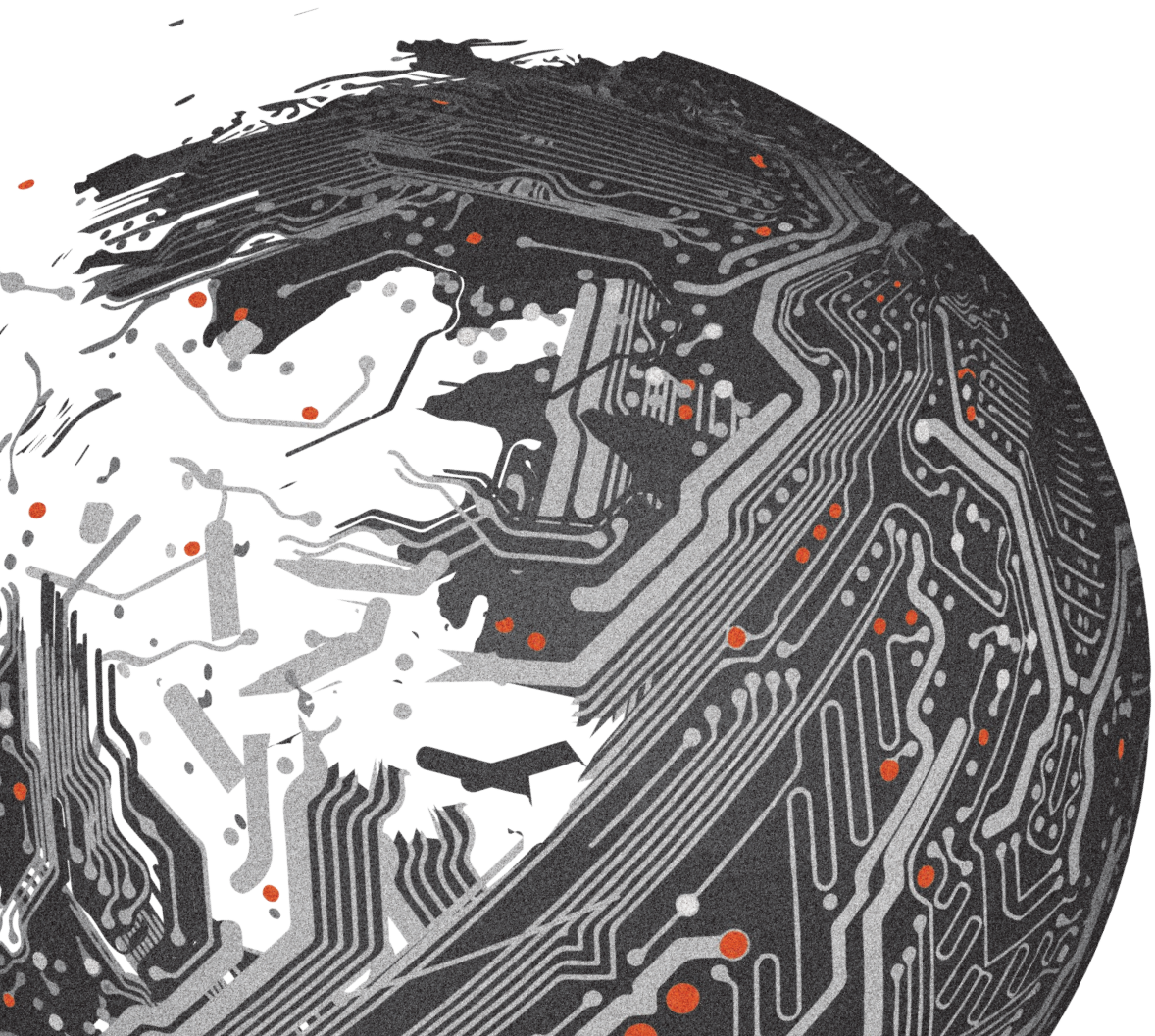
INFRAGRAPHY

VOL III SPRING 2020



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INTRODUCTION

Samir Bhowmik

The world moved online in 2020. The global spread of the coronavirus COVID-19 with the resulting quarantine and lockdowns forced a significant portion of humanity to accept a virtual life. Global Internet traffic soared to over 30 percent in March and online transactions to over 42 percent in April. The internet has done well during the coronavirus pandemic. Its infrastructure has held up. It allowed a transition to remote work, learning, socializing and entertainment. Netflix, the video streaming service added more than 16 million new subscribers, and online shopping giant Amazon hired 100000 workers in March, and reported massive earnings. In between streaming and online shopping, the perfect combination of the so-called late capitalism, one thing remains unconsidered. At what cost? What is the impact of such rampant connectivity and consumerism to our society, to our environment? It is a big mistake to think we will be saving the environment by lockdowns, when all we have been doing for the past few months is streaming and shopping. Connectivity is material and resource-based, supported by a global infrastructure of data centers, power plants and submarine cables. The internet consumes energy. A whole lot of it. Global data centers recently consumed around 205 billion kWh. As the massive pressure on the 'Cloud' intensifies and energy use goes through the roof, we need to again re-consider how we design and implement such infrastructure, or change how we live.

This third volume of Infragraphy is short but rich in its range and contents addressing internet infrastructures. Boeun Kim's 'The Paradox of Online Society' attempts to unbox the hidden cost behind the digital transition by discussing how the quarantine affects the socially disadvantaged, the energy cost and air pollution, and the silver lining during the pandemic. Lassi Häkkinen's 'Vulnerability of Technology and Data in the Physical World' looks at physical world vulnerabilities of our information and data, and the impossibility to separate infrastructural materialities from the the digital. By illustration, Shambhavi Singh examines the 'Infrastructures of Isolation', and finally, Ameya Chikramane explores new approaches to the post-digital. All these critical student texts and artworks deal with the materialities of media technologies and their societal and environmental implications, as outcomes of the course 'Archaeology of Media Infrastructures' in the Spring of 2020 at the Department of Media, Aalto University.

Samir Bhowmik
25 May 2020
Helsinki

