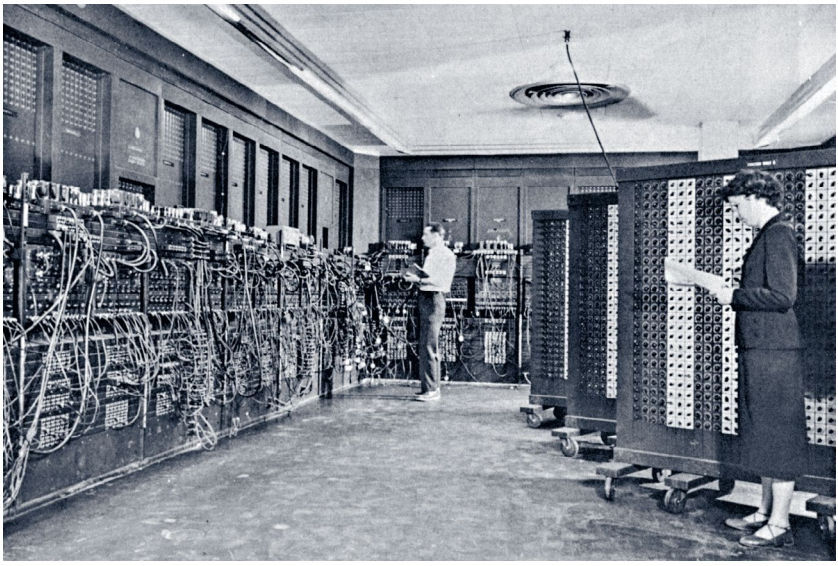
A Brief History of the Server Farm between Emancipation and Manipulation, Public Prestige Project and Private Data Haven

The world's first computer center was located in the Moore School of Electrical Engineering in Philadelphia, Pennsylvania. In February 1946, the physicist John William Mauchly, then thirty-eight years old, and the engineer John Presper Eckert, then twenty-six years old, presented to the world a 167-square-meter room full of devices whose racks already anticipated the monumental proportions of today's data centers: a hall with towering walls, a gigantic machine. The expensive $400,000 "Electronical Numerical Integrator and Computer," or ENIAC for short, was originally intended to help the American military calculate ballistic curves during World War II; however, it was not completed until after the war ended. The monster weighed 27 tons and contained 17,468 vacuum tubes, which were given to failure and often produced incorrect results, and also 7,200 diodes. The energy consumption, at 150 kilowatts, was enormous even then. When it was working, the supercomputer could perform a good 5,000 arithmetic operations per second, a thousand times that of conventional computers. When it was unveiled, the machine was described in *The New York Times* not only as a technological wonder, but also as an aesthetic one: anyone "who wants the answers may then sit down and await results. He seldom has to wait long; the Eniac does most of its tasks in seconds. . . . So clever is the device that its creators have given up trying to

find problems so long that they cannot be solved." It had "some 40 panels nine feet high . . . . Pink neon lights blink on several panels as buttons are pressed." The results would also register as neon lights; the machine could "bring on a new epoch of industrial design."[15]

During the Cold War, it was used to calculate the power of the hydrogen bomb. Nevertheless, the computer was not treated as a matter of secrecy, but rather as part of the United States' self-portrayal after 1945: only one month after the soldiers of the US Army celebrated victory over Germany and Japan at the Victory Parade in Manhattan and demonstrated America's military superiority, the ENIAC—with its racks of flashing pink neon lights—provided the first impressive futuristic image of the new, electronic postwar era under America's lead.

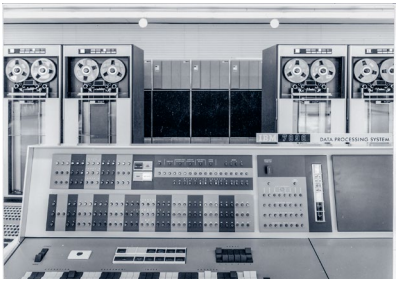
In Germany, too, planning for mainframe computers began after World War II. The Commission for Computing Systems of the German Research Foundation[16] planned both smaller, local, decentralized data centers at the universities, as well as a central mainframe computer center. The latter was built in Darmstadt and officially inaugurated on June 12, 1963. Its core was an IBM 704, which was soon replaced by an IBM 7090 that was six times more powerful. The state presented itself



Electronic Numerical Integrator and Computer (ENIAC) in Philadelphia, Pennsylvania, USA, 1947. Glen Beck (background) and Betty Snyder (foreground) program the ENIAC in building 328 at the Ballistic Research Laboratory (BRL) for the calculation of ballistic tables for the US Army.

as an active shaper of digital policy in this building: the public facility, which had been largely driven by Alwin Walther, builder of the DERA computing machine, was intended to provide universities and independent research institutes with access to the solution of complex problems, but it was also a training center where high-school graduates and students could learn about electronic computing and meet experts. By 1970, well over 3,000 students had received training in programming there. Thus, the DRZ, the German Computing Center, also became one of the earliest computer-science schools long before informatics was introduced as a discipline at universities. Research results generated at the DRZ—for example, in the testing of new mainframe computers—were made available to the public, a kind of open-source concept *avant la lettre*. DRZ's architecture, its construction having been paid for by the German Federal Ministry of the Interior, also reflected the aspiration to create a new form of scientific public sphere in the young Federal Republic of Germany (FRG): the 2,000-square-meter, three-story building with its two single-story wings was generously glazed—not a research fortress, but rather a modern, inviting cloister with a meditative inner courtyard. Guest apartments were available for experts who had traveled from other cities or countries to stay for longer periods. In this way, the DRZ data center—a foundation of the State of Hesse, the Federal Republic of Germany, and the German Research Foundation (DFG)—also became a space for a vivid scientific community, a research site where the public sector laid the foundations for the age of electronic data processing in Germany, and was thus able to help define its conditions and business models.

At the same time, the development of digital computer technology became a part of the party doctrine in the country's communist eastern German Democratic Republic (GDR). The era of data processing in the East began in 1958 with the Council of Ministers' decision "on the formation of computer centers of the VEB Machine Computing in the German Democratic Republic." The model was based on Soviet plans for a computer network that the cyberneticist W. W. Alexandrov had developed for Nikita Khrushchev. The socialist brother state was building up its own computer industry. Regional computer centers were planned for all districts, which were equipped with mainframe computers. The historian Martin Schmitt describes how the GDR deliberately staged an image of modern state leadership with the help of buildings for digital storage technology and data evaluation. In 1966, the GDR's government released 3 billion marks for the



German Computer Center (DRZ), Darmstadt, FRG, 1961

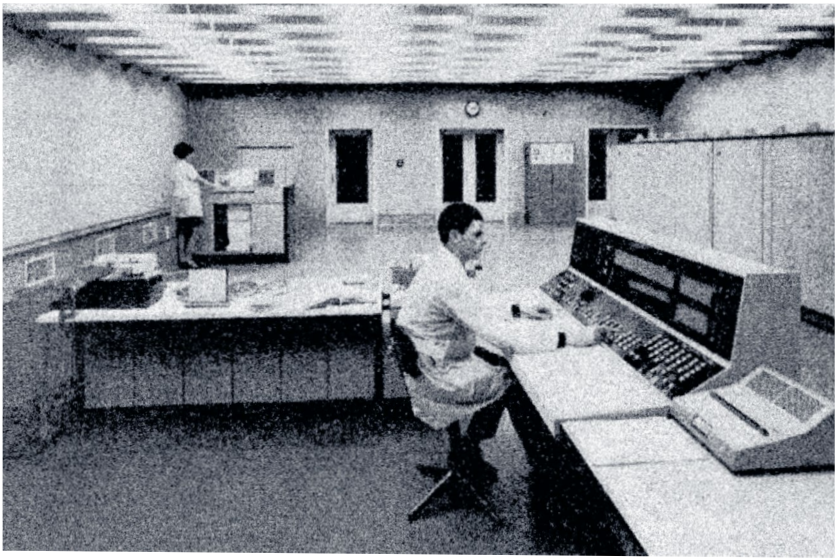
nationwide network of state-run data centers. In his groundbreaking essay, Schmitt also traces the history of the Potsdam data center.[17] On Sunday, May 23, 1968, at the hour usually reserved for church services, the regime dynamited the ruined steeple of the Garrison Church in order to build the Potsdam data center in its place. "Hardly any other technology was so connected to the future at the time as computer technology. Rational modernity with the steady forward progress of socialism in the scientific-technical revolution was supposed to replace the 'gloomy' past and erase it from the cityscape," writes Schmitt.[18]

Potsdam was equipped with Robotron 300 electronic computers. Socialist central planning lived from the data records supplied by companies and institutions. Everything that was to serve the progress of GDR citizens was recorded and calculated: from food requirements to official cancer statistics, from payment transactions to domestic trade, from cadastral data to housing requirements. In 1981, the Potsdam data center even developed a card index for diet recipes. "A separate department," says Schmitt, "was dedicated to route optimization—for example, for the transport of wood, ore, or steel—a classic problem in computer science. The programs were so successful

The mosaic *Der Mensch bezwingt den Kosmos* (Humanity Conquers the Cosmos) by Fritz Eisel at the base of the data processing center (DVZ) in Potsdam, GDR, 1972

"Die DDR ist richtig programmiert" (The GDR is programmed correctly): slogan on a banner behind the Robotron stand at the exhibition *Kämpfer und Sieger* (Fighter and Winner) in East Berlin, GDR, 1969

that the DVZ [data processing center] also sold them in the West." This data processing center, with its two-story computer hall and five-story administrative building, built by a collective around Sepp Weber from 1969 to 1972 for VEB Maschinelles Rechnen in the center of Potsdam's old town, was an architectural statement: like many public buildings of GDR modernism in Potsdam, the façade was profiled by vertical slats that seemed to echo the columns and pilasters of local classicism. East Germany's Ministry for State Security (Stasi) also bought three Siemens mainframes for 23 million Deutschmark in the late nineteen-sixties, which—bizarrely—were maintained by the Western company in the seventies.[19] The vision of a data-based future, a computer-driven socialism with a digitally optimized planned economy, was also publicly illustrated in a monumental work of art: the ground floor of the Potsdam data center is decorated with an eighteen-part glass mosaic by the artist Fritz Eisler, which he later described as an artistic exploration of "electronic data processing."[20] The scenes of this pictorial program, entitled *Man Conquers the Cosmos*, reminiscent of Latin American murals, depict the stages of humanity's scientific and technical evolution from agricultural machinery to space travel to data processing; one of the panels shows a Robotron 300. The data



Robotron 300, data processing system, GDR, 1971

centers were a central part of the GDR's narrative of the future, according to which digitalization was supposed to guarantee the success of the planned economy for the benefit of all citizens. The promise of emancipation and the desire for surveillance were already intertwined at the beginning of computer-based data processing. In Silicon Valley, an early data center like this would surely be protected as a cultural heritage site of digital modernity, and a part of its own digital antiquity; in Potsdam, it was to make way for the reconstruction of the demolished Garrison Church.

In Chile, the assumption that an entire economy could be intelligently controlled by mainframe computers led to one of the most interesting early experiments in the history of data-driven policy. In 1970, the British cyberneticist Stafford Beer, inventor of the Viable System Model and author of a fundamental work on the viability and mutability of biological and social systems,[21] was commissioned by a close associate of the recently elected Chilean president Salvador Allende to organize the country's underdeveloped economy more efficiently, thus laying the economic and technological foundation for the new government's political success. This collaborator, Fernando Flores, was the technical director of the economic development

authority. Like Allende, he believed neither in American-style capitalism nor in communist central planning; therefore, Beer was to design a third way for Chile's national economy, using cybernetic principles. Beer was not a classic socialist; when he went to Chile, he was a wealthy management consultant, drove a Rolls-Royce, and owned a bizarre country house in Surrey where a remote-controlled waterfall terrorized guests. When he left Chile three years later, he not only looked like a revenant of Karl Marx—he had mutated into a rather left-wing utopian.

Beer wanted to equip each of Chile's four hundred most important nationalized factories with a computer or (because there were not enough computers) teleprinters that could send information about material and energy requirements in real time via telephone lines to a central supercomputer in Allende's palace. In this data center, the software Cyberstride was to coordinate the factories and facilitate the organization of supplies. Data was defined as a "common good," not as a possession of the companies. The project faced major difficulties that were rooted more in Chile's financial situation than in Beer's ideas. Because IBM charged $10,000 a month in rent for the equipment needed by the overall project Cybersyn, Allende's economic development agency could only afford a mainframe computer that did not even have the computing power of today's iPhone. Seen in this light, it is not surprising that Cybersyn functioned only rudimentarily, if at all, under these conditions. When the association of Chilean transport entrepreneurs and other opponents of Allende, supported by the Central Intelligence Agency (CIA) in the US, instigated a major general strike, plunging the country into chaos in October 1972, it was at least possible to locate and inform truck drivers who were loyal to the government, to distribute food, and to identify and organize Allende supporters among the factory workers, via the teleprinters that also fed Cybersyn[22]—and thus to prevent the collapse of the democratic government for the time being. Beer coordinated the maintenance of supplies from the "ops room," the operations room of his data center. This room is another example of the great emphasis placed on data center design around 1970. Beer had commissioned the German designer Gui Bonsiepe, who created a room more reminiscent of the control center of a futuristic spaceship than any other control room in data centers at the time: decision-makers would sit on tulip-shaped white fiberglass chairs with orange upholstery and look at the incoming information and simulations of future scenarios that the computer would distill for them on large screens. In the right

armrest, buttons for decision-making were integrated; the left armrest had a different function, as the passionate drinker and smoker Stafford Beer had asked Bonsiepe to integrate an ashtray and a space for a whisky glass.

This room is also an example of a tradition of encoding iconic images of the future: Allende's promise of emancipation and prosperity thanks to cybernetic, real-time digital data analysis had found one of its most striking images in Cybersyn's decision room. The military coup of 1973 abruptly ended the already dysfunctional Cybersyn project. Today, despite all its shortcomings and abstrusities, it is considered to be pioneering[23]—since it was based on the needs of the population and on real-time interaction between politics and citizens. Beer anticipated essential ideas of the early Internet in a rather bizarre way. One wall in the decision room in Santiago, for example, was reserved for the Cyberfolk project, which was to measure the satisfaction of the Chilean population with the decisions made in the ops room. Beer had designed an apparatus for this purpose, the "algedonic meter" (from the Greek *algos* for pain and *hedone* for pleasure), to be placed in every household. Using a selection lever, people were invited to mark their mood on a scale—from very angry to extremely happy. These devices were to be connected to the television network so that the government could gauge the mood of the people and the effect of its decisions at any time.

After the military coup, Beer retreated to a cabin without a telephone, took up painting, and did yoga. He later tried to offer Cybersyn to various African and Latin American governments who showed no interest in either Cybersyn or the algedonic meter. Half a century later, all that remains of Stafford Beer's idea of collective happiness measurement as an interactive instrument of politics is a "like" button and a blue Facebook thumb.

Operations room (ops room) of the project Cybersyn, Chile

From Prestige Project to Secret Command Center: The Path to Invisible Omnipresence

Just as the Internet—which started out as an emancipatory project, with the promise of providing tools for citizens' self-empowerment beyond the existing power structures and communication channels—became increasingly commercialized, and the drivers of data processing were more and more interested in behavioral analysis and the predictability of their users, the places where the population's data was stored and analyzed became increasingly invisible.

The celebration of computing as an emancipatory technology of the future in the design of government data centers of the nineteen-sixties and -seventies followed a process in which mainframes, now mostly operated by private actors, were hiding in existing structures such as the AT&T Long Lines Building, a monstrous 170-meter windowless tower on Manhattan's south side. The California architect John Carl Warnecke had designed it in the early nineteen-seventies for the telecommunications company AT&T.

A data center like Interxion's in Frankfurt am Main is an anonymous apparatus that does not reveal what is going on inside. One can

El pueblo Unido Jamas Sera Unido (The People United Will Never Be Defeated), cover design by José Balmes for a song of the same title against the Chilean military dictatorship, 1974

Facebook logo

interpret this invisibility—the disappearance of data centers in box-like architecture embedded in industrial parks—as a strategic attempt to not offer a foothold for attack, both in terms of security and politics: to not endanger the ideological metaphors of the airy, environmentally friendly "cloud" with built proof of the physicality of the Internet—and to not unsettle citizens with the dimensions of the digital revolution, whose mega-storage halls will soon be a kilometer long, and unable to conceal their monstrous energy consumption.

VI. Architecture Has Become the Décorateur of Platform Capitalism

The Decorated Box

Although the generic box is the rule, there are exceptions in recent server farm design. Especially large private operators have been discovering architecture. The AM4, Equinix's new data center in Amsterdam, is advertised as making "the invisible visible."[24] The 72-meter tower stands on the site of a technology center near Amsterdam, through which 38 percent of all Dutch data traffic passes, while 80 percent of all data goes through the Equinix International Business Exchanges, which are connected to the Amsterdam Internet Exchange, the largest of its kind in the world. This building is also a demonstration of power. From a certain perspective, its vertical profiling is strikingly reminiscent of the World Trade Center destroyed in 2001: the data center seems to echo the central building of international financial capitalism, which itself anticipated the idea of the twin, the mirroring, and the backup copy, central to the Internet age, in the motif of the double tower.

