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More-Than-Human Infrastructures in the World Wide Wet

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Abstract

The presented research contributes to discourses that center questions of materiality in relation to networks by following the materials and animals that make and circlude submarine cables in the World Wide Wet of Earth's oceans. The sleeves of telegram cables are an invitation to think with the sticky entanglements of a tree that produced a natural plastic that insulated transatlantic telegraph cables from the 1850s onwards and facilitated a technology that both deepened and challenged colonial control. A second story makes slippery connections between a lubricant that surrounds thin fiber-optic strands and the history of human skin care. To render the internet as a material-discursive performance of various materials and nonhuman animals (Parks 2019), a third story follows a mollusk that short circuits cables and the gender binary. Developing infrastructural rewirings and rewritings, the article continues with discussions of internet infrastructure workshops that I collaboratively developed as a critical designer. Playing with cables in the form of strings makes for frictional imaginaries of internet infrastructure that are needed to counter dominant narratives of the internet as linear technoscientific progress.

Keywords

internet infrastructures, networked ecologies, critical design, matter and materiality, access, friction

This article has recently been a series of light pulses that traversed the vast darkness and pressure of Earth's oceans faster than any human can blink. It will likely be tunneled through an ocean again whenever someone opens it in a browser or attaches it to an email. The data packages these words are composed

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of are called bits, and within the protective layers of submarine cables that are laid on and under the seabed, they move near salt water, but they never get wet. Despite the popularity of the metaphor of the Cloud that implies that the internet is in the skies, internet infrastructure is "rural and aquatic" (Starosielski 2015, 2), and 99 percent of internet traffic is being transmitted through the 1.2 million kilometers of submarine cables that span the globe (Brake 2019, 2). Playing with metaphors, this text renders the internet as a World Wide Wet and floats with the materials and animals that are involved in its networked ecologies.

The presented research aims to contribute to discourses that center questions of materiality in relation to networks by telling the story of communication infrastructures from transatlantic telegraphy to today's internet infrastructures through how cables have been constructed to resist wetness. This text begins with the question of why the trope of immateriality and misleading metaphors such as the Cloud are so persistent when it comes to networks, and introduces why keeping wetness at bay is necessary for electromagnetic and fiber-optic transmissions. It then tells three stories that take cables and attempts to insulate them as their starting points: the materials they are made from, the geographies they traverse and co-shape, and the nonhuman animals that interact with them. The first story is an invitation to think with the sticky entanglements of a tree that produced a natural plastic that insulated transatlantic telegraph cables from the 1850s onwards and facilitated a technology that first deepened and later challenged colonial control. The second story follows the slippery connections between a lubricant that surrounds the thin fiber-optic strands that refract light pulses across oceans and the history of human skin care. To render the internet as a material-discursive performance of various materials and nonhuman animals (Parks 2019), the third story follows a mollusk that eats at cables and the gender binary. These stories move inwards: from the sheath of cables to the soft materials within them to the animals that eat through them.

Developing infrastructural rewirings and rewritings, this article continues with discussions of a series of internet infrastructure workshops that I collaboratively developed as part of my practice as a critical designer. The workshops were conducted to both build literacy for existing structures and to unfold potentials for inventing more just infrastructures, a frictional relation I will engage to draw connections between theoretical and practical modes of imagining the internet differently. These frictional imaginaries are needed to counter dominant narratives of the internet as linear technoscientific progress.

Material All the Way: Watering Down Immateriality

Despite scholarly critique, the trope of immateriality (Blanchette 2011) is persistent when it comes to public imaginations of the internet.[1] This trope, or rhetorical figure, stands for the assumption that digital media are supposedly independent from material constraints and thus immaterial. An example for this

trope is the metaphor of the Cloud, which is often used as a direct equivalent for the internet, as is evident in Microsoft's (n.d.) statement that the company delivers services "over the internet ('the cloud')." Nathan Ensmenger argues in his article "The Environmental History of Computing," that if this so-called "Cloud were a country, it would be the sixth largest consumer of electricity on the planet" (2018, S10). Metaphors and imaginaries surrounding the digital are oftentimes misleading, and while the term *Cloud* suggests a locality in the skies, digital devices are powered by so-called rare earths. Rare earths are neither a rarity on Earth nor actually "earths"—but metals. However, "what *is* rare are regions of the world that governments and companies are willing to subject to the environmental risks of rare earth mining and processing," specifies journalist Ingrid Burrington (2018). The digital is material: from the formation of high-tech industries being based on ecocides and the exploitation of immigrant labor (Pellow and Park 2002), to the immense amounts of water and electricity used to cool data centers (Ensmenger 2018), to the planned obsolescence of electronic devices (Gabrys 2011), to "power plants, fiber-optic cables, satellites, mines yielding coltan and copper, and assembly-line workers and e-waste handlers regularly exposing themselves to toxic materials" (Mattern 2018).