Yevgeniy Sverdlik, *Will the Coronavirus Break the Internet?* Datacenter Knowledge, 13 March 2020 <https://www.datacenterknowledge.com/uptime/will-coronavirus-break-internet-highly-unlikely-says-cloudflare>

Trefis Team, *Netflix Subscriber Growth 2x Expectations; Good News Or Peak?* Forbes, 28 April, 2020 <https://www.forbes.com/sites/greatspeculations/2020/04/28/netflix-subscriber-growth-2x-expectations-good-news-or-peak/#5d046ad53ea1>

Alina Seyukh, *Amazon To Hire 100,000 Workers To Meet 'Surge In Demand'*, NPR, 16 March 2020 <https://www.npr.org/2020/03/16/816704442/amazon-to-hire-100-000-workers-to-meet-surge-in-demand?t=1590396613400>

How Much Energy Do Data Centers Really Use? Energy & Innovation, 17 March 2020 <https://energyinnovation.org/2020/03/17/how-much-energy-do-data-centers-really-use/>

THE PARADOX OF ONLINE SOCIETY

Boeun Kim

There is a deadly virus out there that sickens or even kills people and there is no cure yet. This could be a possible beginning of science fiction in the dystopian world, but it's not the case. The COVID-19 is in the air and this has become our life now.

A virus outbreak that started in China has first moved to Asia and then to the rest of the world. What seemed like a cautionary tale to the West, now overwhelmed them and many authorities had to decide to make a transition to online and encourage "social distancing" as a new culture of human interaction. Public facilities such as schools, universities, libraries, concert halls, workplaces, and many more are shut down for the sake of public health. However, in the age of the internet, not everything is canceled and our life goes on—online. For example, my classes are now streaming online on zoom chat rooms instead of a room in a university building. Many people (at least those who can) are working remotely. Our social gatherings also moved online.

"According to the United Nations, school closures in 13 countries to contain the spread of Covid-19 are disrupting the education of 290 million students globally, "a figure without precedent." That has left millions of teachers, administrators, and students at the mercy of online learning, much of which is unfamiliar, and untested at such scale."

Figure 1. Video still image of "iSphere" project by Plastique Fantastique. "iSphere" is an open-source, retro-futuristic face shield shaped like a fishbowl to protect wearers against coronavirus. Source: https://plastique-fantastique.de/iSphere (2020)

said Anderson, a Senior Reporter at Quartz.[1]

The COVID-19 pandemic has immensely affected our daily lives in a one-eighty turn towards rapid integration to the digital society. This affected how many perceive reality to feel surreal. This change also affected our interaction and dependency on digital infrastructure as well as our daily life and culture.