33 Thomas Street (former AT&T Long Lines Building) in New York City, USA, 1974

Aesthetics of invisibility: Interxion data center in Frankfurt am Main

The Darmstadt data center (DARZ) in the former vault building of the Hessische Landesbank evidences how the desire to show off what you have can go hand in hand with security requirements. The operator who offers server housing, hosting, and management services not only advertises the advantages of being only 30 kilometers away from the main campus of DE-CIX, the world's largest Internet exchange node, thus offering the best conditions for accelerated access applications. The DARZ "has a special position due to its architecture alone"—it is not a "sober, functional building," but "surprises" with white painted racks, "an interesting floor plan, and elegant façades characterized by large expanses of white and glass," which are "not only bullet-, but also grenade-proof."—"For protection against data theft and sabotage, comprehensive video surveillance, even outside the building, is a big plus"; thanks to tamper protection, "no part of the servers can be unscrewed from the outside." [25]

After years of tactical visual disappearance, the server farm seems to be entering a new era of visibility. In Germany, the German Data Center Award has been presented at the Data Center Congress trade show for over a decade. In the United States, the Quality Uptime Services group sponsors the Data Center Architecture Awards, a gala

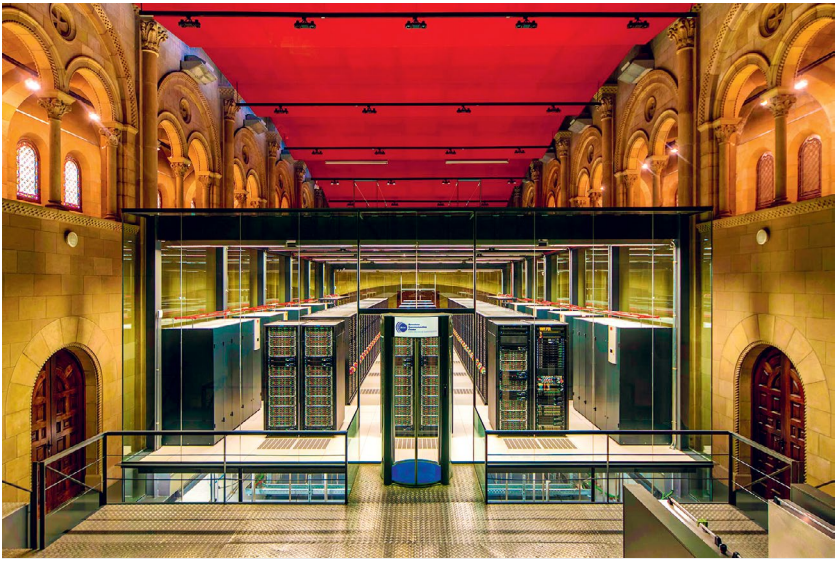
where tuxedoed server-farm architects and operators accept awards for their data center design in various categories. In 2020, prizes went to Yotta Infrastructure's NM1 data center in Mumbai, which was said to have reached a "new level in design," and, in the hyperscale category, to Facebook for its giga-data center in Eagle Mountain, Utah. The Data Center Dynamics website states that "Data centers should look good." Among the "Top 10 beautiful data centers," a first-place award went to the Switch Pyramid near Grand Rapids, Michigan, a 21,000-square-foot data center in a seven-story pyramid that was originally designed by Steelcase as a design center. The building gives the data tomb a pharaonic monumentality: things stored here must be at least as divine as the Egyptian rulers. The list includes two converted sacred buildings: Salem Chapel in Leeds, built in 1791, closed in 2001, and subsequently converted into a data center; and Barcelona's Supercomputing Center, established in 2005 in the nave of a former nineteenth-century church, now home to the MareNostrum supercomputer, a joint venture between IBM and the Spanish government, which was

Equinix AM4 data center, Amsterdam, Netherlands

once the fastest computer in the world. Both churches house the technological deity that knows everything about everyone. Even when no old church is being converted, data center designers play with the set pieces of religious aesthetics. In Portugal, João Luís Carrilho da Graça designed Portugal Telecom's Data Center in Covilhã as the mystical, shimmering black Kaaba of a new networking religion.

Rem Koolhaas was one of the first to describe the post-human world of data centers—building complexes the size of entire cities, such as those near Reno, that are located outside of cities and store only data. "The Tahoe-Reno Industrial Center serves as the Valley's 'invisible' complement," writes Koolhaas. "During the last 20 years, an immense proliferation of boxes . . . has emerged in this landscape—a combination of high-tech warehouses, factories and data centers . . . . it is urbanization without people, a phenomenon so alien to the notion of the city, the urban, that no one has begun to theorize it. . . . What we are witnessing here is mankind nearly achieving the outlines of a post-human civilization."[26]

Server farms have to please algorithms, not people. This creates space for a new aesthetic of the sublime. The server racks shimmer like a metropolis at night, with skyscrapers inhabited not by people but by information about people, strung out over hundreds of meters in blocks, like a data Manhattan. The abstract flashing of the control lamps is reminiscent of the red marker lights of skyscrapers; in a way, the endless sets of data, housed in towers, are also an equivalent to the massive agglomeration of steel and concrete and light in the big cities of the twentieth century. It's the collective brain of humanity: all the uploads and all the expressions of opinion and feeling, everything that ever left people's cell phones and brains and everything that was collected about them, such as text messages, photos, music, messages, emails, Facebook likes, comments, and the chaos of emotional states contained in all these expressions of hatred, joy, cynicism, deviousness, generosity, courage, fear: everything stored in the endless shelves, arranged into crypto-urban avenues and blocks, an outsourced brain of humanity mutating into its own being. It is a new autopoetic nature of sorts, where data is not only stored but also communicates internally, thanks to various algorithm-based AIs, and produces new knowledge. People's data sets develop an algorithmically controlled life of their own here; yet we do not have the slightest idea that this knowledge exists, though it will eventually come back to us as new truths about ourselves. It is quite possible that future generations will view the artificial halls, in which thousands of racks



Data center MareNostrum, Barcelona, Spain

store billions of data, emitting a cold and enigmatic light, with the same shudder that the Romantics of the early nineteenth century viewed their mountain heights and misty seas: as an alien, estranged part of their own Nature. The server farm is the blue grotto of the present.

Art as Appeasement

Much of what designers are proposing for server farms relates in some way to the familiar futuristic aesthetics of fifty years ago: the interiors of Google's server farms or of the NGD Newport Data Center in Wales look like a design collaboration between James Turrell and Verner Panton: Land Art turned inward.

Often, the operators try to soften the cold technicality of the computer world, and the social, political, and ecological problems generated by server farms, by applying aesthetic embellishments that are recognizable as "art." At Google's Data Center Mural Project in Oklahoma, the artist Jenny Odell was allowed to paste patterns onto the façade; they show photos of pools or fields that she found on Google Maps.

Impressive aesthetic effects also enliven the façade of the 110-meter-high tower for 3,515 mainframe computers, built by the architectural firm Schneider + Schumacher in Shenzhen, China. The Qianhai Telecommunication Center is largely windowless; a mantle of thin steel elements is intended to represent the number Pi, composed of stylized zeros and ones, with the zeros moving in the wind to give the façade a lively appearance.

Qianhai Telecommunication Center, Shenzhen, China

Snøhetta, The Spark, design proposal

A Paradise of Wood and Data for the Sedated User: Snøhetta's "Spark"

The international architecture firm Snøhetta, based in Norway, also stages the server farm as an aesthetic event. For the real-estate developer Miris, and in collaboration with Nokia and the construction companies Skanska and Asplan Viak, they have designed one of the most elegant data centers to date—a kind of Mies van der Rohe national gallery for computers, which at first glance does everything so right that you almost miss the catch. "The Spark" is the name of this promisingly gleaming server farm, which is to be fed with water energy, produces more energy than it consumes, and supplies heat to housing estates and public baths. It will be built with wood, avoiding concrete and steel as much as possible, and the supporting structure will be made of local stone. The Spark is intended to rethink the data center as "anchors of smart city developments," but also to "reintroduce a human touch back into our digitalized, smartphone driven lives" so that the body can once again be at the center of a "living and breathing city," according to the architects' website.[27]

Here, the server farm has reached its next propagandistic level: it is a tech druid's castle, designed to heal society and bodies deformed by

Snøhetta, The Spark, design proposal

the digital. The server farm is the "body and brain" of the new city, with the body pumping energy and information through its veins, and the brain—the computers—representing "the possibilities of controlling a data-driven city."

Vegetables grow on top of this brain; the roof of The Spark accommodates a contemplative water lily pond and flower beds. This ecologically correct Zen architecture, which claims to be healing, is typical of its time in how it ignores all political and social issues and focuses on pressing ecological questions; their ecotechnological solution is then psychologically enhanced with a little "human touch": the energy-plus building, the new amalgam of wood, water lilies, behavioral data, and vegetables, cures us of our "digitalized, smartphone driven lives." The paradox of this architecture lies in the fact that the very problems of which the roof of the data center is meant to cure its users may be simultaneously manufactured one level down in its server racks, thanks to data-based manipulation that deliberately turns cell-phone users into pathological addicts.

More interesting than the question of whether you can make the roofs of server farms look like real farms is the question of the political power relations that are reflected inside.

VII. Personal Data Must Belong to Those Who Produce It

If data is the greatest collective treasure of a digital society—the gold, the oil, the raw material of the twenty-first century, the basic material of business and politics—and if even the ability of governments and the public sector to act depends on the possession of this data, which is increasingly being siphoned off by private platforms, then shouldn't we at least treat certain data as common property, as part of the public infrastructure? It is crucial "that municipal governments do not lightly cede ownership of their own data and the data generated by residents in the urban environment, but rather retain and use this data themselves," argued Evgeny Morozov and Francesca Bria in their studies of the social and political implications of Big Tech years ago. "They should also control the relevant infrastructure (software and hardware, data centers, etc.) and join forces with others so as not to be completely dependent on large technology corporations in the field of artificial intelligence and machine learning. Such steps would bring municipalities and their populations considerably closer to the goal of technological sovereignty. The challenge is to move away from surveillance capitalism and, step by step, build a system that can socialize data and allow us to try other forms of cooperativism and other collective approaches, as well as to drive the democratic and social innovations that we will need in order to develop viable and sustainable social and economic models for our clients and communities."[28]

In addition, Chinese and US tech companies are increasingly buying up European competitors, giving them access to their data. If European countries do not want the healthcare of European citizens to be taken over by Google subcontractors, and transportation by Uber—and the enormous profits made by both to be diverted to the United States—then they have to regulate the Wild-West-like data outflow. And it would need institutions that can guarantee the digital sovereignty of Europe (and, just as importantly, Africa) beyond US and Chinese corporations—European and African tech companies, more quantum computers, better algorithms.

Resource Nationalism

Some argue that the question of ownership of one's own data is about nothing less than saving the idea of the Enlightenment from a society that replaces the ideal of sovereign citizenship with that of predictable people's behavior; about defining ethical standards that establish sustainability, solidarity, and emancipation as fundamental maxims of action rather than profit maximization through the conditioning and manipulation of users. In this counter-model, municipal administrations should have the resources to operate within a decentralized data infrastructure and to develop—also in cooperation with private parties, also with the prospect of profit—public-benefit-oriented services. In his essay "Big Data for the People: It's Time to Take It Back from Our Tech Overlords," Ben Tarnoff calls for society, not industry, to define whether and how its resources are extracted, Big Data being no exception. "Resource nationalism"—the idea that states control the resources found on their territory, not foreign companies—is one possible path, argues Tarnoff. In 1938, for example, Mexico's president Lázaro Cárdenas nationalized oil resources and revoked drilling rights from foreign oil companies. "Data is no less a form of common property than oil or soil or copper," says Tarnoff. "We make data together, and we make it meaningful together, but its value is currently captured by the companies that own it. . . . Wealth that belongs to the many—wealth that could help feed, educate, house and heal people—is used to enrich the few."[29] It would not even be necessary to nationalize the data centers—it would be enough to declare the data hoarded in them a public good. Companies could be paid to refine and analyze it—"but for our own good." Yet, who is we, and who defines this "good"? Who decides whether the analysis of personal data for a health app is for the "good" of the user (as the providers would argue) or whether it is meant to scare them into paying for more products and apps designed to prevent death and thus fill the coffers of the providers: A government agency? The individual citizen? And who determines what citizens' health data is worth?

Residents of the Global South in particular need to secure sovereignty over their data and "nationalize" it, argues Ulises Ali Mejias, director of the Institute for Global Engagement at the State University of New York.[30] Not only oil, rare earth, and raw materials, but also data could be mined there on a large scale by Western and Chinese corporations, implementing a new form of data colonialism. "[W]e are experiencing a situation in which things that were once primarily outside the

economic realm—things like our most intimate social interactions with friends and family, or our medical records—have now been commodified and made part of an economic cycle of data extraction that benefits a few corporations," argues Mejias. He also refers to the example of the Mexican nationalization of 1938 and extrapolates it to the current situation: "According to the latest available statistics, in 2018 Facebook had 54.6 million users in that country. Since each of Facebook's global users generates about $25 of profit per year, this makes about $1.4bn in annual profit for the company from the Mexican market alone. Suppose Mexico nationalised its data and demanded to keep a substantial portion of that. And suppose similar arrangements were enforced on Google, Amazon, TikTok, etc. With billions of dollars collected from the nationalisation of data, the Mexican government could do a lot in the areas of healthcare, education, or the migration crisis."[31]

Data Dividend

In the US, the Data Dividend Project aims to bring class action lawsuits against companies that have violated existing privacy and data ownership laws. Under the California Consumer Privacy Act and the California Privacy Rights Act, citizens have the right to know what data is being collected from them, and they have the right to stop it from being sold or shared and to have it deleted. Companies that violate these rules can be sued. This is exactly what the lawyers of the Data Dividend Project are doing under the motto "My data, my money." Both make sense and can ensure greater transparency.

Others go even further and demand that companies should pay everyone involved a dividend for the use of data that is produced by millions of people. In the most optimistic case, though, this "data dividend" model would lead to tech corporations having to pay a basic income to all citizens whose data they use, but even that would only change the relationship between the individual and the tech corporation.

Fundamental Rights as a Commodity: Toward a Two-Tier Digital Society

If tech companies paid the basic income of entire societies, however, then structural dependence on these companies and a systemically unjust distribution—the dissolution of basic rights into services and handouts—would only grow, while the role of politics, the state, and citizens as a collective would shrink even further. Even worse, the fundamental right to privacy, to control and shape one's own personality, would no longer be perceived as an inalienable right, but rather as a commodity with a monetary value. Selling one's data would be about the same as selling one's right to freedom of expression or physical integrity. Any court would condemn companies that offered immoral contracts in these areas related to the right to integrity, and would classify the corresponding contracts as immoral and illegal. In fact, data abuse is not a trivial offense; it can have dangerous, even lethal consequences, as evidenced by the aforementioned cases of data-driven racism. A study from Berkeley has already proven[32] that algorithms in the US preferentially eliminate people from Latino and Black communities from applications for vacant properties, allegedly because of greater incidence of payment defaults.

A data dividend, money in exchange for data, would be particularly interesting for economically fragile population groups: single parents, freelancers in precarious jobs, people working in the low-wage sector—such as the new gig economy of digital startups like Deliveroo and Gorillas, for example. The Telecommunications company AT&T has offered customers discounts of up to $10 if they allow their data to be analyzed, and personal advertising clips to be sent to their cell phones. "I think we have a group of customers who will take that if they can save five or ten dollars," said John Stankey, one of AT&T's chairmen, at a press conference. Those who can afford to give up $10 will be able to protect their privacy, while those for whom every dollar counts will be forced to give up this right. That, too, is one of the bleak prospects for the future of the digital economy: freedom will become a service that you pay for, a luxury you have to be able to afford. There will be second-class citizens for whom the universal rights of self-determination and freedom no longer apply. Of all people, those who are already exploited by the digital economy are forced to supply this system with the most valuable thing they have to offer, their data—thus contributing to discriminatory algorithms that end up affecting them, and to fantastic profits of which they see nothing.

Get-paid-for-your-data, as defined here, will only further erode the welfare state, education, and healthcare systems. A stronger legal regulation of data exploitation would make much more sense than compensation payments in the form of a dividend, which can never make up for the damage to the aggrieved parties.

The hoped-for gains expected by those who demand "their share" from "the digital corporations" in exchange for their data turn out to be sobering when calculated more precisely. Facebook earned a good $69 billion in 2019. Facebook is a platform with billions of users whose data represents enormous power when taken together. If the profit were paid out per person, however, they would only receive around $7 each.[33] Individuals are worth very little in this system. For just a few dollars, they ruin their elementary rights to freedom and contribute to the trillion-dollar profits of a few companies.

Mejias recognizes this problem as well. He sees the required levy as just one step toward building their own network that will replace Facebook and Google in the long run, instead of making them the unassailable primary financiers of a new welfare state: "The reclaimed wealth could be used to develop public and private national infrastructures that could provide less invasive and exploitative versions of services than those offered by big tech companies from China and the West. It seems difficult to envision alternatives to the ones provided by these major corporations, but there are already technological models that the Global South could adopt to provide services that respect people's privacy and do not exploit their human desire to connect. We have the blueprint to create an Internet for the South, and the wealth recuperated through the nationalisation of data can help us build it collectively."[34]

Francesca Bria also argues that it can't just be a matter of "saying, as an individual, that I want to keep my data to myself, and then I, as a neoliberal subject, throw my data on the market and sell it and charge Facebook a few dollars for it, where infinitely more profit is gained from it. We need to take the right to informational self-determination not only as an individual right, but also as a collective right, and generate social value from the data, make better policy. We need data commons, collective data that we can use to generate public value. If you don't have a model for how to manage this data infrastructure and what to do with it, then you are perhaps putting the greatest collective treasure of digital-age society into the hands of private parties, and with it the critical knowledge of how to run a public administration.

In this way, the city is slowly losing its know-how and its ability to guide and shape society according to its own ideas—instead of the ideas of the tech companies."[35]

VIII. Cities Must Reconsider What Really Makes Them "Smart"

Barcelona as a Model: Data Commons

Francesca Bria rose to international prominence in 2015 when, as a member of Barcelona's municipal government, she launched the world's largest experiment in digital democracy: 400,000 citizens voted on municipal Internet platforms and in subsequently convened meetings on issues such as housing and transport policy. Nowhere were citizens' wishes translated into policy so quickly, radically changing the image of the city—and the image of what urban planning can be. The experiment was made possible by the DECODE project, previously launched by Bria in London: an EU-funded initiative to reclaim citizens' data sovereignty and fundamentally change our idea of state governance and civic participation. In the DECODE project, European programmers succeeded in developing algorithms that allow the public to decide which of the self-generated data they want to share and with whom—and which to keep to themselves.

Bria was one of the first to recognize that if you don't want surveillance capitalism, you have to change the legal and public framework at the European level for how people's data is handled—and also the currently prevailing business model. "The EU could say: the data that is generated in Europe by our citizens is a public good; you cannot steal that, and if you want to use some of it, you have to pay us," Bria said. "Now it's the other way around: we're giving away our data for free, and then we're also paying for the services that the tech companies distill from it. So we're paying twice."[36]

For Barcelona, Bria designed the digital platform Decidim. It allows citizens to be involved in all phases of political decision-making. "We believe that data should be part of the public infrastructure—like water, like roads, like the air we breathe," says Bria. "It belongs to the citizens." If tools were developed that allow citizens—rather than companies acting for the benefit of their shareholders—to make policy

based on their data, then the city could be reshaped, not according to the interests of investors, but, that is the promise of Decidim, to those of the entire population.

In Barcelona, Bria got Vodafone, the city's main telecommunications service provider, to contractually commit to not use data produced by the public for its own purposes, but to make it anonymously available on the municipal government's Open Data portal. The same online platform is used to experiment with data commons: here, citizens can decide whether they want to share their data, with whom, and for what purposes. For example, they can provide information about their daily trips to the city's transportation planning department without their car insurance company getting it too. They can share personal data with neighbors without the municipal government knowing. In this way, Barcelona's model differs both from a model in which the de-privatization of data primarily helps a dictatorial regime to track and monitor the population down to the last detail of their lives, and from the dominant Western practice of large tech corporations grabbing all behavioral data and building highly lucrative products with it.