The trope of immateriality is perpetuated by tech companies, but it has anti-capitalist origins that become evident in the writings of Nicholas Negroponte, who described a paradigm shift from "atoms to bits" in his 1995 book *Being Digital*. In John Perry Barlow's (1996) text "A Declaration of the Independence of Cyberspace," the cyberlibertarian falsely predicted that corporations would have no power in cyberspace exactly due to the supposed immateriality of bits: "Your legal concepts of property, expression, identity, movement, and context do not apply to us. They are all based on matter, and there is no matter here." About thirty years later, the trope of immateriality still has far-reaching consequences for how we speak of, think of, and act in digital spaces. Questions about who owns resources, why it is so, and how it could be otherwise do not fit the equation of digitality with immateriality, but these questions are important in regard to the fact that submarine cables still dominantly connect locations above the equator and follow similar colonial lines as telegraph cables. When acknowledging networks as material, critique of domination becomes possible.

Before my research into cables, salt water was not a material that I thought of when imagining the internet. In her book *Wild Blue Media: Thinking Through Seawater*, Melody Jue describes the shift happens when "becoming aware of habits of perception that reflect the fact that we are acculturated to certain conditions of gravity rather than the buoyant and vital fluidity of the ocean" as a way of "going into the blue" (2020, xi). More than 70 percent of Earth's surface is covered in ocean water, and for global communications to be possible, cables must pass through them without leaking. A cable's electric current and fiber transmission get lost when they are in touch with the ocean. Salt water is highly

conductive, and it carries electric currents so well that a cable without insulation immediately loses its current to the ocean's currents. Keeping electrons in place or moving them along defined lines requires boundaries: The outer layer of today's submarine communication cables consists of polyethylene, which is a product of the oil industries. When the first working telegraph was presented in 1839, this plastic had not been invented yet. To communicate over large distances and water masses, a good insulator to avoid leakage that could withstand extreme temperatures and pressure was needed—and found in the rubber-like material gutta-percha.

It Begins with a Tree: Gutta-Percha, Insulation, and Control

Gutta-percha describes the tree sap or gum of Palaquium trees, of which the Palaquium gutta trees native to the tropical rainforests of Southeast Asia, particularly Malaysia, Singapore, and Sumatra and Borneo, promised the most durable product. This material is a shapeshifter: Slow flowing sap coagulates into a solid when exposed to room temperature—reheated again, it becomes a plastic that can be shaped into a desired form. As I slowly rip open the leaf of a gutta-percha tree that I ordered online, sticky sap threads appear in the openings that keep holding the pieces of the leaf together. Taking up this invitation to think with sticky, leaky entanglements, I am following gutta-percha and its conditions of production and usage to question the ongoing colonial motivations behind both the telegraph and today's internet infrastructure.

Helen Godfrey's book *Submarine Telegraphy and the Hunt for Gutta Percha: Challenge and Opportunity in a Global Trade* provides a deep insight into the peoples and materials involved in the structures that moved gutta-percha from Indigenous Sarawak to Chinese trade networks to European cable manufacturers in the second half of the nineteenth century (2018, 95). While global power relations remained so that "the periphery was left to do the task assigned to it—supply resources to the metropolitan core" (270), the trade was only possible because of the knowledges of local communities, about the trees from which they harvested gutta-percha. They knew the flow of the tree sap to be best in the morning, set harvesting periods in relation to the wet season (165), and transported the material over vast distances on rivers and via hinterland paths that they often cut into forests and grasslands on the go and that were simply too slippery for Europeans to navigate (191).