Figure 2. A black box is a device, system or object that can be viewed in terms of its inputs and outputs, without any knowledge of its internal workings. Source: https://en.wikipedia.org/wiki/Black_box

This vital turn to digitization is breaking open the "black boxes"[2] of digital infrastructure in the time of the pandemic. In this paper, I attempt to unbox the hidden cost behind the digital transition by discussing how the quarantine affects the socially disadvantaged, the energy cost and air pollution, and the silver lining during the pandemic.

Quarantine for socially disadvantaged

Since everyone is quarantined, our daily lives turned to digital infrastructures. Being online has been a common practice for many in the 21st century layered with the physical material world. Now, digital ways are becoming the only way for safety.
South Korea has put off school openings and instead opted for online classes. While South Korea's high internet penetration rate (96%) and internet-usage rate(91.8%)[3] demonstrates it to be one of the

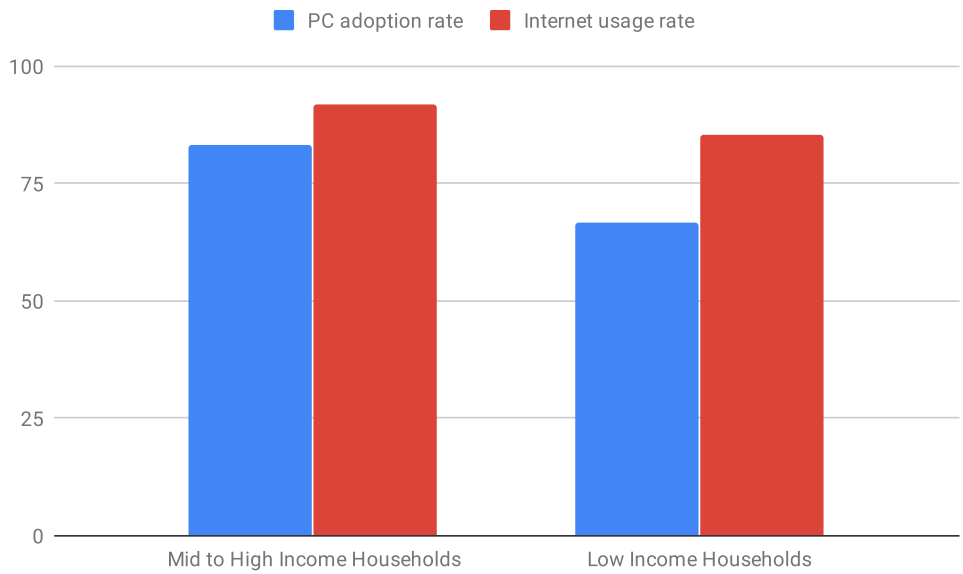

Figure 3. PC adoption rate and Internet usage rate in South Korea by income level 2019, © Source: Korean Statistical Information Service.

best-connected countries in the world, yet structural problems exist with the decision to go online. The primary reason being the inadequate PC adoption rate for low-income households that stands at 66.7% compared to 83.2% for average to high-income households.[4]

This brings challenges to students' education, thus calling for structural support to give access to a computer to the socially disadvantaged. South Korean PM Chung Sye-kyun "promised to ensure student's access to technology at home to minimize academic disruption."[5]
Not only is the adoption of PCs are important, but also access to the Internet. For those who do not own a PC, it is likely that they do not own the routers to access the Internet as well. According to KOSIS statistics on the Internet usage conditions report, most Koreans use the Internet either through 3G/LTE mobile networks, and not WiFi. As Dr. Bae Sang-hoon, pedagogy professor at Sungkyunkwan University says "for an online class to run smoothly, these three criteria must be met: right device, internet access, and quality contents." He further added the government should act more proactively to come up with a better solution to meet those said criteria instead of a bureaucratic approach. [6]

Technology often comes with a positive notion of progress and inclusivity. Ironically, the current drastic transition to digital infrastructure further excluded the socially disadvantaged. Before the crisis, not having a personal computer was a minor inconvenience or even a choice, but in this case, access to those technologies became a major hindrance to their access to education.