Bria's attempt to introduce data commons in Barcelona was also an attempt to salvage the idea of transparency and control, elementary to any democracy, and launch it into the age of data. Barcelona sought to redefine what public goods are in the digital age. "It was about creating a new space that would be run neither by the state nor by private tech companies, but that would be a legally new idea of a res publica, enabled but not controlled by the state. A space of participatory democracy where the state acts as an enabler of self-organized processes." Bria had a digital civic platform set up on which 400,000 citizens of Barcelona could help to define policy goals. But there were also physical citizens' meetings in neighborhoods. Seventy percent of the proposals that emerged from these discussions were implemented within a year: "They were about concrete issues like bike lanes, spaces for cultural life, water management, pollution issues, support for small stores and workshops, local production, etc."[37]

Data Commons Could Be a Savior of Free Competition from Quasi-Communist Monopoly Capitalism

The data commons, which hardcore market liberals view as an undesirable regulatory intervention by the state in private-sector processes,

paradoxically defends the functioning of the market against monopolistic tendencies that ultimately lead companies like Google—which, thanks to their monopoly position, have meanwhile taken over state services such as healthcare and are even indispensable to the US Department of Defense because of their data expertise—to eliminate all competitors, much like quasi-state corporations in the Eastern bloc.

Data commons are not data communism in the totalitarian sense—they keep the market open for smaller competitors and participants. "We want competition based on data for services, and we want to give all this talent a chance," Bria says. At the same time, the focus of data evaluation is shifted from profit maximization to a public-welfare orientation and prevents the city, as planned by Sidewalk Labs in Toronto, from becoming a robot designed according to the value-creation interests of tech corporations. To help organizations of all kinds improve services, Bria founded i.lab, an innovation lab dedicated to solving social or urban problems, where startups collaborate with local cooperatives and universities. This, too, was an attempt to avoid delegating innovation and the shaping of a digital society exclusively to privately financed startups, which would subject them to the profit orientation of their investors.

The new Barcelona also shows that the transformation of cities as a result of digitalization—the crises of shopping streets and office districts—does not inevitably mean their decline. "Where there was a shopping mall, there is now a kindergarten and a cinema; a mall has been transformed into a theater; empty buildings have been redefined, reoccupied by small workshops and social spaces in which value is no longer to be understood only in terms of stock market value," says Bria. "We also had the goal of achieving data sovereignty. We therefore wrote clauses into public procurement contracts stating that all data collected by private contractors in the course of cooperation—whether through the rental of bicycles or telephone and Internet use—must be handed over to city hall in machine-readable form and become public property. At first, of course, many claimed that this was technically impossible. We fought with Vodafone for a year. In the end, they accepted the clause. On the other hand, if you ask a city like Berlin today whether they have machine-readable data on waste disposal and electricity consumption, they won't have an answer. The providers might give the city a PDF every few months. But you can't do anything with this data—nor can you check the effect of political measures. If the infrastructure of the city is organized by private

parties, then the state not only relinquishes its creative sovereignty but also deprives itself in the long term of any kind of design opportunity."[38]

Barcelona was also a first model for how local politics can force international platforms to comply with new rules: "Airbnb, for example, didn't want to give us any data. So we didn't know if they were following the rules, if they were paying taxes, to what extent they were raising rents. Portland [Oregon] threatened to ban Airbnb for this reason. But because it was just Portland and Barcelona that were at a loss, [Barcelona's] Mayor Colau talked to the mayors of Amsterdam, Berlin, New York, and other large cities where Airbnb generates the most revenue. And suddenly they listened and accepted some rules, because they didn't want to lose all cities as a market. It's the same with Uber. Individual cities alone can't change much—but global networks of cities that fight back can."[39]

Decentralization as an Opportunity

Data sovereignty would require the programming of apps to ensure that transparency and privacy standards are met, and that the processing of raw data is clear and transparent. On the other hand, the technological development of data storage necessary to meet the needs of growing data traffic could help to regain control. Mega-buildings operated by large corporations will not be able to guarantee data supply on their own in the future. Cisco's network developers predict that the cloud will be followed by the "fog," a more decentralized way of storing data close to the end consumer. If, for example, politicians and the industry push for the widespread introduction of largely autonomous cars, then these vehicles will produce gigantic amounts of data that must be distributed locally, not stored centrally. The Internet of Things also needs many decentralized data points. The amount of data that has to be stored somewhere is growing so exponentially that it is now only expressed in zettabytes: "By 2024, 149 zettabytes of new data are expected to be created globally every day," is the forecast of the data specialists at CB Insights.[40] A zettabyte is the equivalent of a billion terabytes. After that comes yottabytes. In the long term, data will have to be stored and processed decentrally, at the edge of the network. At the same time, it will become increasingly difficult to serve real-time requirements, the decreasing latency tolerance, with central servers. On the stock exchange, it is under

50 milliseconds, which is why the cables leading from the SIX server to the individual institutions are exactly the same length, so that no one has an advantage in automated program trading[41]—another example of the strangely physical basis of operations in digital space.

In view of the billions of networked devices, this decentralization, which is technically almost impossible to circumvent, also offers an opportunity to reduce dependence on large cloud operators such as Amazon Web Services, Microsoft Azure, and Google Cloud—because, often, the edge devices and smaller data centers with an area of around 100 square meters would not be permanently connected to a central server and could be built by other companies. It would also be easier to prevent the outflow of data to other countries.[42]

Architecture of Enlightenment

What is missing above all, however, is a place where one can understand, and make visible to a large majority of the population, what the situation actually is—that governance, the governability of communities, cities, and countries, is no longer possible without access to data; that Europe and Africa are politically and technologically squeezed between two hegemonic blocs—on the one hand, surveillance capitalism, in which tech companies are taking over the healthcare system and encroaching on security, undermining education policy and other sovereign tasks of the state, and on the other hand, the Chinese Big State, with its social point system and the ultimate abolition of individual liberties. Both Europe and Africa urgently need to free themselves from digital colonization—which is difficult when the state, the public sector, has largely abandoned the political shaping of a digital future and handed it over to private digital corporations.

Architects have played a strange role in this game so far: while the engineers of the server farms work on important ideas for saving energy, their architects are primarily cosmeticians; they beautify what needs to be legally rebuilt, aestheticizing what should in fact be political.

The past few years have been marked by a new privatization of cities and societies, by their reshaping according to the commercial interests of corporations that exploit their data. The consequences for democratic life, for fundamental ideas of self-determination and social equality are not foreseeable. Virtually no one would think of marching in the thousands before Google's and Facebook's server

farms or demonstrating against cases like the Cambridge Analytica scandal; the question of digital sovereignty, unlike issues such as migration and climate change, is of little concern to most.

For this reason alone, there is an urgent need for a new public space where we can see how closely data storage and governance are linked; how great the danger of losing control really is; how urgent it is to concentrate artificial intelligence not in the servers of large private corporations, but in the hands of citizens, and in a decentralized way; and what opportunities might open up for creating a new form of civil society, a new wealth for all, when we regain control over our data. But what might this place look like?

Building for Democracy

When the Federal Republic of Germany was still young, there were two building typologies—in addition to schools—that embodied the new democratic state's efforts to allow all citizens to claim a space to participate in social life and educational opportunities: the district library and the public swimming pool. Both were soon to be found in every small German town, and both introduced a new form of public sphere beyond social differences.

Among the ruins of Berlin's Tiergarten district, Werner Düttmann built one of the most beautiful public buildings of German postwar modernism, for the International Building Exhibition of 1957: the Bücherei am Hansaplatz (Library on Hansa Square), with 12,000 freely accessible books, a number that later more than tripled. In fact, this architecture was an entire social blueprint, a vision of how living, working, leisure, and education could intertwine in the new cities.

What is remarkable about Düttman's library is its scale. The public building appears rather domestic: the four single-story wings enclose a so-called "reading garden," an atrium where, as we see in old photos, Hardoy chairs were scattered around. The library could also be a luxurious Case Study House in Los Angeles or Palm Springs. Düttmann transformed a private building typology, the bungalow, into a public place of education that was accessible to all and yet had the intimacy of a private retreat. In the garden of his library, every inhabitant of the small social-housing apartments in the neighborhood could feel like the owner of a modern American mansion. The book bungalow was a collective living room, and a democratization of a once privileged form of construction—Palm Springs for all.

Werner Düttmann, Hansa Library, Berlin, FRG, 1957

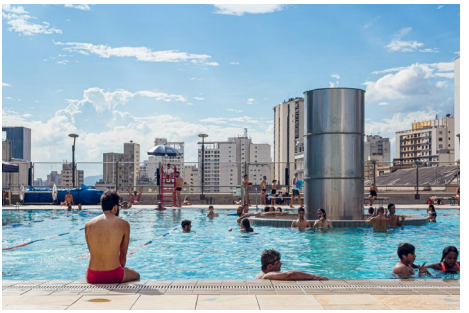
In a way, Düttmann was very close to one of the great masterminds of collective building in modernity, Charles Fournier, who, at the beginning of industrialization in the early nineteenth century, sharply criticized the small, miserable workers' cottages that were newly emerging, instead calling for the construction of a "phalanstery"—a kind of Versailles for thousands of workers, who would thus be able to enjoy pleasures formerly reserved for the nobility: here, as there, the aim was to democratize education, and hedonism.

The public swimming pools of the time were also counterexamples to an urbanism that insouciantly placed the future of cities in the hands of private investors. One of the latest developments of large public pools can be found on the roof of a former administrative building in São Paulo, which Paulo Mendes da Rocha, together with the architectural firm MMBB Arquitetos, converted into a cultural center—also financed by public funds—in 2018.

The client was a trade union organization founded in 1940. Today, Sesc 24 de Maio is visited by up to 10,000 people each day. The library, collective living rooms, and restaurants—but above all, the huge pool on the roof—help to bring back together, at least temporarily, a society that is drifting further and further apart. Sesc 24 de Maio has its roots in the legendary Fun Palace, as envisioned by the architect Cedric Price and the film and theater director Joan Littlewood. In 1961, they designed an open steel framework with suspended spaces, stages, and plateaus that could be assembled from modules, and on which public space, the collective rituals of society, the way people spend time together, educating, celebrating, researching, producing, loving, were to be redefined. Littlewood wrote: "Choose what you want to do—or watch someone else doing it. Learn how to handle tools, paint, babies, machinery, or just listen to your favorite tune. Dance, talk or be lifted up to where you can see how other people make things work. Sit out over space with a drink and tune into what's happening elsewhere in the city. Try starting a riot or beginning a painting—or just lie back and stare at the sky."[43]

Although never realized, the Fun Palace was one of the models for one of the largest and most influential educational institutions of the twentieth century: the Centre Pompidou.

If, as Shoshana Zuboff writes, we must return to the initial promises of the digital era, to the moment when the Internet emerged, in an attempt to establish emancipatory networks beyond existing power structures and distribution channels for knowledge, then it is helpful to look closer at the decade of the "education shock." After 1968,



Paulo Mendes da Rocha + MMBB Arquitetos, Sesc 24 de Maio, São Paulo, Brazil

significantly more schools were built in Europe, and new pedagogical concepts tested; in France, the Centre national d'Art et de Culture, or Centre Pompidou for short, was built in 1977, a cultural machine designed to give all sections of the population free access to art and knowledge. For the first time, an art museum, a large library with 2,000 seats, a media library, restaurants, terraces, cinema halls, and a children's workshop were housed in one building. School groups from all social classes and all regions of the country visit the building every day.

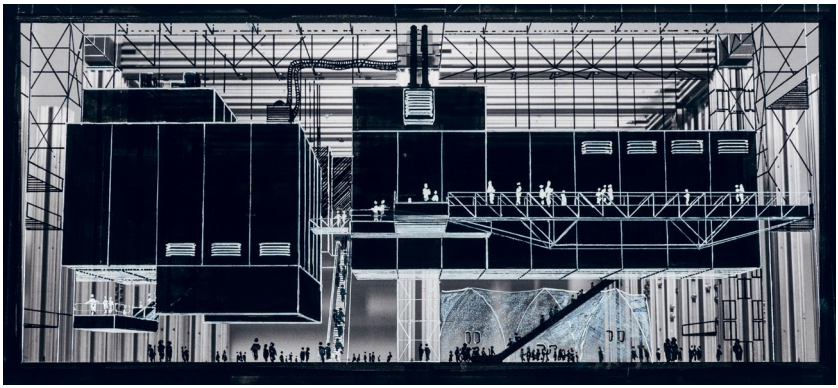
The idea of an architecture that would provide not only spaces for education, but also a new form of political participation, was also born in the nineteen-sixties. For his project in California City, Konrad Wachsmann designed a town hall that consisted only of a gigantic floating fiberglass roof strung with high-tension cables between sculptural concrete abutments—and an endless plaza underneath that could be used for meetings or concerts.[44] The town hall and plenary chamber were to be embedded in the ground like an empty swimming pool, with a huge transmission tower rising above like an exclamation point in the desert sky. Cameras were to transmit the political debates from the hall in real time to people's televisions, giving them the

opportunity to influence political decisions as directly as the Chileans would later be able to do—at least in theory—in Stafford Beer's Cybervisions.

Thus, long before the invention of the Internet, this hybrid of architecture and television was to become a kind of interactive communication machine, a new political space, physical and virtual at the same time. It was never built. Nevertheless, today Wachsmann's idea is more topical and necessary than ever.

Cities Do Not Need to Be "Saved"

Technological inventions shape the form of our cities. The object that changed everything for the twentieth century was the automobile; for the twenty-first century, it was the cell phone. If the goal of twentieth-century urban planning was the car-friendly city, then the goal of the twenty-first century is the data-driven city; just as everything was built around the needs of the car until the nineteen-eighties, everything is now being built around the smartphone and the networking of things.



Cedric Price, Fun Palace, 1964

Centre Pompidou, Paris, France, 1977

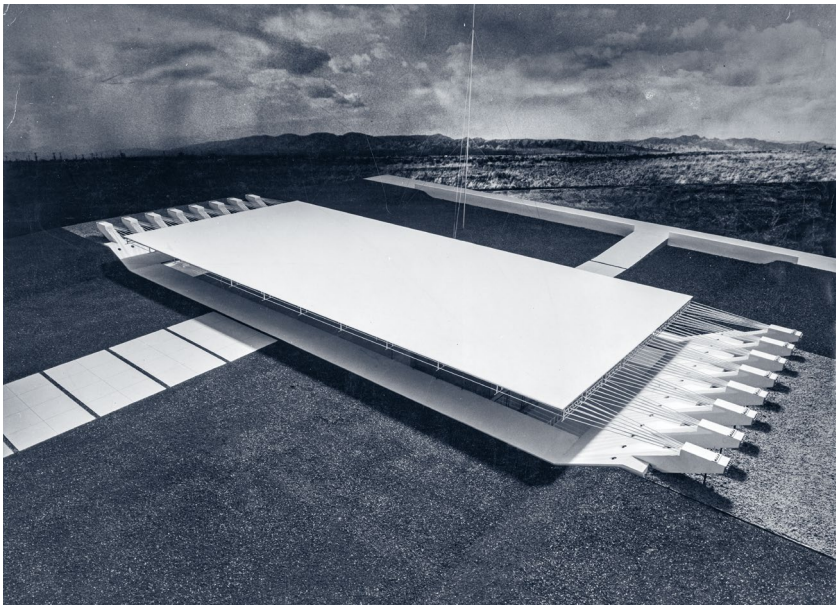
Cities were attractive because they enabled people to escape the confinement and surveillance of the village community, the arbitrariness of the feudal lord, to reinvent themselves, or to immerse themselves in anonymity (a quality of the city that was unrightly mourned by urban researchers). Freedom and personal responsibility were the great promises; with danger, noise, and chaos accepted in return. It would be worth deeper research to find out at what point freedom and self-reliance were replaced by comfort and security as the city's supreme promises and goals; what happens when an authoritarian state degrades people to mere information objects can be seen in Hong Kong and China.

At the same time, large private corporations like Google's parent company Alphabet are ripping out of cities what the public sector had built over centuries—not only post offices, cables, pipes, roads, wires, squares, stores, infrastructure, and public life, but also health insurance and public safety—and replacing it with their products.

Smart-city planners and automobile companies persistently calculate how much time and energy one saves on the way from home to the city center with their networked apps and devices and all-electronic, autonomous "solutions," but no one asks what one *might still*

want in the city center at all, if people no longer work there because factories are robotized and offices have shifted to the home; if no one shops there because everything is ordered online; if no one goes to the movies anymore because everyone watches Netflix. In the past ten years, department stores have lost over 40 percent of their sales. Online retailing is turning department stores in city centers into ruins, and not just because of the coronavirus pandemic.[45] The structural crisis of the city in the digital age also reveals the weak point of smart-city visions: they only ask how to make the status quo more efficient and economical via technology; the axiomatic question of what else one might actually want instead of the status quo is not raised.

The reaction of politicians to the economic decline of city centers has so far been one of mild panic followed by attempts to save what has characterized the city up to now. In 2020, the German Minister of Economics, Peter Altmaier, convened a City Crisis Summit at which one of the topics discussed was how to save retail in Germany's pedestrian zones. But is the rhetoric of saving appropriate in a context of city centers that formerly have been described as the result of a destruction process where an ecosystem of age-old small businesses and shops has been replaced by the ever-same retailers which are now



Konrad Wachsmann, California City Hall, 1966 to 1971

under pressure? Is it really such a bad thing if chains like H&M can no longer be found in city centers? If exhausted commuters who work in the office tower would no longer sit in traffic jams for an hour every morning, honking their horns with unhealthy blood pressure? What would happen to the city if labor as we know it vanished from its precincts? If its economic topography, its collective rituals, were no longer built around the idea of work and consumption?

In rather dystopic scenarios, tourism is the future of city centers, where "downtown" will resurrect as its own simulacrum for visitors and a few privileged apartment owners, with restaurants, carriages, and historical attractions or their replicas—people would then go to city centers the way they used to go to museums.

But perhaps this is not the only perspective.

If capitalism, of all systems—which once promoted the proliferation of office towers and shopping malls and allowed prices for inner-city real estate to skyrocket—ensures the final withdrawal of retail and office work from the physical space of the inner city through the even more efficient invention of online retail and the home office; if the inner city thus becomes a ruin park and loses its economic value, then it could end up being repopulated in a more relaxed manner, without the exaggerated expectation of profit—just as the Roman arenas and palaces were converted into residential complexes in Late Antiquity and the Middle Ages. The threat of vacancy comes at the right time, when less new construction is planned for reasons of climate protection. In the emptying inner cities, working and living and producing and consuming could be restructured. But what would be the economic basis for this reinvention?