The first cables that were insulated with gutta-percha were laid far away from the trees and peoples that made such an undertaking possible: within the New York harbor, from Dover to Calais, and from Deutz to Cologne. The first successful transatlantic cable was laid in 1858—although it stopped working after only six weeks. At this point, the role of the telegraph in securing colonial control was well

established: One year earlier, during the Indian Rebellion of 1857, the British use of telegraphy as the fastest form of long-distance communication available at the time had allowed the colonizers to overthrow the rebellion. A rebel allegedly exclaimed before being hanged, while looking at an above telegraph wire, that this was "the accursed wire that strangled us" (Choudhury 2010, 31). Despite the fast and brutal reaction of the British in India, the news of the rebellion only reached London forty days later, and telegrams sent via landlines that were established in the following years still took days to reach their destinations (Headrick 2010). With access to gutta-percha and the possibility to lay cables across the oceans, the British were eager to connect London to Bombay and succeeded in 1870. In the years that followed, telegraphy deepened the control that colonizers had, as they could coordinate and command through a technology that upset the previous communications paradigm that more distance equals slower speed. In India, as Dhanashree Thorat writes, "the colonial administration turned the telegraph into an instrument of control over territories, commerce, information, and above all, colonized people" (2019, 260). To keep connections across the country stable, the telegraph network in India was built with wetness, namely monsoons and hurricanes, in mind: In an interview, Prashant S. Kumar tells me that while high-tension thin wire was used in the West, the telegraph wire in India was three-eighths of an inch thick, and the rods were suspended on top of bamboo poles so that they could sway in the wind. Kumar's research shows that the sturdy materiality and the fact that wires and poles were produced by local manufacturers on bazaars made it possible to hack the network, which local stock speculators did by intercepting wires with a stolen Morse code machine to falsify opium prices (Kumar 2024). While the expenses of extending and maintaining the network forced the British to open telegraphy to Indian people early on, "telegraph messages were physically handed over to telegraph authorities, who would read the messages and transmit them as signals to their destination," and British surveillance unfolded through modes of "interception, detention and censorship" by the physical manipulation, delaying, or withholding of messages, as P. Arun (2024) explains. Despite these mechanisms of control, anti-colonialists made use of telegraphy for coordination, information, and international exchange. As Daniel Headrick puts it, the "very media of communication that the British had introduced, did not make British rule permanent, but undermined it instead" (2010, 13).

It is gutta-percha's relationship to wetness and temperature that made telegraph transatlantic cables possible: Its insulating qualities "actually improved when cold, wet, and under huge pressure" (Newland 2022, 58). Landline cables too were constructed in relation to the specific geographies and weather conditions that they traversed. Another form of pressure, namely the threat of extinction, informed the fate of the slow growing Palaquium gutta trees, that were mostly felled and not tapped to harvest their sap. John Tully argues that the extraction of the tree led to a "Victorian Ecological Disaster" (2009, 574), and even today,

aggravated by the felling of rainforests for palm oil plantations, Palaquium gutta is listed as Near Threatened on the International Union for Conservation of Nature's (IUCN) Red List. However, the long echo of telegraphy lies not only in its political and ecological consequences: Studying telegraph and internet submarine maps shows that cables follow similar routes that make for similar well-connected centers in the Global North.[2] As I hope to show in the next sections, paradigms of geography, wetness, and materiality are as relevant now as they were then.

Slippery Conditions: Light and Lube in Fiber Optics

Ninety-nine percent of internet traffic is transported through submarine cables, and these cables are laid on the seabed of oceans. In her book the undersea network, Nicole Starosielski critiques the common Western imaginary in which landscapes are easily modifiable by force: "the environments that cables are laid through—the oceans, coastal landing points, and terrestrial routes—are seen as friction-free surfaces across which force is easily exerted" (2015, 5). The previous section of this text has shown the colonial origins of this imaginary by complicating the narrative of frictionless technological development via the history of the gutta-percha tree. Today, geography is still one of the determining factors when it comes to how fast and reliable submarine cables can transmit bits. Ensmenger opens "The Environmental History of Computing" with the example of the Hibernia Express, a 4600-km fiber-optic cable that became operational in 2015 and achieved a 10 percent reduction in network latency—not by technological advancements in data transmission, but simply by being five hundred kilometers shorter than previous cables (2018, 8–9). In this section, I am turning my attention towards the workings of internet communications and will follow light and lube within fiber-optic cables.

Used for internet communication since the 1990s, fiber-optic cables work by transporting pulses of light through thin strands of glass, while optical amplifiers that are powered by an electrical current keep the pulses stable (Brake 2019). As with their predecessor—the copper cables used to send on telegraphic messages—protecting them from wetness requires significant material and operational efforts: For the World Wide Web to work, fibers and waters need to be kept out of touch. To prevent water damage, most fiber-optic submarine cables consist of eight layers that protect the optical fibers inside of them. I am interested in a slippery material that is directly applied to the fibers: They are surrounded by a mixture of petroleum jelly, polymer additives, and anti-corrosion agents that are held in place by a copper or aluminum tube (Brake 2019; Malekian 2024). Petroleum jelly is a semi-solid, translucent substance that is insoluble in water. Insoluble means that the hydrocarbons of petroleum jelly do not mix with water molecules and instead form a slippery and greasy layer that keeps wetness at bay. In addition to providing an extra layer of protection from water by repelling moisture, petroleum jelly also has insulating properties, which means that it prevents electrical leakage and possible corrosion of a cable's metal

elements. Because it is thermodynamically stable, it further protects the delicate fibers from temperature swings in the oceans. What intrigues me about this versatile material that encloses fibers across the globe is that most readers will have touched petroleum jelly: Its household name is Vaseline.