The hidden cost of the Internet

The other aspect of being constantly online is energy costs. Using a computer and the Internet daily consume energy from booting up a laptop to shutting down. With the increased amount of internet users

for public and professional life, the environmental cost also increases. My day begins with consuming energy. It starts with turning on the lights and getting my coffee machine started. Then I move to my desk to go to a class online. I communicate with my teachers, peers, and friends online on different social media channels. I go to work online, work on my computers, and send emails to my colleagues. When I'm done with school and work, I would play video games or watch something on Netflix. Not to mention many other activities on top of that consumes electricity—like using an electric stove for cooking. Now that work, education, and other infrastructures have moved online, the consumption of the internet is much higher—50% in some parts of the world.[7]

The surge in the internet population has demanded an infrastructural change in internet broadband. Internet services often get affected and compromised by a rush of people online. The European Commission has taken the unprecedented step of asking everyone to help. The Commission's Internal Market Commissioner, Thierry Breton, was directly quoted as requesting "Streaming platforms, telecom operators and users, we all have a joint responsibility to take steps to ensure the smooth functioning of the internet during the battle against the virus propagation,".[8]

As a result, major streaming platforms like Netflix were asked to reduce their video quality to reduce the load on European networks by 25%.[9] This problem only applies to developed countries. "In many developing countries, there isn't the infrastructure to handle a significant increase in demand. Many mobile networks are still running on decades old-2G, while wired and wireless internet connections are far from ubiquitous—all of which makes the possibility of home-working a remote one."[10]

Not only internet usage but also storing all the data in the data cen-

ter costs energy. Even before the surge of the internet population (at least in Europe), the concerns about the energy consumption of data centers were already raised. "Data centres processing and storing the world's data already use around 1% of the electricity we generate, according to the IEA."[11] To put this 1% into a digestible perspective, it's about the same amount of electricity that Australia consumes in a year. "[A]s societies become more digitalised, computing is expected to account for up to 8% of the world's total power demand by 2030, according to some estimates, raising fears this could lead to the burning of more fossil fuels."[12]

Now that people are isolated in their own homes, society is resorting to digital space to continue their daily lives. But we must be mindful of the invisible—intangible consumptions. It's easier to picture the carbon footprint for air travel than that of sending an email.

No more clouds of dust

Public facilities are being shut down globally due to the spread of COVID-19. These actions—especially the decline of manufacturing, reduced travel, and more have brought recognizable change over the short quarantine period. Demand for electricity has gone down, carbon dioxide emissions have fallen, and air pollution levels have dropped significantly. In "Both China and Northern Italy have also recorded significant falls in nitrogen dioxide, which is related to reduced car journeys and industrial activity. The gas is a serious air pollutant and also indirectly contributes to the warming of the planet."[13]

These energy cuts come with the sacrifice of the economy to stop the COVID-19. "China's industrial power demand in 2020 may decline by as much as 73 billion kilowatt hours (kWh), ... as the outbreak of the coronavirus has curtailed factory output and prevented some workers from returning to their jobs. The cut represents about 1.5% of indus-

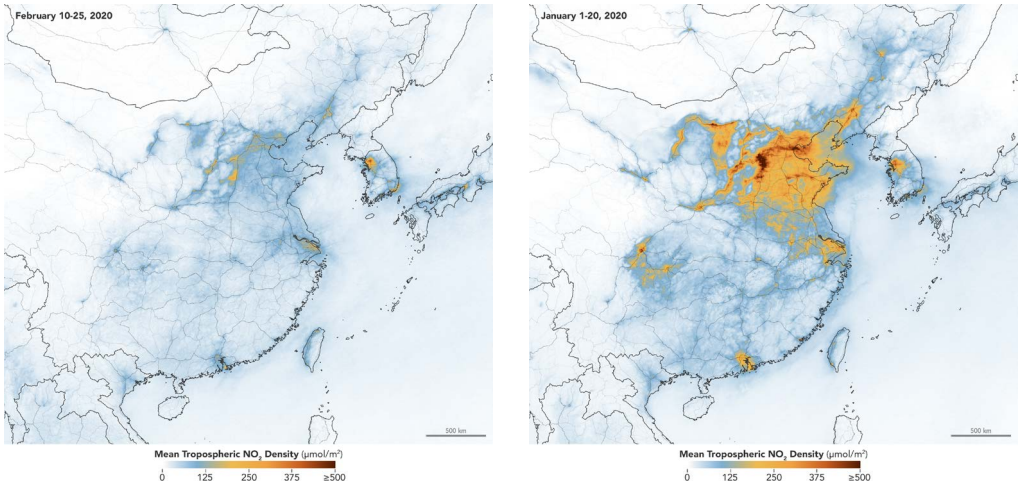

Figure 4. NASA and the European Space Agency (ESA) pollution monitoring satellites have detected significant decreases in nitrogen dioxide (NO2) over China. Source: NASA Earth Observatory (2020)

trial power consumption in China. But, as the country is the world's biggest electricity consumer, the loss is equal to the power used in the whole of Chile and it illustrates the scope of the disruption caused by the outbreak."[14]