IX. Data Commons Need a Place

One must not confuse the shell with the content, the crime scene with the crime. The server farm itself, as a building, as a storage location, is not the problem. But what happens inside it must be made transparent and regulated: when server farms contain personal data, it must be made clear that this is a public good. This is first and foremost a political demand that must be regulated politically, through international agreements and laws.

Can you make digitalization and Big Tech visible—and if so, how? If, as some architects are already suggesting, data centers were to be built with glass walls in order to display the server racks behind them in the same way as cars are displayed in a showroom, it would be just another form of aestheticization, a formalistic short circuit similar to the equation of glass and democracy in many parliamentary buildings of the nineteen-seventies and -eighties, such as the Bundeshaus in Germany's former capital Bonn, in 1992. The glass façades were bulletproof and shielded the representatives physically and acoustically as perfectly as a massive fortress wall would have done. While glass only visually serves the promise of permeability and transparency, lobby registers and websites like Abgeordnetenwatch.de are much more important than transparent panes in meeting such needs. Could architecture play a role in a more enlightened vision of a data-driven democracy, with citizens better understanding the power structures and pitfalls of Big Tech?

Any architecture that claims to make new forms of public life possible has to put up with the rhapsodically asked question of whether it is merely symbolic, imagistic—in other words, just accomplishing aesthetically what should be solved politically. Conversely, this does not mean that a society no longer needs physical places.

Perhaps Big Data cannot be pictured, either artistically or architecturally—but it is possible to build spaces in which a society learns what Big Data actually is, what can be done with it, and what kind of new forms of public life would be conceivable if it weren't left to private corporations or authoritarian states.

If it is clear that governance is no longer possible without access to data, then a public place in the digital age would have to conceptualize the political sphere—the town hall, the parliament—together with its greatest treasure, data. Again and again, it is claimed that the idea of a central place, of any physical place at all, is obsolete, and that the Internet or social media would be the place for actual debates, and that the formation of the political will ultimately take place virtually, between online petitions and shitstorms. But this would completely ignore physical space as a place of political experience, gathering, and decision-making. People are not made of zeros and ones: they will still want to go out in the future. But where to? To do what?

It would be the task of the state to build something new that makes all of the incomprehensible technologies that profoundly shape our

lives both visible and comprehensible: a hybrid of data center, library, and museum of the future, a new educational institution in which the entire population—schoolchildren and politicians alike—can learn how dangerous the prevailing business model of digital capitalism is for democracy and self-determination. This new institution would also shed light on the extent to which the current concentration of digital profits in a few corporations endangers broad-based prosperity, the idea of codetermination, and the governability of communities, cities, and entire countries.

What is needed is a public server farm in which the collective treasure trove of data is celebrated and displayed as if in a glass showcase, just as modern architecture used to celebrate the art and consumer goods of its time; a New National Gallery for servers. This new hall would not just be a shrine for enigmatically shimmering computers harboring people's stored knowledge, and stored knowledge about people, but rather an educational space dedicated to the question of what is—and what should be—done with all this data.

X. The Public Server Farm Can Become a Centre Pompidou for the Digital Age

If the democratization of culture and education was the goal of the most momentous French cultural construction of the twentieth century, then what would a Centre Pompidou for the digital age look like? What would it have to offer? Which formerly separate spheres would it need to bring together? Will we live apart from our data, or with it? Will we perceive server farms as alien worlds, and hostile planets, or will we colonize them like the moon?

There are enough plans for data centers sugar-coated with islands of wellness and roof gardens, where users, deprived of their data, may pick an apple as consolation. The opposite is needed: the server farm as a place of political activation. The sustainable self-government of 10 billion people urgently requires the invention of new institutional regimes. These regimes will have to rely on data, and on collective, participatory decision-making.

Could a public city hall or parliament, in the spirit of Wachsmann's Civic Center, be built on top of a server farm that makes the citizens' great collective treasure trove of data visible—not in the sense of an

imagistic, merely symbolic architecture, but as a civic center of the digital age, where education takes place, and information about who controls artificial intelligence, the platforms, the cloud, and the algorithms can be accessed? Where school classes can go and learn how we are analyzed, predicted, and monitored? What sovereignty over one's data actually means? What happens if you lose it, and how can you get it back? And what new forms of participatory democracy would then be possible?

A civic center for the digital age would have to be a place where even politicians could understand that digitalization does not have to mean that a few startups and tech corporations can make hideous profits by breaking down public life into individual paid services.

Such a civic center, where a digital modernity can be invented that benefits everyone, a Centre Pompidou for the digital age, would show the people how their data is used, by whom, and for what purpose—and eventually how they can resist this use. There would also have to be a large, open square (not idyllic urban gardens cluttered with benches and other obstacles), partially covered in case of inclement weather, where the physical side of democratic expression and education can take place—a space for demonstrations and rallies. At the same time, this square would be the city's largest collective living room and playground-cum-meeting-place-without-the-obligation-to-consume, where public life would not be limited to café, restaurant, and museum visits: a place where, in the event of more equitably distributed digitalization gains, society could allow itself a less efficiency-driven, less hurried existence—new social rituals, new ways of spending time together. This building could house coding schools, exhibition spaces, and research facilities, including a center for digital sovereignty that explores what political and economic choices can prevent a society from having its foundations eroded by digital corporations and authoritarian regimes. It could also contain political sites—city hall, parliament—not only as an image of how data has become the foundation of politics, but also as a visible dovetailing of this research with politics.

The civic center for the digital age would be scalable. Even in smaller cities and towns, local, decentralized servers could become public places, just as community halls, village schools, and libraries once were. The enormous heat generated by cooling the data could also be used to create entirely new architectures here. On their roofs, one could—the way various car bodies can be built on one electric platform—heat the most diverse array of public places with waste

heat: greenhouses, swimming pools,[46] a collective living room for the village, domed tropical evergreen settlements à la Buckminster Fuller. The fantasies of the nineteen-sixties could become a reality.

In the age of data capitalism, such a public server farm, combined with political and educational facilities and a research center, would be a symbol of civil liberty similar to the city hall that once served as a counterweight to the castle of the feudal lord. It would be a treasure trove of the digital age, in which data could be understood as a collective possession, as a "public good"—and as the necessary capital stock for a political alternative to both a form of society in which tech corporations gain ever greater power over politics, cities, and citizens, and one in which an authoritarian state uses data-skimming to monitor and predict its citizens' future behavior.

The philosopher Armen Avanessian argues that we live in a time "that is determined in many aspects, in many dimensions, by the future. We must learn to deal with the fact that we produce a quantity of data that makes us not simply inferable from our past behavior, but from the future: that the algorithms already know things about us that we don't yet know about ourselves—for example, what diseases we will have in the future, what products we would like to buy in the future."[47]

But if we are attacked by our digital twins, who have been raised in private server farms, from a speculative future, then the public civic center / server farm could become a space where we react to the data-based predetermination of our future behavior with preemptive strikes, learning how to know our possible future self better than tech companies could. The civic center / server farm would be a poeto-political machine of self-prediction.

A Centre Pompidou for the digital age would display masses of data as a stunningly new form of beauty—just as the original in Paris invented a memorable image for education without exhausting itself in metaphorical imagery. It would be a place of not only symbolical transparency, but an instrument of politization, a machine that gives the city a novel public space beyond shopping, business lunches, and sightseeing. It would counter the privatization of the city with a place where education, emancipation, community, solidarity, collective experience, self-determination, and adventure would replace the now dominant obsession with comfort, efficiency, and predictability. It would turn users back into actors. It would visibly bring digitalization into the center and no longer leave it to private

platforms. Seen in this light, the civic center of the future would be a democratic anti-platform, a counter-model to the current clichés of “public space.”

Notes

1 For a comprehensive, brilliant analysis of this new building typology, see Jesse LeCavalier, *The Rule of Logistics: Walmart and the Architecture of Fulfillment* (Minneapolis, 2016).
2 See Cynthia Harvey, "What Is a Data Center?" *Datamation*, July 10, 2017.
3 See "The Spark," Snøhetta, https://snohetta.com/project/388-the-spark (all URLs accessed in November 2021).
4 In Stockholm, Interxion already feeds the waste heat from its servers into the district heating network, and the heat pumps under the server room could theoretically heat up to 10,000 apartments. Theoretically: in the immediate vicinity, the temperature can be sufficient for heating; practically, the temperature is too low for hot water production, and the exhaust air is much too cold for the existing district heating network. The company Cloud & Heat now wants to feed 55-degree water into the water-cooling circuit, and the heat from the servers can heat it to 60 degrees, which is what is needed to heat buildings. Then the cooled water returns to the server farm, and the cycle begins again.
5 Other operators are also going where it's cold: Facebook has built its first European data center in the Swedish arctic circle, and Google has opened one in Hamina, Finland, which is cooled with Baltic Sea water. Apple is building a data center in Viborg, Denmark, that will have an electricity demand comparable to that of a medium-sized city, but the power will be supplied exclusively by renewable sources—Danish wind energy and Norwegian hydropower. Hydro Miner in Vienna wants to produce Bitcoins in depreciated hydropower plants in the Alps. In Gais, Appenzell, waste heat from the East Switzerland Data Center will be recycled in a nearby cheese dairy. The Eco-DataCenter in Falun, Sweden, will also feed server heat into the municipal district heating system: you warm yourself with your own data, with your memories captured in saved images and film clips.
6 Kimberly Mlitz, "Big data and business analytics revenue worldwide 2015-2022," *Statista*, August 17, 2021, https://www.statista.com/statistics/551501/worldwide-big-data-business-analytics-revenue/.
7 Cited in Shoshana Zuboff, "Märkte sollten nicht die menschliche Zukunft verkaufen," *Frankfurter Allgemeine Zeitung*, November 8, 2019, www.faz.net/aktuell/feuilleton/debatten/interview-shoshana-zuboff-ueber-den-ueberwachungskapitalismus-16473832/kritikerin-des-16473739.html.
8 Ibid.
9 See also Evgeny Morozov, *The Net Delusion: The Dark Side of Internet Freedom* (New York, 2012); Evgeny Morozov, *To Save Everything, Click Here: The Folly of Technological Solutionism* (New York, 2013).
10 Deborah Raji's text "How Our Data Encodes Systematic Racism" (published in *Technology Review*, December 10, 2020, www.technologyreview.com/2020/12/10/1013617/racism-data-science-artificial-intelligence-ai-opinion/) shows the dramatic racism of AI-based image interpretation: "Google Image search results for 'healthy skin' show only light-skinned women, and a query on 'Black girls' still returns pornography. . . . ImageNet-trained models label me a 'bad person,' a 'drug addict,' or a 'failure.'" Once AI's interpretation of data sets is recognized as an "objective" method of describing reality, then it becomes difficult to maintain awareness of the racial underpinnings of those epistemes that underlie knowledge production, of the fact that they represent, as Raji writes, a "constructed reality, not the natural one": "Data is not just arbitrarily 'political'—there are specific toxic and misinformed politics that data scientists carelessly allow to infiltrate our data sets. White supremacy is one of them."
11 Ibid.
12 David Schaper, "Boeing To Pay $2.5 Billion Settlement Over Deadly 737 Max Crashes," *NPR*, January 8, 2021, https://text.npr.org/954782512.
13 Zuboff 2019 (see note 7).
14 Jillian D'Onfro, "Would Google build a city from scratch? 'Great idea'," *Insider*, April 5, 2016, https://www.businessinsider.com/google-dan-doctoroff-sidewalk-labs-building-a-city-from-scratch-2016-4.
15 T. R. Kennedy Jr, "Electronic Computer Flashes Answers, May Speed Engineering; New All-Electronic Computer and Its Inventors," *The New York Times*, February 15, 1946.
16 Kommission für Rechenanlagen der Deutschen Forschungsgemeinschaft.
17 See Martin Schmitt, "Geschichte des Potsdamer Rechenzentrums: Sozialistische Computernutzung und die Digitalisierung in Ostdeutschland," http://lernort-garnisonkirche.de/?p=456.
18 Ibid.
19 See also Azadê PeÐmen, "Die Stasi und die Computer," *Deutschlandfunk Kultur*, December 7, 2016.
20 Ibid.
21 See Stafford Beer, *Cybernetics and Management* (London, 1959).
22 Opinions differ on whether the collapse was prevented

thanks to Cybersyn or could have been averted with simple phone calls and telegrams. See also Sascha Reh, *Gegen die Zeit* (Frankfurt am Main, 2015). A more critical view is offered by Evgeny Morozov, "The Planning Machine: Project Cybersyn and the Origins of the Big Data Nation," *The New Yorker*, October 6, 2014, www.newyorker.com/magazine/2014/10/13/planning-machine.

23 See also Henry Mauricio Ortiz Osorio and José María Díaz Nafría, "The Cybersyn Project as a Paradigm for Managing and Learning in Complexity," *Systema* 4, no. 2 (2016), pp. 10–19, https://bitrumcontributions.files.wordpress.com/2016/07/2016-systema-ortc3adz-y-dc3adaz-the-cybersyn-project-as-a-paradigm-for-managing-and-learning-in-complexity.pdf; Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA, 2014).

24 "Benthem Crouwel Architekten: AM4," Divisare, https://divisare.com/projects/371579-benthem-crouwel-architekten-jannes-linders-am4.

25 See Schäfer It-Systems, www.schaefer-it-systems.de.

26 Rem Koolhaas, "The Cut: Where to from Here, When All of the Horizon is in the Cloud?," *Flaunt Magazine*, January 6, 2016, https://flaunt.com/content/art/rem-koolhaas.

27 See "The Spark" (see note 3).

28 Francesca Bria and Evgeny Morozov, *Die smarte Stadt neu denken: Wie urbane Technologien demokratisiert werden können*, Rosa-Luxemburg-Stiftung (Berlin, 2017), pp. 104–5. See also Ben Tarnoff, "The Data is Ours!" *Logic* 4 (April 2018), https://logicmag.io/scale/the-data-is-ours/.

29 Ben Tarnoff, "Big Data for the People: It's Time to Take It Back from Our Tech Overlords," *The Guardian*, March 14, 2018, www.theguardian.com/technology/2018/mar/14/tech-big-data-capitalism-give-wealth-back-to-people.

30 Cited in Ulises Ali Mejias, "Why the Global South Should Nationalise Its Data," *Aljazeera*, December 14, 2019, www.aljazeera.com/opinions/2019/12/14/why-the-global-south-should-nationalise-its-data. See also Nick Couldry and Ulises Ali Mejias, *The Costs of Connection: How Data Is Colonizing Human Life and Appropriating It for Capitalism* (Stanford, 2019).

31 Ibid.

32 See Laura Counts, "Minority Homebuyers Face Widespread Statistical Lending Discrimination, Study Finds," *Berkeley HAAS*, November 13, 2018, https://newsroom.haas.berkeley.edu/minority-homebuyers-face-widespread-statistical-lending-discrimination-study-finds/.

33 See Hayley Tsukayama, "Why Getting Paid for Your Data Is a Bad Deal," *Electronic Frontier Foundation*, October 26, 2020, www.eff.org/de/deeplinks/2020/10/why-getting-paid-your-data-bad-deal.

34 Mejias 2019 (see note 31).

35 Francesca Bria and Niklas Maak, "Holt euch eure Daten zurück!" *Frankfurter Allgemeine Zeitung*, October 19, 2020, www.faz.net/aktuell/feuilleton/francesca-bria-im-interview-holt-euch-eure-daten-zurueck-17007960.html.

36 Ibid.

37 Ibid. On the data commons discussion, see also Sir Nigel Shadbolt, "Data for Public Good," *Geospatial World*, May 26, 2021, www.geospatialworld.net/article/data-for-public-good/; Mariana Mazzucato, "Let's Make Private Data into a Public Good," *Technology Review*, June 27, 2018, www.technologyreview.com/2018/06/27/141776/lets-make-private-data-into-a-public-good/; Mahbubul Alam, "Data for Public Good," *Towards Data Science*, December 12, 2019, https://towardsdatascience.com/data-for-public-good-1414cbc99335; for a critical view of data as public property, see Linnet Taylor, "The Ethics of Big Data as a Public Good: Which Public? Whose Good?" *Philosophical Transactions R. Soc.* A374, Tilburg, 2016, https://royalsocietypublishing.org/doi/pdf/10.1098/rsta.2016.0126; in a similar vein on the nationalization of data in India: Nikhil Pahwa, "Nationalisation of Data Will Destroy Value for Businesses, Investors," *The Times of India*, August 8, 2020, https://timesofindia.indiatimes.com/blogs/toi-edit-page/nationalisation-of-data-will-destroy-value-for-businesses-investors/.

38 Bria 2020 (see note 36).

39 Ibid.

40 See Björn Godenrath, "Edge Computing nimmt Last aus dem Cloud Computing," *Börsen-Zeitung*, March 23, 2021.

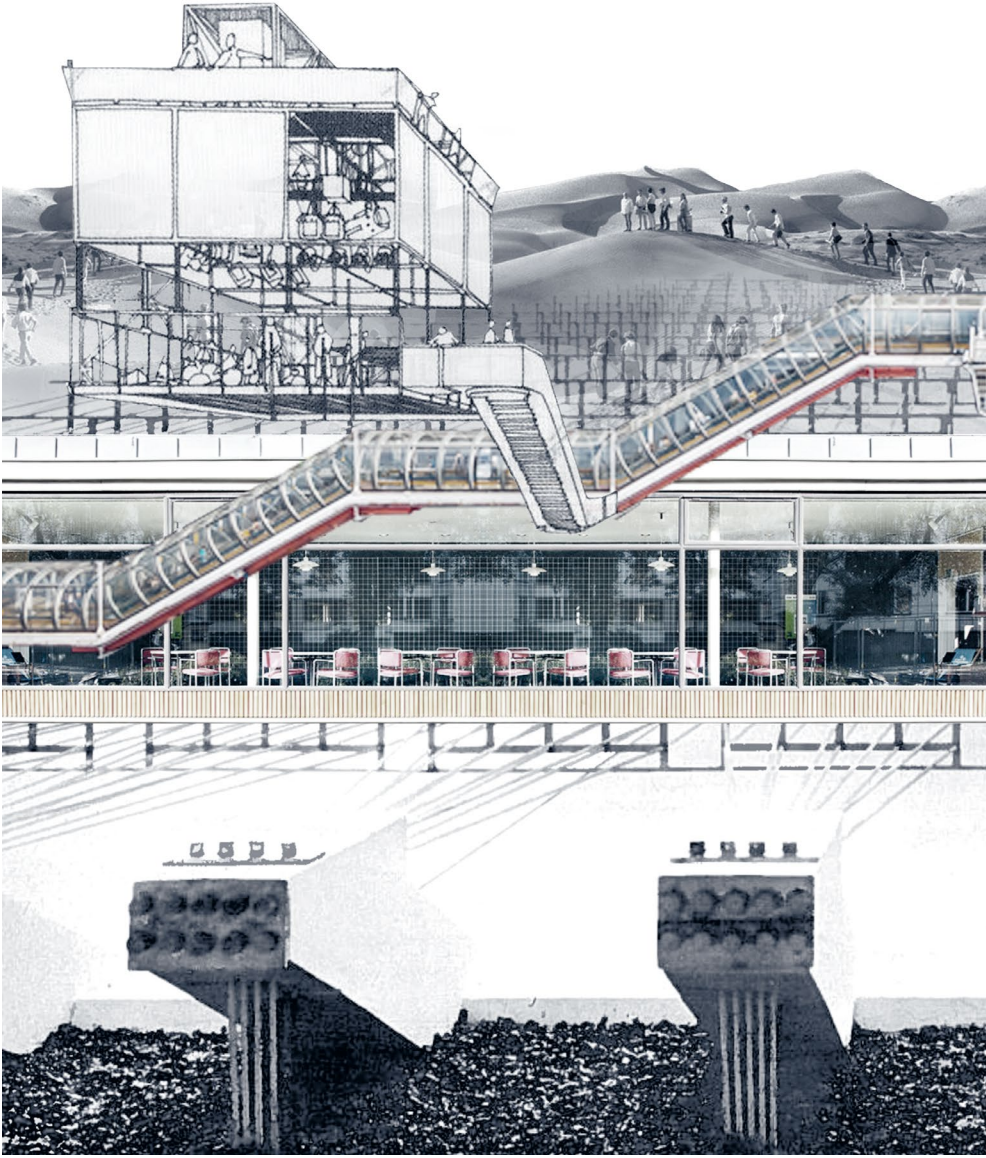
41 See ibid.

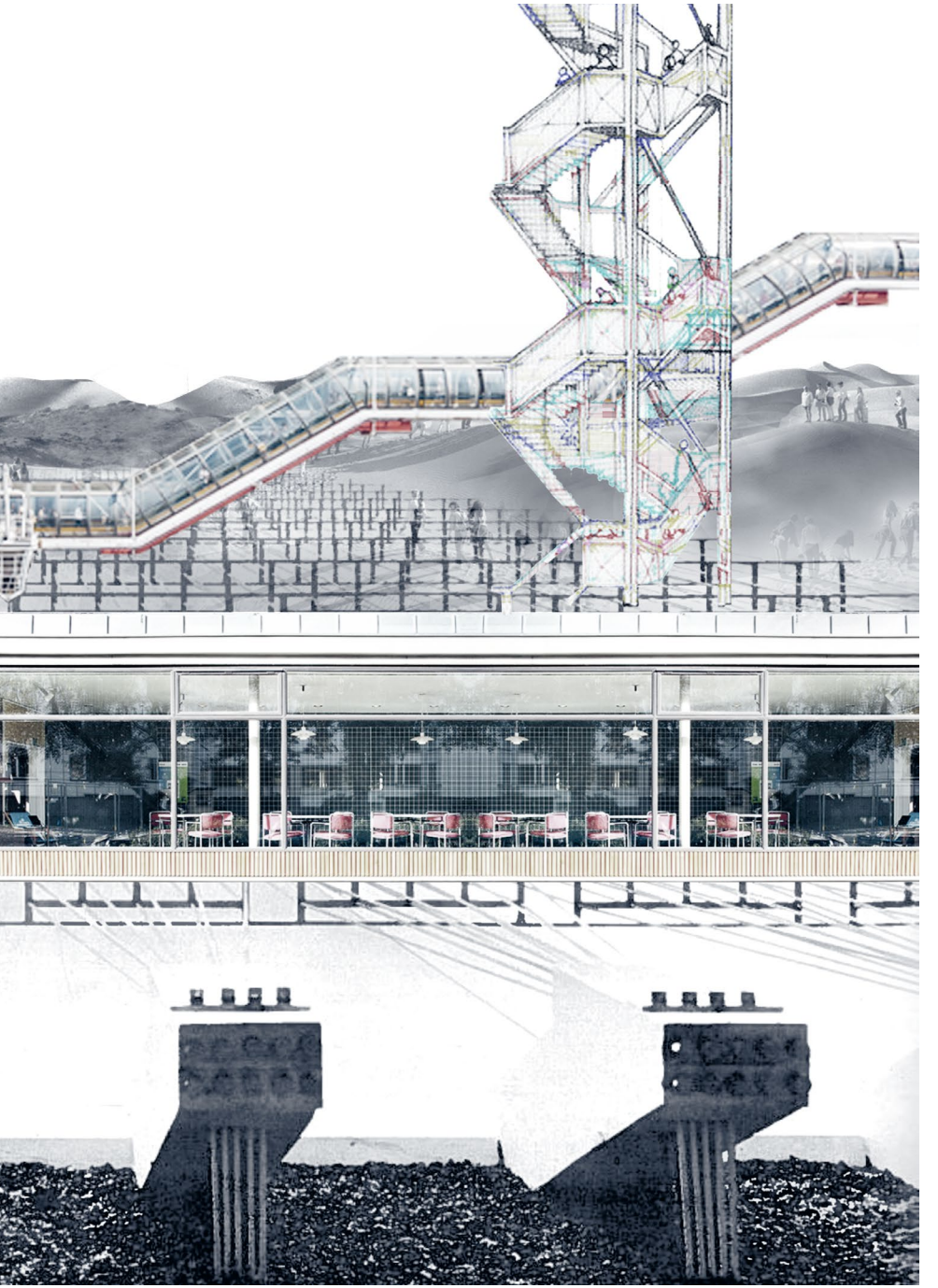
42 CB Insights is quoted as estimating that less than one-fifth of all corporate data is processed outside central server farms, but that this share could shift to edge computing by up to three-quarters in the coming years. A European solution could be developed in this area, for example, before the large providers again control the market with projects such as Azure's IoT Edge.

43 Peter Blundell Jones, *Architecture and Ritual: How Buildings Shape Society* (London, 2016), p. 321.

44 For a detailed discussion, see Mark Wigley, *Konrad Wachsmann's Television* (London, 2020).

45 The real-estate agency Jones Lang LaSalle reports that demand for office properties in terms of space fell by 30 percent in the seven major German cities in 2020, and by over 50 percent in Stuttgart, and the market is only recovering slightly. The time when office towers were springing up like mushrooms—in 2019 alone, there were 1,800 new buildings in the seven largest German cities—is gone. Paris, London, and Barcelona also saw declines of over 40 percent, and in Frankfurt am Main, almost a million square meters of office space is vacant.
46 Comparable ideas have been presented by the Rhizome project: http://project-rhizome.com.
47 Armen Avanessian in conversation with Karin Fischer, *Deutschlandfunk*, January 2, 2018, https://www.deutschlandfunk.de/reihe-eine-frage-der-zeit-wir-muessen-uns-von-dieser-100.html.





A New Building Type on the Block: Data Centers and the City
What Are the Greatest Challenges Offered by the Data Center Boom?

Interview with
Karsten Spengler

Karsten Spengler is based in Frankfurt and heads the Science, Industry and Technology business of Arup Germany as Director. Born 1969 in Weißenfels, he graduated from the Technical University of Dresden as a Diplom Engineer for Building Services in 1995. Since then, he has worked on a wide range of projects, such as the Reichstag renovation, the new building for the Federal Ministry for the Environment in Berlin, numerous research and education facilities for universities in Leipzig, Cologne, Gummersbach, Göttingen, and Frankfurt, and at various industrial research and production facilities, including the world's largest catering factory in Doha. Spengler has been involved in data center building design since the turn of the millennium.

Niklas Maak According to Frankfurt's Report on Climate Protection, the city will fail to reach its energy target for the year 2050 as a consequence of the energy demands of its servers. In 2020, local data centers used 1,600 gigawatt hours of electricity—about 60 percent more than the total usage of Frankfurt's circa 400,000 households during the same year. How do you respond to this situation?

Karsten Spengler One of my favorite topics. Here are a few theses. Using electricity is neither good nor bad per se: it depends on its source. Remarkably, all of the major tech companies and the vast majority of data center operators procure their power from renewable sources already. Beside their aim to decarbonize, they also consider green power to be more economical and secure in the long term. In theory, their data centers run net zero carbon already, with the sole exception of the periodical testing of their fuel-driven generators. Is everything fine, then? Well, the true dilemma is that overall there is not enough green power available in Germany to match societies' ambitions to decarbonize: about 50 percent of Germany's power generation is still based on oil, gas, coal, and nuclear, and the overall generation of green power stagnates for years, whilst the overall power demand is increasing because of transport, households, industry—everyone is trying to electrify in order to lower fuel consumption and carbon footprints. The way out is to accelerate the transition to 100 percent renewable power generation and infrastructure. Some tech companies don't want to wait for governments and power industries and thus invest in their own green power generation and infrastructure in response.

NM In data centers, all electrical power gets converted into heat. Why can't this energy be used to heat apartment blocks or swimming pools?

KS It can! To illustrate the potential: for wider Frankfurt, we're talking about more than 100 megawatts of waste heat generated by data centers alone—a reliable, carbon-free heat source at a capacity to heat the entire city of Frankfurt. And if you think about this in the context of the previous question, it becomes clear that we cannot afford not to exploit this potential if we are serious in our aim to decarbonize. There are built examples in Scandinavia, and we will see small initial island solutions in Frankfurt in next few years hopefully. However, for tapping into the full potential a common effort of governments, investors, energy providers, and the data center

industry, but also building owners, is required, because we are talking about a long-term program and massive investments to create such infrastructures. All parties have expressed their basic interest, but so far it lacks a reliable legal, political, and economic framework—in short, the regulation to enable such investments and to align the different parties.

NM Of course, the future is not readily discernible. It has no shape, while architecturally it seems to take the form, primarily, of gigantic boxes: the ones occupied by huge delivery warehouses and data centers. What exactly goes on inside of these boxes anyway?

KS From the outside we can just see the envelopes that house the vital nodes, the "powerhouses" of our digital infrastructure where data gets processed, calculated, and stored. Behind the façade are large halls full of computers and electronic storage, as well as the serving technical infrastructure, which is mainly cooling, power, and fiber, but also spaces for those people who supervise, control, maintain, and optimize this infrastructure day by day.

NM What is it about the task of building server farms that appeals to designers?

KS Purpose. For us architects and engineers, getting involved in the creation of something so fundamental and so useful is a source of great satisfaction. A hundred years ago, the creators of the large railway stations must have felt the same.
But there is also the contrast between the very manifest building and the technology inside that I can see, touch, and grasp, and the entirely invisible processing of virtual data that takes place at the speed of light within the server. At the latest with quantum computing, things have become genuinely fascinating.
The buildings themselves have a large impact on the surroundings already by virtue of their dimensions, especially when located in an urban context. At the same time, they are fairly introverted buildings, accessible only to that small number of people that is required to maintain the servers and infrastructure inside, but not accessible to the public. It is challenging to create a building that is mediating between the needs of machines inside and the citizens living around it, but that's why we became designers.

NM Something no one had expected occurred recently when a fire broke out at a data center on the Rhine: the data was destroyed, since the customers had not allowed it to be mirrored. How reliable are server farms? Is it possible for the cloud to simply dissolve into thin air?

KS Absolutely essential when planning "mission critical" infrastructures such as data centers, air traffic control centers, nuclear power stations, and so forth, is to design them to be fault tolerant, to avoid "single points of failure" or SPOF. This means that a single faulty component or event must not cause the system to fail as a whole. We have good guidelines designed for this purpose, and there are certification systems meant to ensure reliability while safeguarding against failure.
A good friend, who had central responsibility for engineering on the customer side all over Europe, told me once that, for all of the statistics to be accurate on which the tabulation of the reliability of critical facilities was based, he would have to be older than 100,000 years. Twenty years later, I would have to agree. Although none of my data centers have ever needed to go offline, I've seen nearly every individual system and component fail, often for reasons we could never have predicted, such as faulty software updates or material defects in equipment that were never detected, despite meticulous testing. As an engineer, I had to learn to question the robustness of design. In our aim to optimize, we often tend to add complexity, when in fact good technical solutions are robust and simple. Depending on the criticality of the digital infrastructure for their clients, the industry has defined different tier levels for fault tolerance. Truly essential data is processed and stored in diverse locations. We won't lose "the cloud" because of a single data center going off.

NM There was a time when it was primarily the government that built computer centers, for example in Darmstadt, and celebrated them proudly as places of the future. When and why was the entire digital issue delegated to the private sector?

KS From the nineteen-fifties to the -seventies, the "future" had positive connotations. That seems harder today where—with climate change, pandemics, polluted seas, the destruction of life and nature, increasing political escalations and military conflicts, and the foreseeable end of essential natural resources no longer being science fiction but reality—society seems to yearn for a fictive past,

one that never really existed. And maybe that's one of the big attractions of *cyberspace* and *metaverse*.
The opportunity to create a better future does exist, but only when we finally begin doing something about it. With today's knowledge and skills, we are able to decelerate climate change and to generate greater overall wealth for all by transitioning from a consumer economy to a user economy, from a linear create-to-consume-and-waste approach toward a circularity of creating for use and recreating for reuse. To be clear, that's not just an option but a necessity if we don't want to mess up the planet. However, it requires a reorientation toward social values and a will to shape the future as a society. For too long we have surrendered the future solely to the private sector.
The possibilities of expanding digitalization were soon joined by an awareness of its enormous potential. During the nineteen-nineties, sufficient vision, creativity, and investment confidence were found in the private sector. Just when traditional markets and service options started to disappear, a completely new market emerged. We speak of the Internet as the initiator of a Fourth Industrial Revolution: in the near future, following upon the invention of the steam engine, mass production, and automatization, we will see machines, devices, and sensors communicating with one another digitally and processing directly without humans needed.

NM Constructed beginning in the nineteen-eighties and -nineties were data centers that were essentially invisible and practically oriented—which remains the case today, with few exceptions. How did this renunciation of architecture and visibility come about?

KS Data centers are meant to host computers. Their users and operators have a legitimate interest in protecting their own production resources, their own technologies, and their own data. Which is why most computer centers take the form of introverted industrial buildings. In this regard, they resemble other production facilities, research institutes, and banks, but also many other public sector areas which strictly regulate access and exclude the public, which is also perceptible in their architectural language. Today, productive labor often takes place out of sight, and so much is now virtual, literally intangible, and in many cases only very few people are involved. How many people today understand what a business administrator actually does, or an administrative director, or a media consultant? Do we know where and how our food is produced? Or

how a laptop is manufactured? How many children can tell what their parents do at work?
That said, I like to think of industrial buildings that communicate their purpose by design, especially in an urban context.

NM Could computer centers become places that no longer stand anonymously at the edge of cities, and instead become centers for new urban districts?

KS In the future, alongside the large computer centers, which are best situated along the urban periphery, there will be smaller edge data centers, having perhaps the dimensions of shipping containers, which might be distributed throughout city centers, and which could pre-filter and prepare the greater part of locally occurring data before it is sent on to larger computer centers for processing. In order to harvest the waste heat from such data centers, the idea suggests itself to situate functions around them that can exploit this heat as directly as possible: apartment and office buildings, shops, sports facilities, and swimming pools, as well as vertical farms and greenhouses that can produce food locally in an ecofriendly way. The list could go on and on.

NM Are there data centers that you consider of outstanding quality?

KS Fortunately, there are a number of remarkable buildings, the most exciting being conversions. The MareNostrum in Barcelona is a church only from the outside, whereas within, it's a kind of cathedral of data processing that houses the Barcelona Supercomputing Center. A very similar example is the Salem Chapel in Leeds in Great Britain, which has been converted into a conference center, with the server farm below visible through the glass floor . . .

NM . . . which now resembles a temple of a new deity, the all-knowing Internet.

KS And there are other examples as well, of course. The Plonen, an old nuclear shelter below Stockholm, was spectacularly converted. There are also good new buildings such as the Amsterdam Data Tower, built by AGS Architects. Schneider+Schumachher are currently building a high-rise data center in China. Architecturally restrained,

but nonetheless remarkable, is the former Citigroup Rechenzentrum in Frankfurt designed by Arup, which at the time it was built defined a new milestone in the sustainability of data centers that still exceeds most of today's new facilities.

NM According to a website listing the world's top data centers, the seven largest worldwide are found in China. Has Europe missed the boat? Are we on our way to becoming a digital colony with enormous digital profits being diverted to China or Silicon Valley? Or do you see an opportunity for a third European way, a path toward a data-based "big democracy"? European digital giants who could compete with Google, Amazon, and Facebook? State-owned data centers?

KS More important than the physical location of the servers is the question: Who owns the data? Who has access to it? Who is permitted to, who is capable of making something out of it, and how can this proceed with the greatest social benefit?

NM Those in charge of data protection warn us that access to the data of the population—which is located in server farms—undermines democracy.

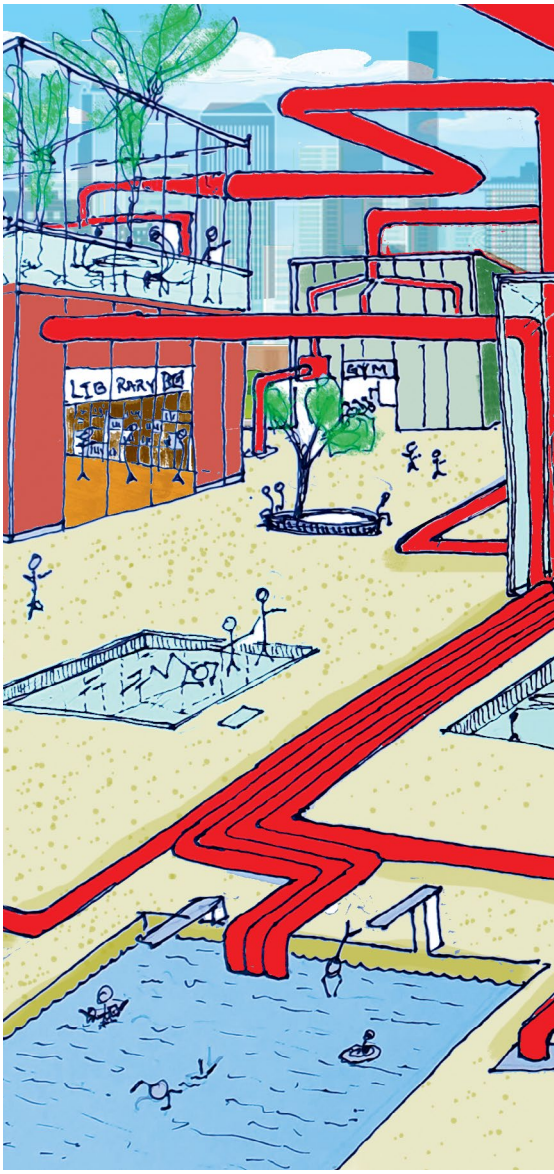
KS Currently, I see two dominant models: our clueless liberalism, which has led to market dominance by a few technology giants and which is now being allowed to progress even further, and an attempt at total state control, which we see in China and a number of other less democratic countries. We should find both extremely disturbing. Maybe if data would become an open source that can be accessed and processed freely by everyone we might gain transparency and control back?
Ultimately, data means control, influence, and power. Every five years, we elect our representatives. But how do we vote for the people who own our data, and who can ultimately control us? At this point, an emphatic book recommendation: whoever can still laugh while reading Marc-Uwe Kling's *QualityLand* has failed to comprehend the fact that this is no longer science fiction. An absolute must-read! Acquiring information is always a good beginning.