Ever since the Industrial Revolution, industrial development has been closely linked with air pollution like smog. The continued technological development and consumption produce clouds of the toxic dust in the air that disease and suffocate our lungs. Our bodies need air to breathe and live. As these operations ceased due to the COVID-19 outbreak, it ironically led to the unprecedented reduction of carbon dioxide emissions and air pollution. We can finally breathe.

This seems like a silver lining in this dark time. As humanity locks themselves into hibernation, nature flourishes. We like to believe in the "power of nature to recover… People hope that, no matter what we've done, nature is powerful enough to rise above it."[15] The quarantined people share stories of wild animals appearing in cities such as swans and dolphins coming back to Venetian canals.[16] But that is not true,

at least in this case. The true silver lining is that this inadvertent experiment puts all these notions out in the open and gives us perspective. Our world and the technosphere.

It is premature to have a full understanding of what this experience has affected me and the world for long term as of yet. Despite that, the rippling effect of the pandemic unpacks what's normally "black boxed"[17] in our daily life so we can feel it with our bodies.

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VULNERABILITY OF TECHNOLOGY AND DATA IN THE PHYSICAL WORLD

Lassi Häkkinen

Cyber Paranoia is a recurring modern-day fear. As users of technology and internet, we usually talk about being afraid of hackers going after our passwords, private emails and confidential information. As personal data transforms into a product to be collected and sold by technology corporations the fear increases exponentially. This is justifiable, as increasingly our information is stored in the so-called 'cloud'- a global array of remote data centers beyond our physical reach. At the same time, when people consider their information to be safe in the cloud, they also imagine it as something intangible and untouchable by the threats of the physical world. Despite the subconscious fear of malware and hackers people log in to their bank apps and mobile pay systems in crowded trains without even thinking of the possibility of someone looking over their shoulder and robbing their credentials. For any technology user it is at least as easy to screw up one's data safety in the physical world right around us than through virtual ways.

Physical world vulnerabilities tend to be common for even bigger companies as outlined by the Finnish cyber security and privacy company F-Secure. Through what they call "red teaming", they infiltrate their client's systems with both virtual and phyical methods similar to criminals who their clients could become victims of. In worst cases, they have even been able to physically reach the server rooms of the company

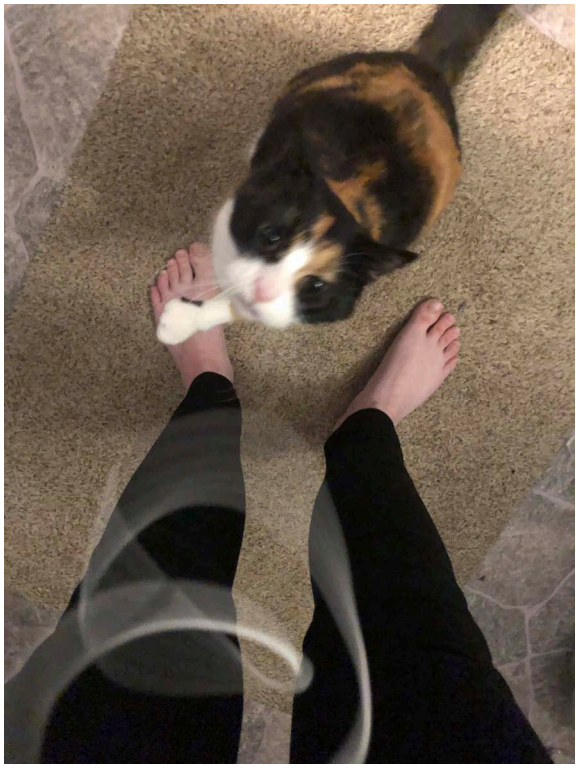

Figure 1. A cat called Daisy eating a cable. © Yahiamice CC BY-SA 4.0

and install their own devices there.

It is no surprise, the classical way of wearing a neon yellow vest of a construction worker still seems to work and grant access to many places. [1][2]

It is well known that technological systems are being targeted by different kinds of attacks and defensive structures against those attacks are actively being developed and maintained. But, occasionally the physical world can clash with technology and the flow of data by accident and in a way that no one could really predict. For example, how a swing of a spade in Georgia cut off internet access to 3.2 million Armenian people in 2011 when a 75 year old Georgian lady scavenging for

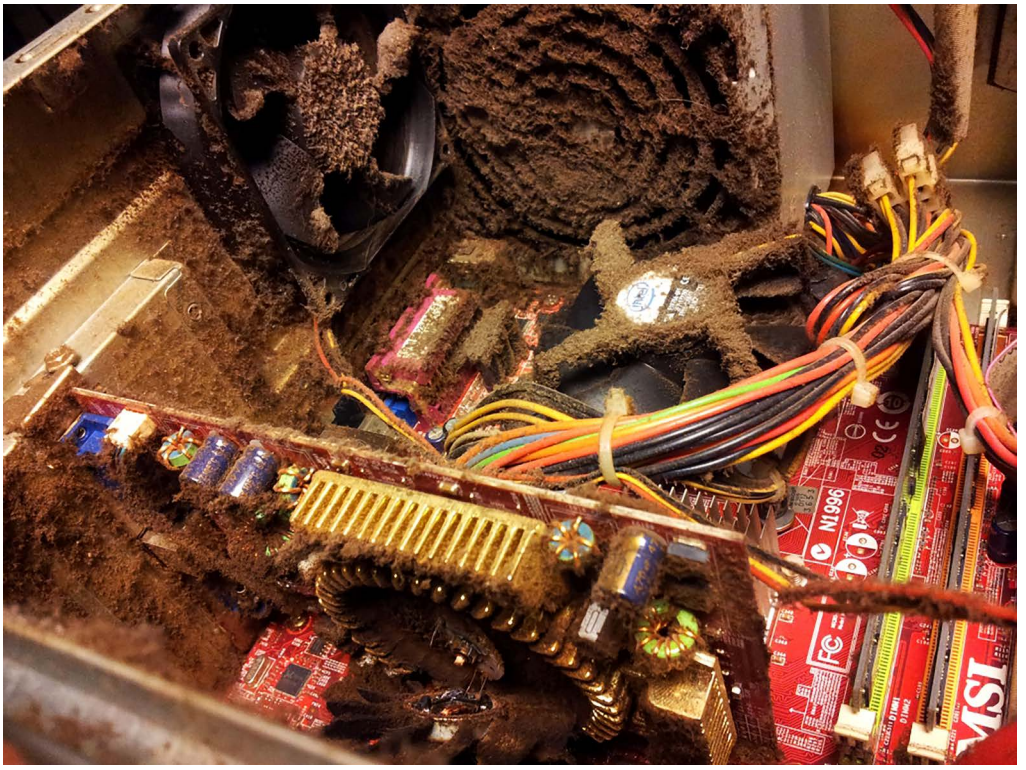

Figure 2. A computer damaged by dust. © Arvutistuudio CC BY-SA 4.0

scrap metals ended up cutting a fibre-optic cable. [3]

During the Cold War a particularly important telecommunications cable that ran between Washington and Moscow through Finland broke down several times. In 1966 the Finnish newspaper Helsingin Sanomat wrote that "Finland is not really known in the United States as the country of sauna and paying your debts but as a country where the hotline cable is always cut." It wasn't just once or twice that such an acciden happened. In 1964 a bunch of kids were suspected to have stolen a part of the cable, in 1966 an unlucky farmer plowed through it and in 1972 the cable was cut by a creeper while a body was being searched from the sea, just to mention a few. [4][5]

Figure 3. Plants have taken over an abandoned mobile phone shop in Ivory Coast.

Figure 4. Doves nesting on phone wiring. © Ivan2010 CC BY-SA 4.0

Over fifty years after the Finns were disrupting the hotline, the United States still appears to be in conflict with the physical world trying to figure out what is going on behind its own borders. But this time it's not us Finns but animals you should blame. The Customs and Border Protection has had trouble with startling incidences of three hundred vultures defecating and urinating on top of a radio tower used for communication. If what happened in Finland was mostly unintended and accidental perhaps this time it is nature's unbiased opinion about artificial borders and forever-present technology. [6]