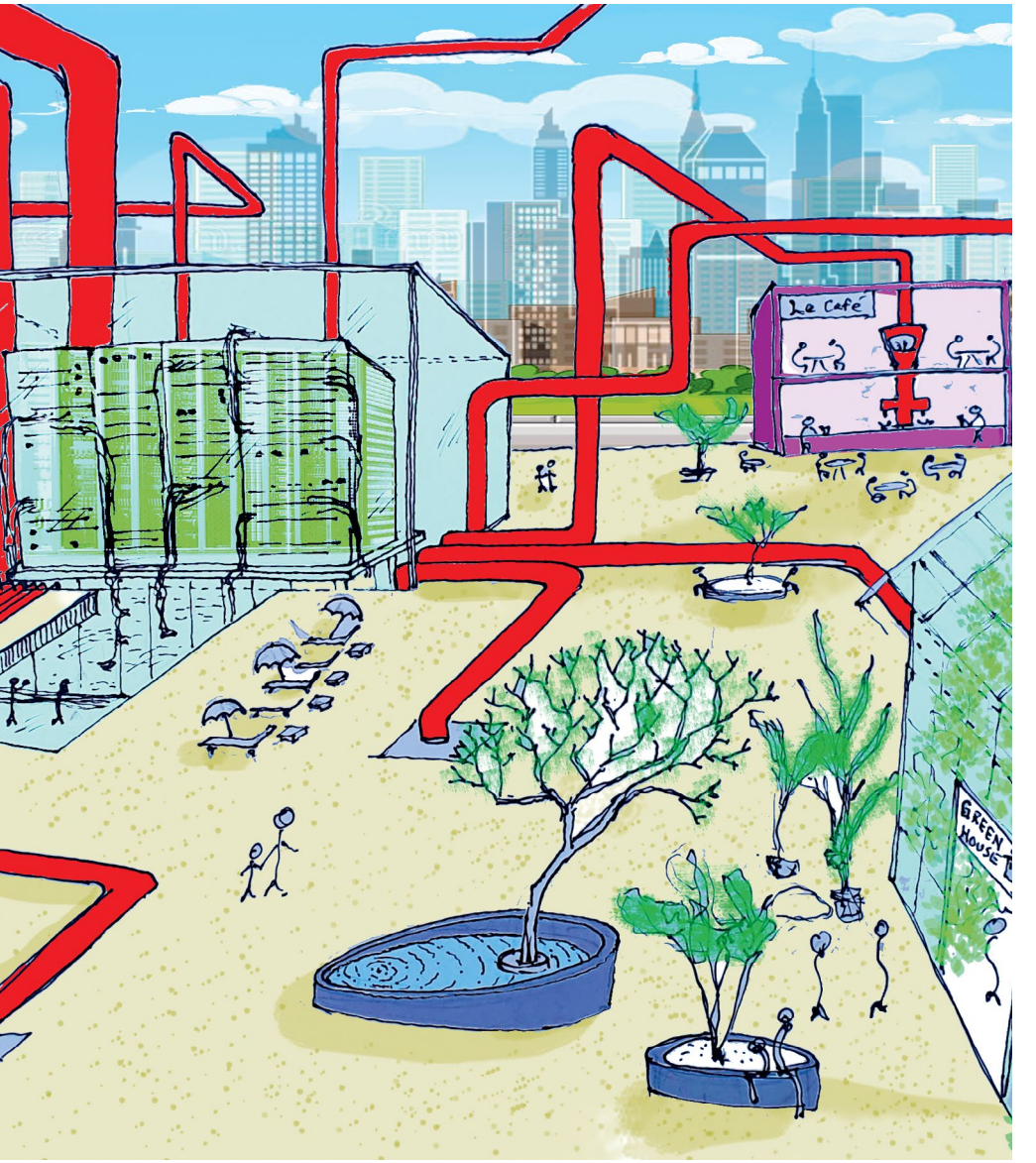
Designs by the Students of the Städelschule in Frankfurt am Main

Hormazd Vakharia
SERVER //{AS A}; FARM

The current trend of having large, centralized data centers on the literal edges of the world is a very convenient way to sweep our mess under the rug, and hope it gets forgotten. Instead, we would propose to decentralize data factories and bring them right here to our city centers—not as a monument, but rather integrated into the very fabric of our society. Let the people see with their own eyes what the back end of their endless hours of screen-grabbing actually looks like! . . . Let them experience firsthand the beeping sounds and flashing lights of what being "online" actually implies. Let them feel the warmth of their personal data as it heats the very room they stand in. Let them feel and taste this heat on their lips as they sip their coffee . . . now perfectly roasted and brewed by their last Google search . . .

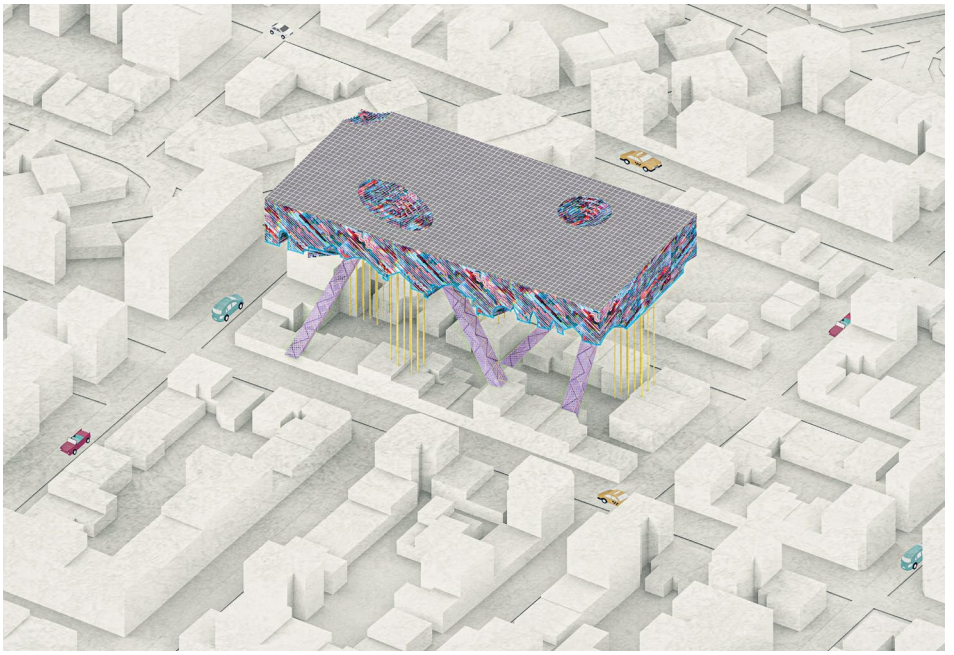
This proposal aims to create a community center that uses, and reuses, energy from the vast heat-exchanger systems of a public data center. The majority of the server farm could be built as a subterranean structure. Multiple "windows" cut into the ground would offer visitors a sneak view into the mysterious world of flashing lights beneath their feet . . . Large red pipes would radiate out into all the different zones of the institute. These pipes could supply the heating. The institute would also house a public library, its heating supplied by the data farm beneath it, a coffee shop or a little bistro, where one of the big red pipes would burst in through the roof and then branch out into smaller "root-like" pipes, a few going directly into a large articulated coffee machine behind the counter, some to the very visibly placed pizza oven, and a big one to a community pool: the dip in a fully heated swimming pool would be a by-product of our chatting, streaming, texting, and liking. On the other side, a gym would use people's activity, for instance on fitness bikes, to produce energy and reduce the impact of human energy consumption . . .




Le Café
GREEN HOUSE

Aayush Bhaskar /
Stuti Maaheshmati Mohapatra
From “Ville Spatiale” to “Ville Digitale”

Most server farms remain obscure and virtually invisible to the common public. This proposal is a counter-proposal to the ideology of the “invisible cloud” where all the public data exchange happens. It represents the cloud almost literally as a tin box hovering over our current city. The tin box has indents and cuts reminiscent of the structures of our governance of the past, brazenly bringing politics and digital culture into an open state of tension. The cloud-like tin box presents the political infrastructure as voids, showing their negligible presence and reducing their prominence in the urbanscape both physically and psychologically. It gives way to digital infrastructure as a more prominent structure for both cultural promotion and governance. Although the tin box, as the infrastructure demands, still remains highly secure, hermetically sealed with an almost opaque façade, it is penetrated by oblique tubes which take the public from the urban landscape through the tin box to the roof where people enjoy a new public garden. Views into the sealed box will make people aware of the public treasure which consists of their collectively produced data, inducing a broader discourse on data ownership, while displaying also, in the heart of the city, a new form of superimposed Ville Spatiale, a new public space hovering over the streets, showing the possibilities and the potential of digitalization for new forms of broad public wealth, joy, and spaces of togetherness.




NEW GROUND
SERVER ZONE
MONUMENTS OF PAST

Uma Nerea Kim Gomez
Otium for the Masses

Growing up with the sea means there constantly is the illusion of a visual limit when the sea meets the sky. Does the Internet have a limit? Is it invisible? What physical space does the Internet occupy?

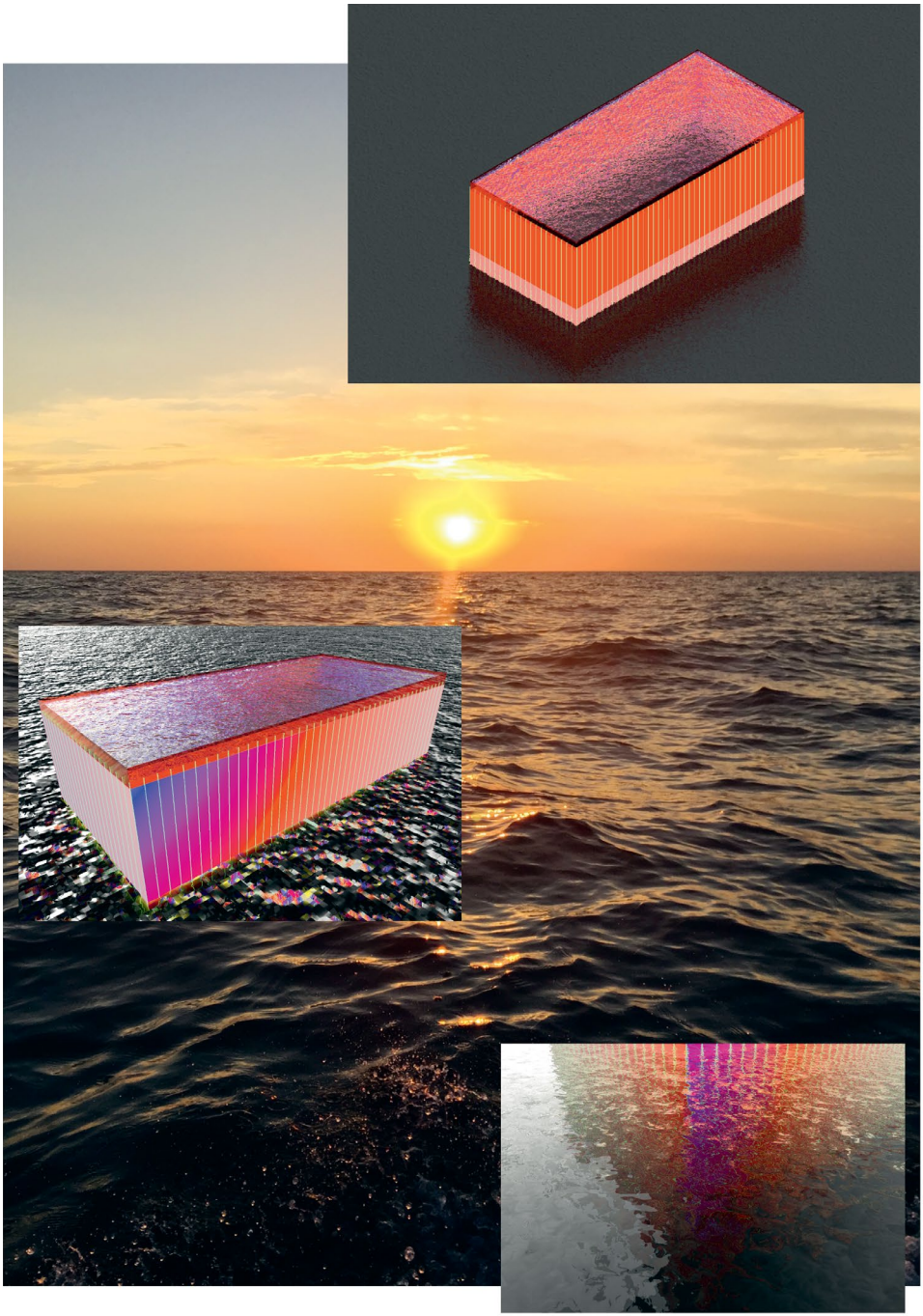
To me it is an "invisible" vast island surrounded by the infinity of an ocean.

This is a server farm that floats in the sea.

The energy of the server farm would be used to heat a giant ocean water pool, to imitate the behavior of the ocean on a fine summer's day all year long: the subtle currents, the ever so slight movement of the water, the warm temperature—an ideal sea in the middle of the sea.

Roman thermal baths served a social and political function; they were ideal for conversation, building social relations, for recreation and "otium."

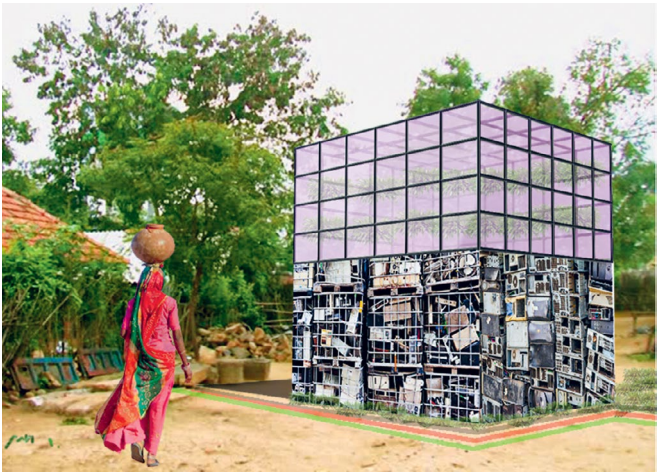
The server island, with its giant, infinite infinity pool, will be the new Roman term.



Shivam Chaudhary
The Rural Micro-Server Farm

When we talk about server farms, we mostly talk about buildings in the Western, industrialized world, about a privately owned typology that gives big firms the opportunity to expand their business. We talk less about those parts of the world that have to pay the bill for this form of Western digitalization. Countries like Ghana, Nigeria, and Thailand not only suffer from global warming, which is aggravated by the apocalyptic energy consumption of server farms and crypto-currencies; they also have to deal with Western countries dumping thousands of tons of their e-waste every year, and the amount of toxic waste will not shrink with the growth of the market for digital tools.

Does a server farm need new materials to be built—or can we use upcycled e-waste for the construction or insulation? A server farm is basically an accumulation of many central processing units. Could the façade be insulated with recycled material from disassembled old computer cabinets? The e-waste could serve as an envelope—and as an image, an all-over mural that makes the scale of digitalization's effect on our daily lives, and on nature, visible and almost viscerally graspable. If the Global South, while only profiting in part from global digitalization, suffers heavily from the related climate-change-inducing, apocalyptic energy consumption and waste disposal, also the countryside becomes a contested territory: server farms are growing bigger and bigger, occupying huge chunks of land. To save money, big companies are buying up rural land that had been, or could be, used for subsistence agriculture, aggravating the situation of small-scale farmers.



Do data centers have to be giant boxes run by big companies—or could edge computing help to decentralize and distribute small-scale data centers more equally over the country? Could a village have its own small-scale server farm and use the heat locally to heat (or cool, depending on the climatic zone it is built in) a greenhouse, a village center, or a pool? Many tech companies buy land that is fertile, and could be used for other purposes, to build a server farm as big as a village: Why don't we distribute the server farm itself over the villages instead?

In countries like India, where people are migrating from rural to urban areas to find work, this redistribution of decentralized data could be beneficial in terms of job opportunities; the combination of small server farms and greenhouses could be a game changer for these people and create a new microeconomy.

Aline Rainer
Digital Footprint App

I am dreaming of an app that calculates and informs me, in real time, how much money is made from collecting my data, every single time I press the "accept all" button.

There should be an automatic notification saying: "*Ding-dong*—this is how much money your behavior just cost you, and your government, because you accepted all cookies" or "this is how much money you could have made by not selling your data."

Data generated by citizens should be available for communal use—with necessary privacy protections. "Reclaiming control over one's data means that we can use it to create digital commons that then will enable new cooperative platforms" (Francesca Bria).

Before that, we have to raise awareness for what is at stake. People freak out when they see petrol prices rising at the gas station. But they don't see the price of giving away your data. We should be able to see the price tag of our behavior—and the invisible attacks on our informational self-determination that are the consequence. Giving away data does not hurt you the moment you do it; it is rewarded with fast information. The pain will come much later.

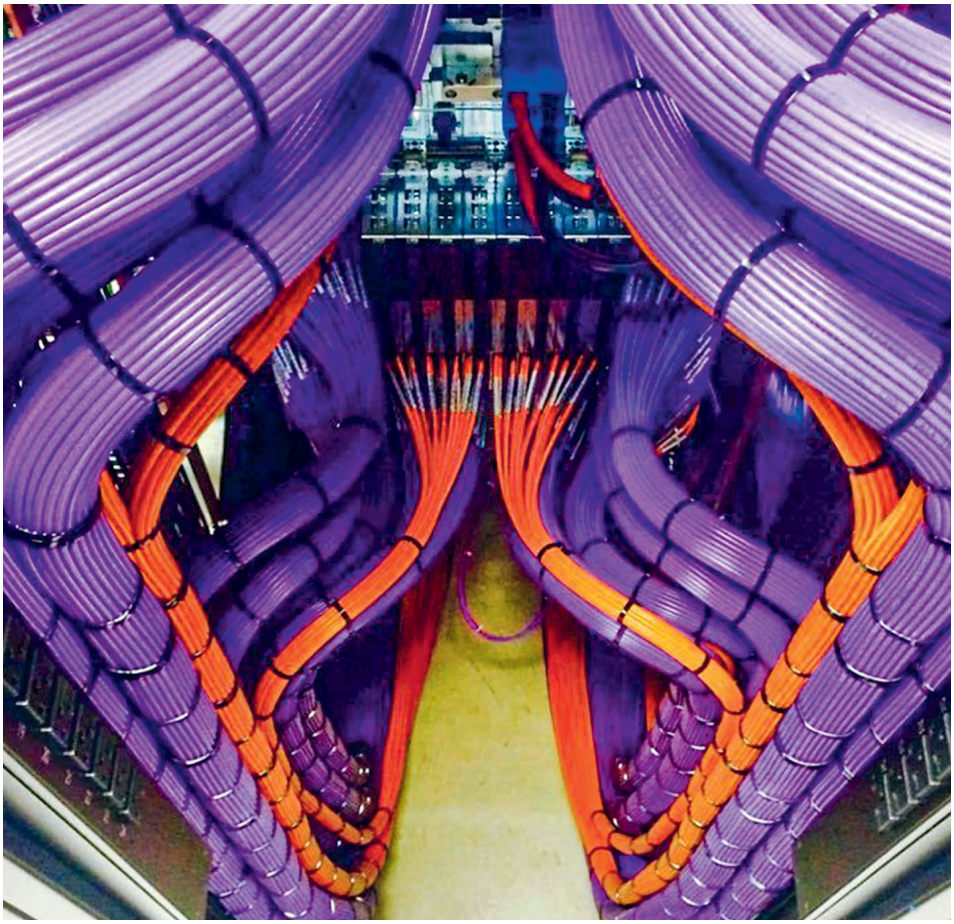
This app will tell you every time you push the "accept all" button—or the "refuse all" button—what costs you just caused for society, the possibilities of democratic governance, and for yourself. Yes—this app should make you feel self-conscious. But to not only emphasize the negative side, you would also get credit for not accepting cookies. In this case, the app shows you how many contracts you did not implicitly sign, and calculates the amount of money you saved for yourself, and society: "Congratulations, you saved . . . €$¥ today!!"

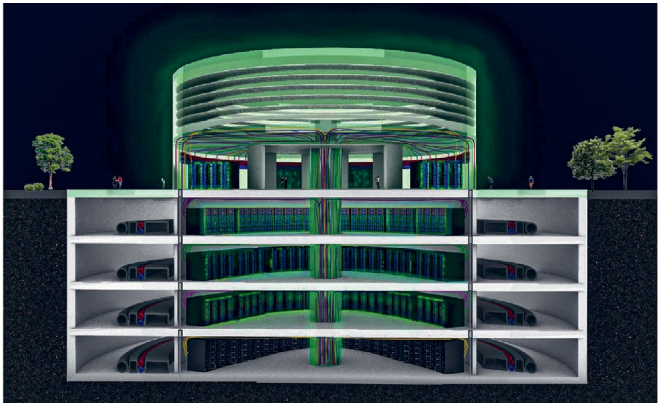
Golnaz Khosrawani
A House for the History of
Storing Knowledge

So far, data centers have been strategically located far from population centers, where access to cheap real estate and energy has been the main concern. This has created a distance between data users and data storage, both geographically and conceptually. Data centers are strangers to the very people who use them every day. Bringing the physical data servers close to their users is a necessary first step, opening the doors to public discussion on data ownership, data security, and privacy.

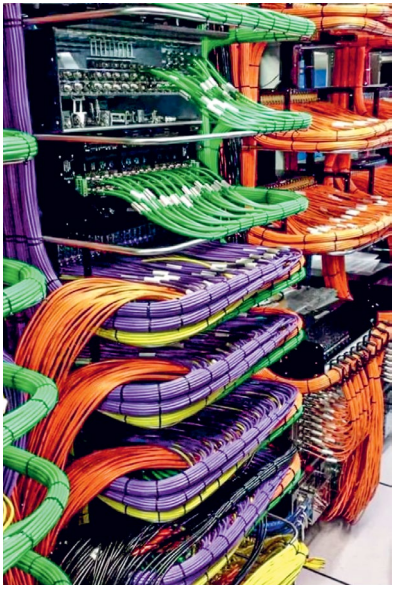
This project includes a public library and a small data center, and therefore would connect the history of data storage on paper to the world of contemporary data storage. Underneath this data library, a multistory underground structure is to be found. In the central void of both levels, we can house rooms for official meetings as well as public conversation and gathering. The attending public would be surrounded by networks and data, from the beginning of storing knowledge to the latest technological achievements.

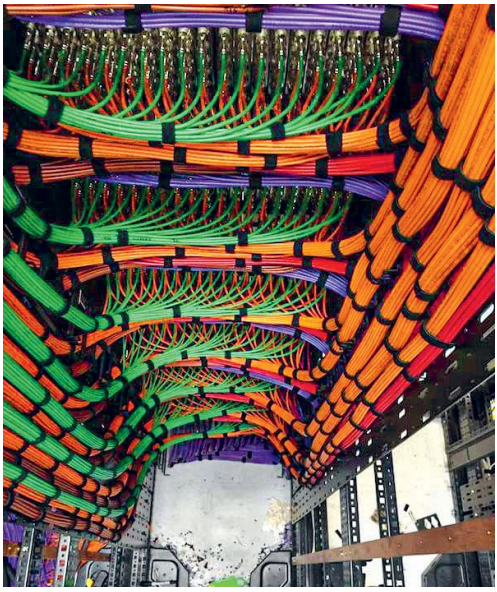
The top level that peaks overground and is visible to the public houses the latest technical equipment, the newest servers





that have been added to the center. As the technical equipment gets outdated, it will be taken down to a subterranean museum, making room for the installation of new equipment. Sinking old servers into the ground, the building's belly turns into a museum of technology, storing the recent history of data storage. A part of this collection will be the complicated, sophisticated, colorful cable networks; they not only have a specific ornamental and metaphorical value, but also bring to light the physical reality of what is mythologized as an eerie, airy form of weightless hyperconnectivity between humans and clouds.





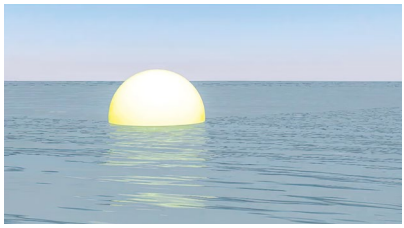
Raúl Lima
sphaerā publica

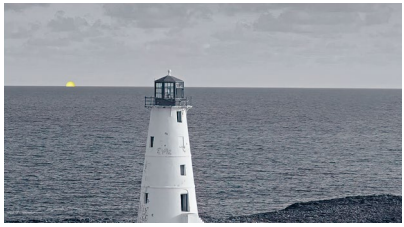
It is no small irony that screen devices, two-dimensional flat surfaces, have managed to provide its users with the largest experience of a non-Euclidean room within humankind's technological development. Our continuous interaction with these coplanar surfaces grants us access to a succession of infinite spaces that appear within their finite amount of pixels. In our pockets, on our wrists and desks, there are devices. As long as they are on and operative, our existence gets a chance to extend itself through a combination of tactile, haptic, and mechanical interactions at the reach of our hands and fingers. One can type, rotate, scroll, pinch, slide, and press in order to bring and generate, so far mainly on a visual level, as many virtual circumstances as the device is able to support and run.

The devices that grant us access to experiencing non-Euclidean geometries have been engineered in such a way that their portability has been improved by unimaginable amounts as compared with their predecessors. This tendency toward portability, a de facto overly accepted protocol by the digital industries and their manufacturers, means not that the physical burden accompanying our devices has disappeared, nor that virtuality has become as weightless as light. But it means that it has been outsourced to vast places of storage and processing of data, namely, server farms and data centers. We're glimpsing an era of formerly unattainable geometries and architectures derived of those geometries. Nowadays we can tell things and experiences through descriptive models that, even if they've been present for a while,[1] were not being used for referring to this newly created extension of the world; not only is there this aforementioned possibility to represent the world, but there is the fact that this world has been built upon nebulous allegories that dew, condensate, and deliquesce around a continuously expanding finite omnipresence of the Internet. And at the same time, it can all be clearly located to geographic coordinates, into server towers and their storage units, which are no metaphor but the embodiment of all the data consumed that passes through our handy devices. Without servers, the Internet as we've made it nowadays wouldn't work. Virtually any human activity makes use of it.[2] It is hence of utter importance to be aware of everything related to the functioning of these server farms, the repositories of the largest expansion of the human world ever to date. And because it is precisely in the servers where our world is housed, it is crucial to figure out who can make use of them, where they are located, and who owns them. This is not a demand to certify their authenticity or their authorship, but it's more a task of gaining a user's consciousness about the implications of dwelling in places currently owned by corporations, and of how to gain control over the transmission of data that occurs whenever we make use of these online architectures. Since we're dwelling online, the intention hereby is to figure out how to exert one's own voice in the geometries—in the polis—that arise there.

Initiatives such as data commons, peer-to-peer and blockchain networks, are platforms that just through their internal functioning are quite capable of opposing the structural organization of privately owned servers and data centers. More often than not, the location of privately owned data centers is kept secret as places cumbersome to access for an average citizen. Their invisibility, or at least their lack of notoriousness within the urban tissue, is not an urge for their operation but the implementation of a politics of lack of transparency when it comes to any physical presence of the digital extension of ourselves, namely, the data we use, consume, and generate every day. If an alternative model for how the repositories of human online allotment and activitiy were to be conceived, then it is out of my speculation to make it into a visible object that, as one does on the Internet, wanders from place to place.

The idea of making the sphere an artifact from a public realm is to let the servers mirror the dispersion we encounter when browsing the online world, to let them as objects roam around as we do within the protocols and geometries of the Internet. A sphere, a shape commonly understood as a three-dimensional object, is in fact defined in mathematics as a two-dimensional surface enclosing a three-dimensional Euclidean space.[3] The ambiguity this may represent is not only a convenient spatial starting point for this speculative proposal, but it grants the idea of a roaming server farm a status of surface (of the non-Euclidean type) to the place where all the data that gets displayed on our screens resides. When regarded as an object, these spheres would be seamless, transparent entities completely subject to all the Earth's physical conditions. Their density would be that of the Internet, that of the Internet that each of them would be capable of carrying in it. A hardware configuration yet to be defined would provide that which a data center can provide, though on a smaller scale, to any Internet users near these objects. Because their physical properties vary according to the data they can carry, these spheres may or may not pose trouble for the rest of the infrastructure where they would be in use. Their 30 meters in diameter, as well as their hardware, would be standardized and constant, but their content would be as manifold as the information it would accommodate. This counter-model for a server farm is smaller in volume than Étienne-Louis Boullée's cenotaph for Sir Isaac Newton, but its manifold iterations and continuous presence in whichever places demand data transmissions ought to make it an alternative artifact and working monument of sorts, granting clear visibility to the data we use, produce, and consume every day.

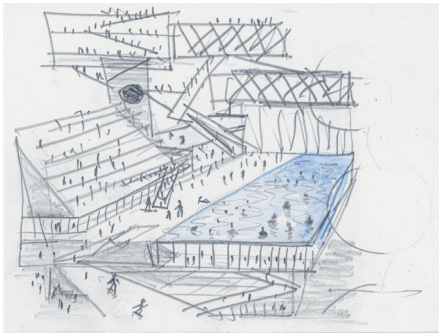


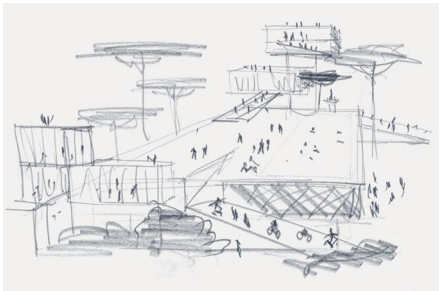


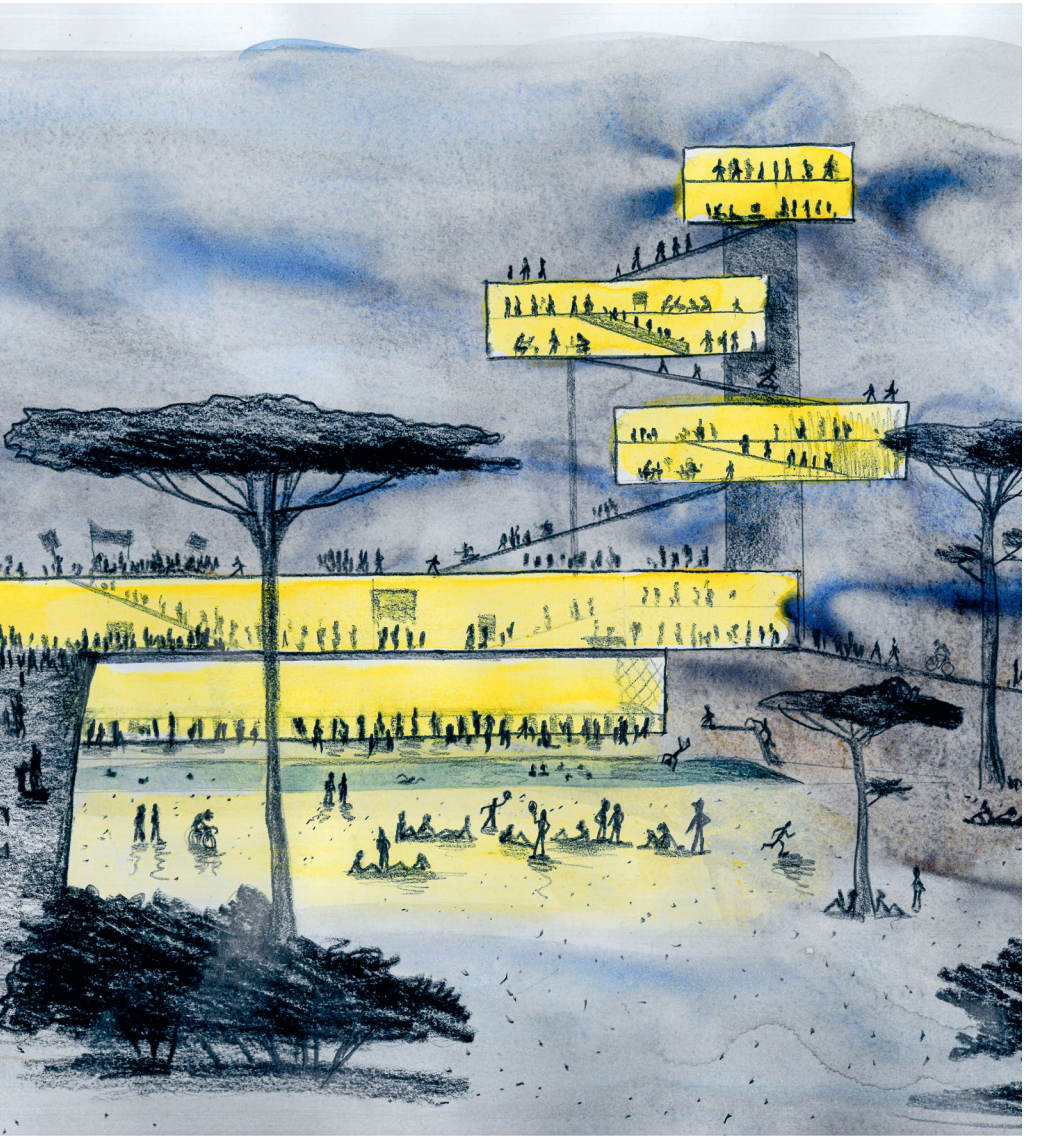
1 Non-Euclidean geometry was discovered and institutionalized in the nineteenth century by mathematicians such as Carl Friedrich Gauß and Bernhard Riemann: https://en.wikipedia.org/wiki/Non-Euclidean_geometry.
2 If you know of human activities that are not indexed online, please do share that information with me.
3 A ball is the solid figure bound by a sphere: https://en.wikipedia.org/wiki/Sphere.

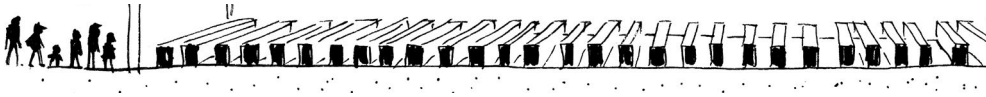
A Collective Proposal
Toward a Public Server Farm

Many data centers are places where thermal energy is wasted, and profits from collectively generated data are privatized. Could the space of the server farm be reclaimed in several ways? If the heat of data storage and analysis would be used to fuel public amenities such as theaters, swimming pools, museums, and research and educational institutions of the digital age—and if at the same time the profits made with the stored data were invested in the education and health systems: Could the server farm become a truly new typology of public space?