Lisa Parks goes through another set of encounters between animals and infrastructures in her essay Mediating Animal-Infrastructure Relations. She combines these animal-infrastructure intra-actions to theories of Donna Haraway and others who "conceptualize technology as a

site of human-animal-machine hybridizations." In this context she finds it surprising how human-build infrastructure is often thought and discussed as something that is or should be disconnected from the materialities around it. Parks ends this particular thought by very well stating the obvious: "...given that infrastructures are surrounded by biomatter, from roots beneath them to fungi on top of them to wildlife around them." When you look at a photograph of a radio tower crowded with vultures and their feces, you are looking at a series of infrastructural materialities that are in a way equal in their intra-actions. In a real world situation it is impossible to entirely separate these materialities. [7]

Technology is ubiquitous, intertwined with the western world, always present no matter what. For example, in Finland's metropolitan centers, we are unfamiliar to major power outages and blackouts. We rarely even have to experience a brief pause on our internet connections. Do we even remember that it all comes down to a physical world in the end. Even the so-called cloud, posing as a non-physical virtual mysterious entity is really just a collection of networked data centers. Nowadays, I am not really sure where my own data lives. Nor do I know who has access to it physically(not me at least) or what kind of other materialities it is surrounded by. And, this applies to not just the data collected by various social media services I use, but I have to admit that I am even unsure where my own websites currently physically reside. As a content creator and user, I merely upload and publish my work through a generic file transfer software and enjoy the end result through my browser.

We have come a long way from the times when my first website and IRC (Internet Relay Chat) bouncer were hosted in Tampere, on a server computer in the corner of a piano room in the home of a Finnish family. The physical existence of that one specific technological device was clear when one day the server had for some reason crashed and shut down. My website did not respond at all. I could not connect to IRC

and the family was at their summer cottage. But at least I knew what was going on. Nowadays the scale is just so much bigger that it gets harder and harder to grasp. Even though internet is a brilliant tool in making the world "smaller" as is often said, the physical world still stays the same size. And the infrastructure is laid on the physical world and even though our virtual avatars nowadays see that as something small and very reachable, it really isn't. And while we rely on technological infrastructure spread far and wide into the shadows, we just need to trust that someone unknown to us takes physically care of it. Losing most of the control seems to be the price to pay for the access to thesedeveloped media infrastructures. Shannon Mattern describes in her text Deep Time of Media Infrastructure in the book Signal Traffic how people have worked as part of the infrastructure throughout the history. Messengers on the side of the telegraph network and people carrying their water home from a common pump are both filling up the gaps that the networks of lines and pipes have. In these modern media infrastructures where the gaps are starting to be almost non-existent, one could argue that we might be free of the infrastructural role. But like stated already earlier in this text, in the real world it is impossible to separate the infrastructural materialities.

Even if the physical world has been taken away from us in the case of the technological infrastructure and we are all just floating in the cloud forgetting that it all comes down to physical things, let's not forget that humans are a materiality too and I would argue that this materiality that we represent has been made into such a merchandise that is impossible to separate from our capitalist world's internet infrastructure. [8]

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INFRASTRUCTURES OF ISOLATION

Shambhavi Singh

At the moment, there are infrastructures that are enabling us to stay connected, stay afloat in these times of a global crisis and individual isolation. Different online platforms are running without interruptions and our phones along with other screens have become a window to the world outside.

The drawing presents an everyday experience of sitting with one's coffee cup and phone to start the day. The colours are resonant of Google's signature colours, evoking through somewhat symbolic and abstract representation, the palette within which our isolation is comfortably nestled.

How do we see the world beyond our comfortable nests when these infrastructures that enable our isolation are so invisible to us?

"Infrastructures of Isolation" by Shambhavi Singh, 2020

APPROACHES TO THE POST-DIGITAL

Ameya Chikramane

Do we live in a post-digital world? What is post-digital? Theories of technology and theories of humanity merge into one as human beings extend the functionality and capabilities of their bodies and minds with devices, sensors, and information to evolve into the next human prototype. The post-human if you will.

The post-digital is also often approached with the concept of "post", or after digital. To signify a departure from the technological tropes associated with the future of humanity. However, it would be a mistake to ignore the technical dimension (Feenberg, 2019) [1]

The post-human is not held down to the earth by gravity or time. The laws of physics mean very little in day-to-day life and overcoming them is just an instant transaction away. Speed, efficiency, power, and imagination are the only things stopping the post-human from reaching God's status, and those too are being hacked into to reach near perfection.We are talking about cyber spaces, prosthetic enhancements, virtual realities and selectively bred CRISPR babies. The period of development defined by the infrastructure and technology built to support and foster the transformation of the human being into post-human make up the post-digital age. That's at least one way of looking at it.