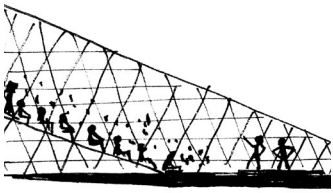




Could you combine a server farm with:

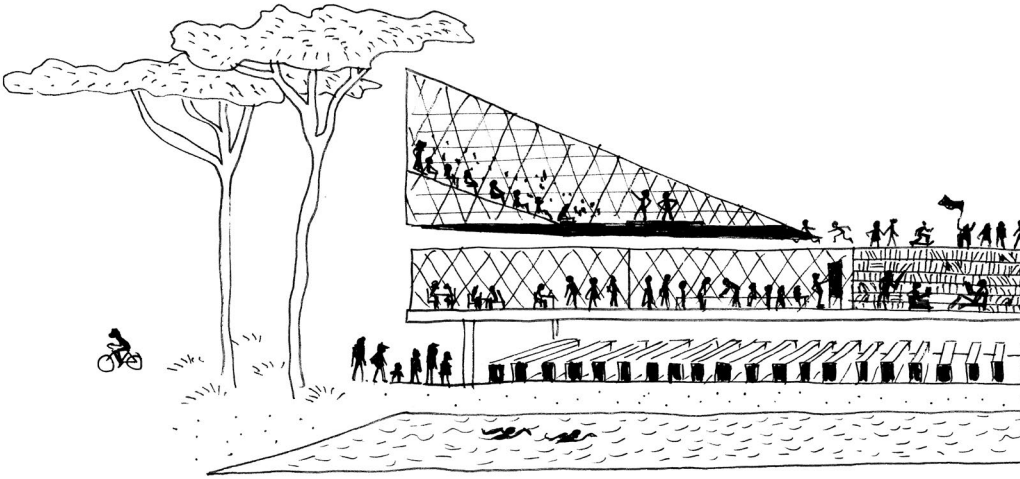
a public square

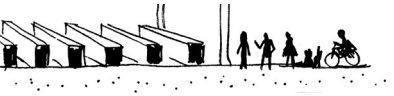
a local town hall

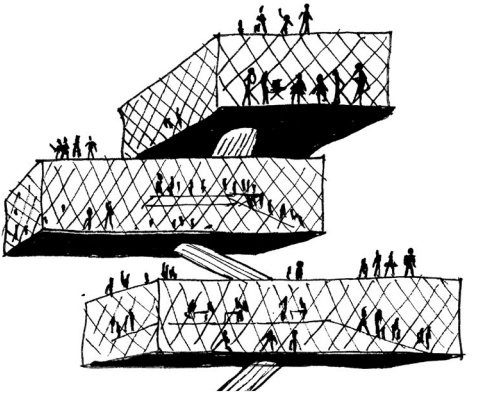


a theater stage

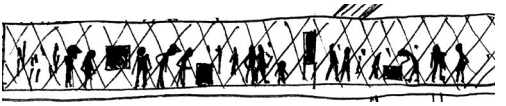
a library



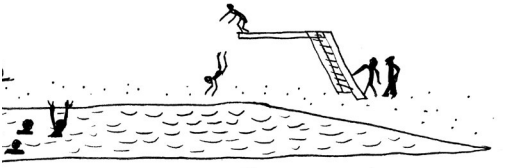




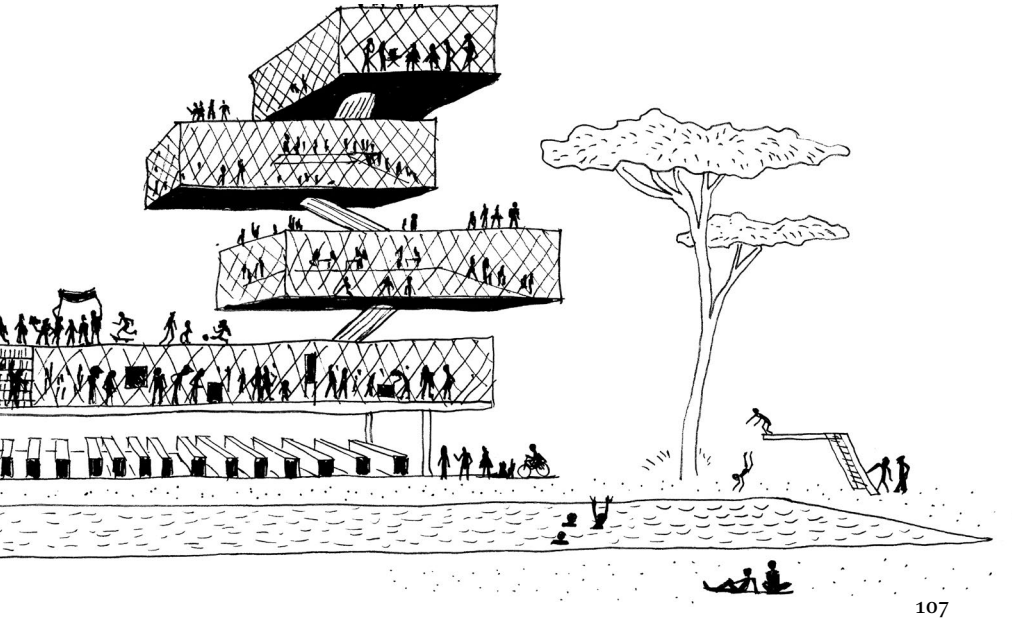
a research institute

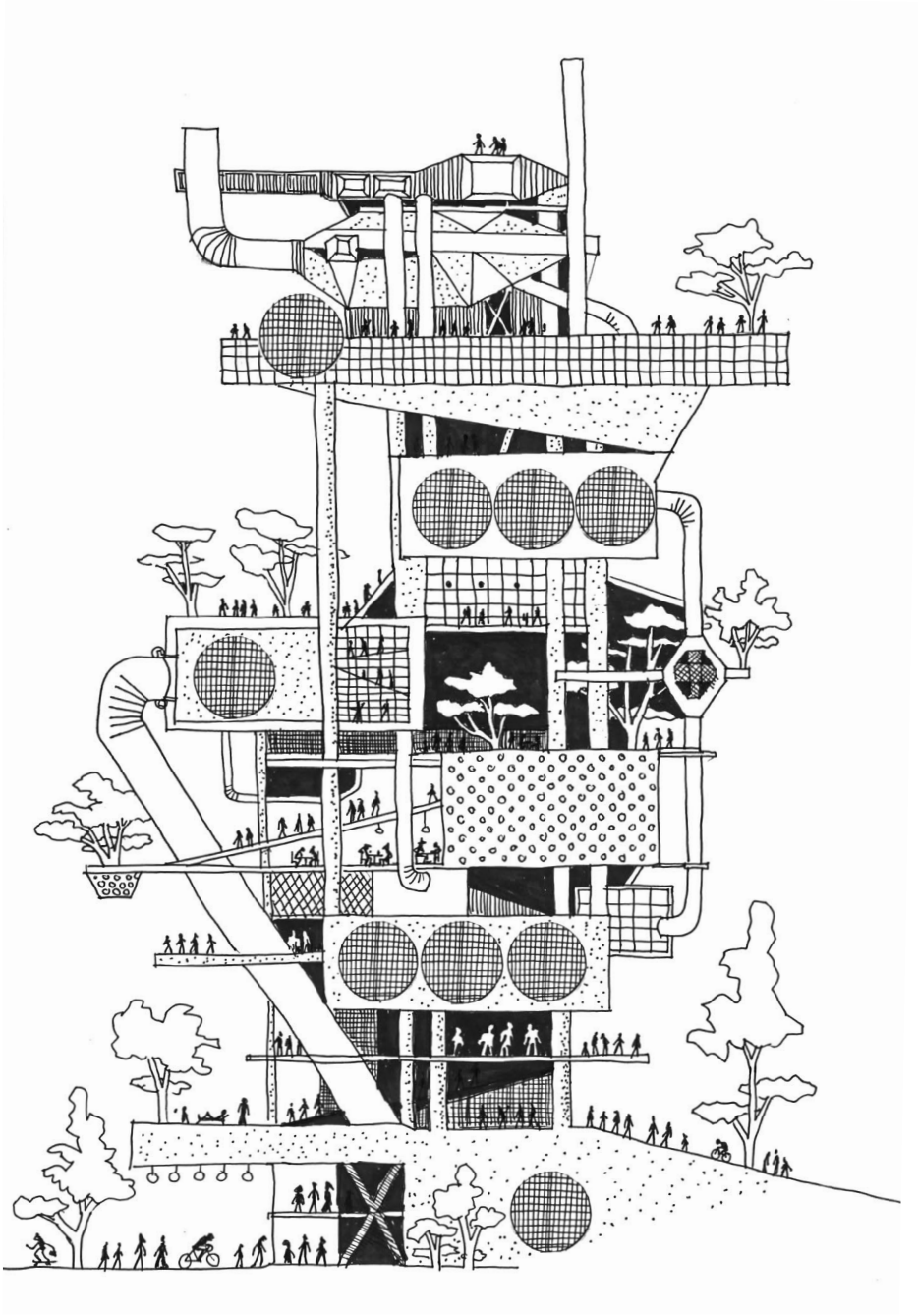


a museum

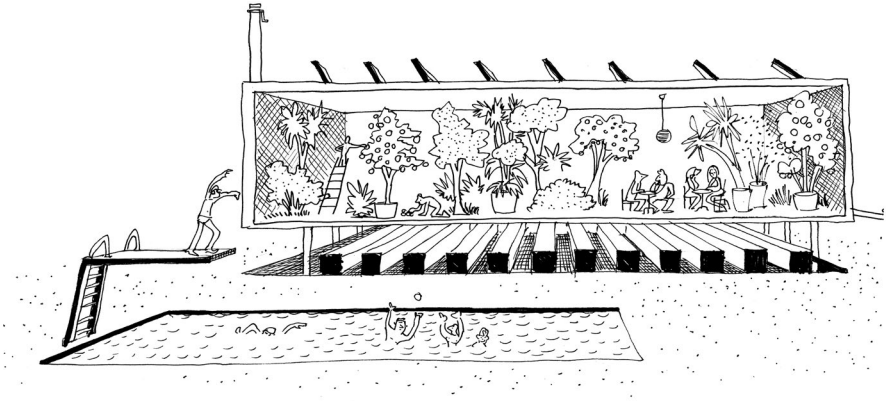


and a public pool?

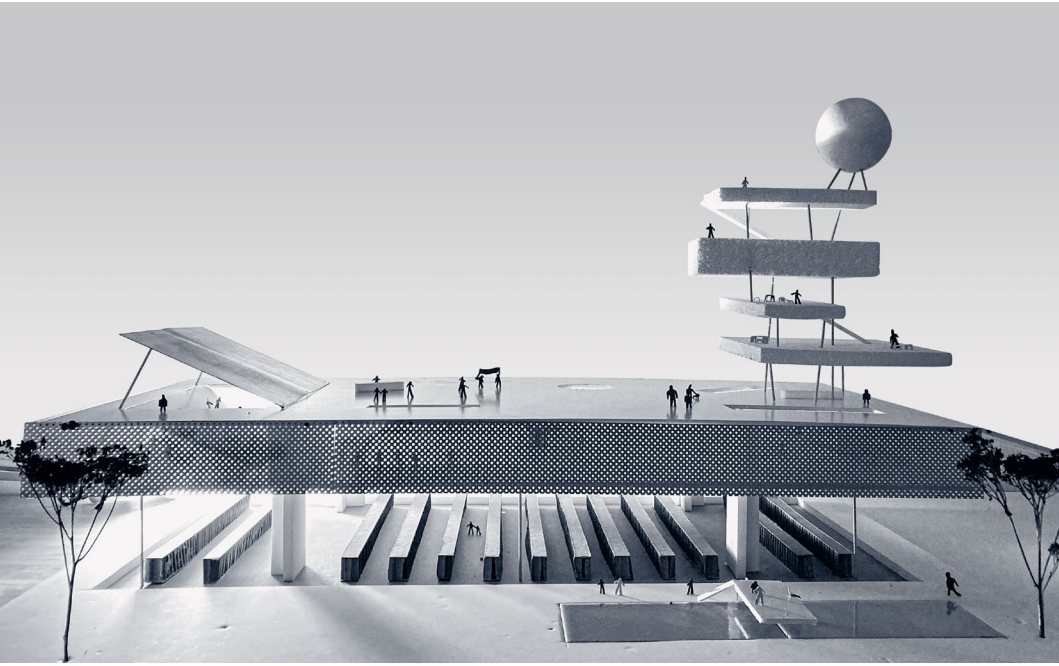


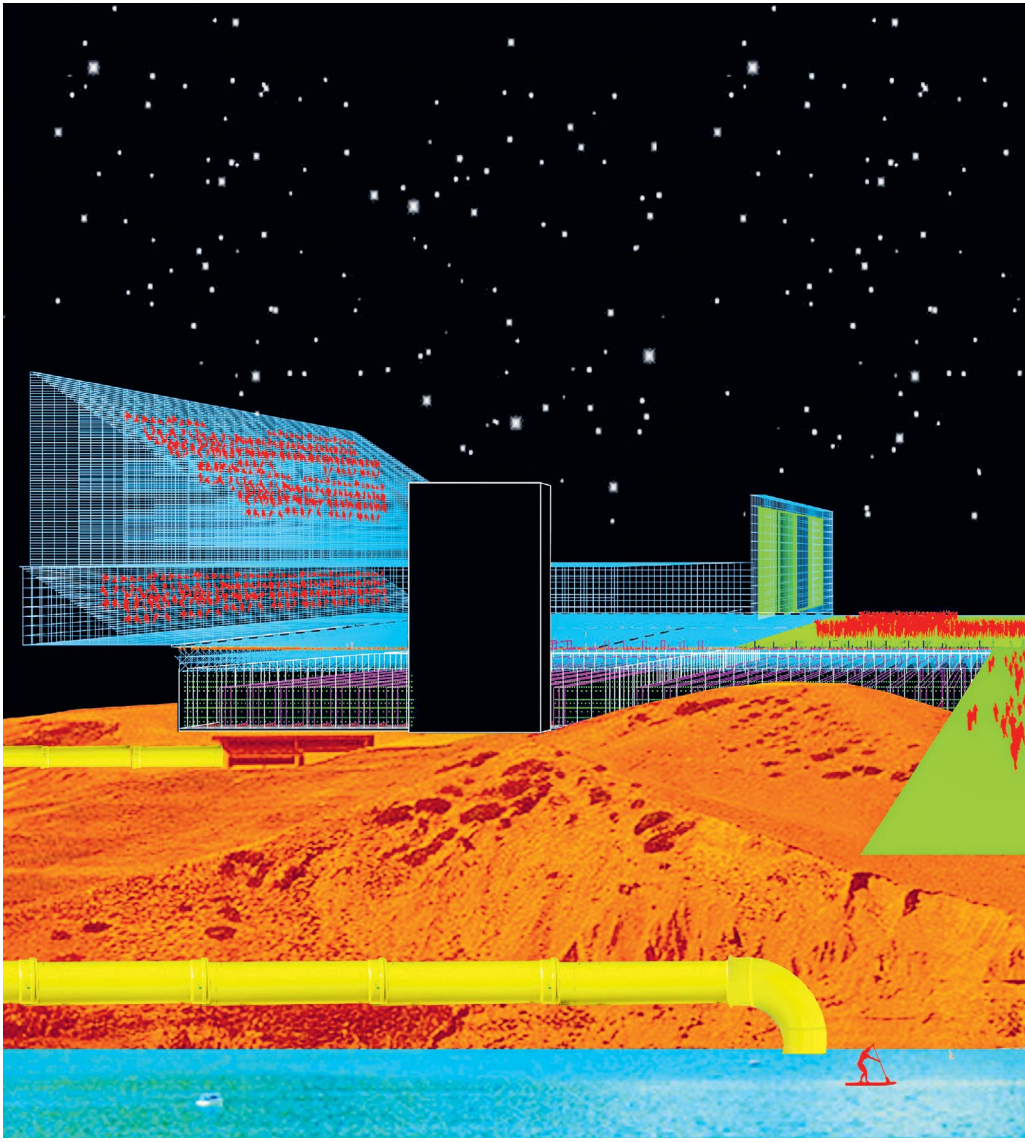


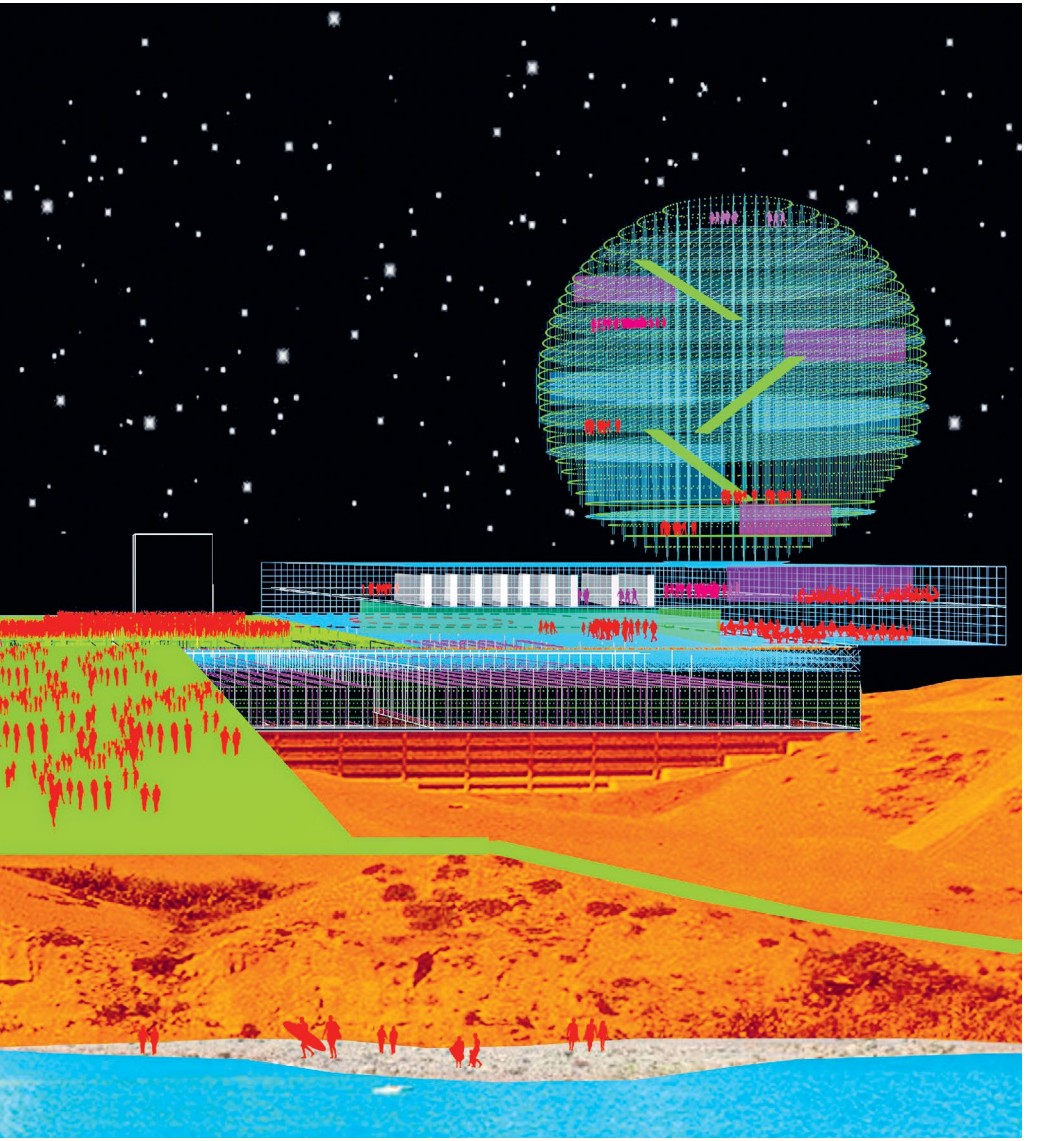
The public server farm with its various uses could also move into an existing former office building.



Even a decentralized, much smaller local data center in the countryside can become a public place.







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