Black box theory

Not many of us know exactly what happens when one sends an email on their mobile phones. The message you type is encoded, sent wirelessly to the recipient who can then choose from a slew of devices to view the email on. Most of us understand this basic explanation, but do we really know how it works? If given all the raw materials and tools required to construct a mobile phone, would we be able to assemble a functioning one? A few hundred years after the light bulb was invented, the majority of the people didn't know exactly how it works, and there might still be some today who do not know.

While access to the technological landscape and all the capabilities it offers is ubiquitous, our understanding of it is complex and fragmented. Programmers, developers or coders seem to have expert knowledge, but it is usually limited to a specific area or field. While one can easily access information or do a task digitally, one doesn't always understand how it was accomplished. There is an output for an input given, abstracting away the inner processes or workings of the system– like a black box.

While there is no arguing that this advancement has led to more comfortable lives for most people, the long term consequences of this trend can become unpredictable. For example, the jobs of tomorrow might be something only machines can do, and this can have vast consequences on human economies (Hynes, 2017) [2]. In fact, today's neural networks work in a way where even experts don't fully understand the algorithm used by the system. As with the lightbulb, while a few 'expert' humans may be able to catch up with the inner workings of the technology we use, the evolution of the technology and our own imagination will always keep us a few steps behind. This abstraction is a prominent feature of the post-digital world.

Quantification to digitization

In the times of the barter systems, there was no clear way to provide value to goods that could be agreed upon by all, objectively. A ton of salt for one person might have been with its weight in gold, yet to another, it would have just been a tonne of salt. Quantification of goods and services into an abstract yet objectively agreeable value gave birth to currency. What followed was an increase in trade, communication, exchange, and globalization. One might argue that this was a key point in the time some refer to as the Anthropocene– a massive transformation of the surface of the earth caused by human agents and their activities. Activities that were brought forth by the advent of quantization and currency.

Today, goods and services are increasingly becoming "online". One can buy storage space "on the cloud" to store their digital properties. Business and trade have now taken up a new platform, one that is virtual, digital and full of possibilities. Shops, schools, jobs, banks, and entertainment– all have their online counterparts and are slowly yet surely surpassing their physical origins in terms of capabilities and usage. Infact, Accenture predicts that by the year 2022, 60% of the global GDP will be digitized [3]. The trend towards digitization could be considered another form of abstraction from our physical reality and a significant marker of the post-digital age.

Digital Realities, AR, VR

The human body, as a vessel for a creative mind, has been tinkered and experimented with over the ages to a sort of perfection– longer lives, healthier lifestyles and better experiences than ever before. While this trend is still very much alive and we are making advances in extending the capabilities of our body, another trend has been taking its roots in our mixed reality. With the advent of AR, VR and XR technologies, we

have begun to digitize not only our goods and services but also our experiences and our very selves. This saturation of digital realities has given companies a granular understanding of their customers (Hadar, 2019) [4]. These alternate or virtual realities are capable of replacing or augmenting our own experience of the world and can be designed to extend or completely break the laws of physics as we know it. Humans can finally break free of physical limitations like gravity, time and space once they are immersed in these virtual realities.

Today, most of our touchpoints to the virtual are still in the form of two-dimensional projections on physical objects. Wearing a VR handset feels clumsy, unreal and a bit over the top for our generation. In the coming years, however, humans will be born into a world where these technologies are everyday experiences. This is yet another form of abstraction– the technology and algorithms behind enabling these experiences may be quite complex, but the ability to break free of our limited realities into virtual, designed and mouldable new experiences will surely be characteristic of the post-digital age.

Are we in the post-digital age yet?

While there are differing opinions on the question, most people tend to agree we might be on the brink of it. There are varying definitions of the term, depending on the context. To some, the advent of quantum computing, machine learning, and AI signal the oncoming post-digital trend. Old dichotomies of "digital" v.s "analog" don't apply anymore, and the meanings of "New Media" and "Software Studies" start to become obsolete (Cramer, 2015) [5]. Others see the post-digital in the context of art, creativity, and innovation. The tools and technologies of the digital age have been enabling factors to help humans connect, collaborate and bring about the massive transformation of the planet, and their post-digital counterparts enable a living species to think, create and innovate collectively.

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