Vaseline is about as old as the first transatlantic telegraph cables, and the company's website describes petroleum jelly as "a naturally-occurring byproduct of the oil drilling process" (n.d.). In 1859 the first Western oil well was drilled in Pennsylvania, and workers discovered traces of a paraffin-like material that hastened the healing process when it was applied to small skin wounds. Robert Augustus Chesebrough, a chemist who would patent Vaseline in 1872 and create a company to sell it as a skin care product, picked up on this knowledge and successfully experimented with refining the material. Chesebrough spent the 1870s traveling the state of New York to demonstrate the power of his "wonder jelly." In public demonstrations, he burned his skin to then treat his injuries with his product. Since then, according to the company's website, Vaseline has written history by protecting human skin from the North Pole Expedition to World War II and beyond. Petroleum jelly is a material of boundaries: It sits on wounds and dry skin, has a noteworthy history as a (nowadays contested) lubricant for sex, and it is an elemental protective layer for fiber optics. Vaseline binds and slips between different fields of practice such as extractive industries, internet communications, skin care and sex. Circling towards queer theory, Bini Adamczak's (2016) concept of circlusion is an "antonym of penetration" that describes "pushing something—a ring or a tube—onto something else—a nipple or a shaft." In this sense, petroleum jelly can be understood as a core material in performing today's internet by circluding fiber optics as they pass through oceans that circlude cables. If what keeps light traveling through submarine cables is the same material that softens skin and enables specific sex practices, the internet can be described as both hard wired and softly coated.

Boring Circuits: Teredo's Taste for Cables in More-Than-Human Infrastructures

In her text "Mediating Animal-Infrastructure Relations" Lisa Parks involves nonhuman animals in her conceptualization of infrastructure and critiques that they are usually not considered "part of infrastructural materialities" (2019, 144). Following osprey, a species of large birds that build nests on cell towers and sometimes even causes "avian delays" (146) in the towers' maintenance, she writes, "infrastructures are surrounded by biomatter, from roots beneath them to fungi on top of them to wildlife around them" (144).

In relation to submarine cables, sharks have sparked the imagination of news outlets, most popularly in the form of a video snippet that shows a shark biting into a submarine cable. Sharks are known to sense electric currents, and even

though the actual threats to cables are ship anchors or underwater landslides, rumors that Google would insulate new cables with Kevlar, a material that is otherwise used for bullet protection, made the rounds (see Gibbs 2014). To give an example of the relationships between humans, nonhuman animals, and infrastructures, I will turn my attention to a much smaller and less discussed species. When it comes to submarine cables, it is the mollusk Teredo navalis, often referred to as "the shipworm," that eats at simple conceptions of an enclosed and stable internet. Teredo navalis has an elongated and reddish appearance and reaches a length of up to sixty centimeters. It uses triangular plates at its front to attach itself to wooden surfaces as larvae into which it then burrows and grows within. Throughout its life, and depending on water temperature, Teredo can self-fertilize and iterate between what biologists call female and male phases. As a so-called invasive species, the mollusk's origins are not known, but what is known is that it has traveled the world on the hull of trade ships that it routinely destroyed when their hollowed wooden structures could no longer withstand storms and other tear—an effect that Paola Palma and L.N. Santhakumaran have termed "global worming" (2014). With the first submarine cables, Teredo navalis developed an appetite for gutta-percha, which it nowadays extends to fiber-optic cables (Parkes and Keeble 2016, 239).

To circle around the history of Teredo navalis, I am reaching back to its discovery in the Netherlands in the 1730s, which etcher Abraham Zeeman captured in one of his prints in 1731 (see Sundberg 2015).[3] In the center and front of the image, three wormlike creatures fill almost the full length of the print. Two of the creatures are oriented towards their left, and have mouths in the forms of half-circles. The third creature is oriented towards the right, has a spiky surface, and exists without a head. Behind them, depicted much smaller, dike inspectors use long sticks to remove infested wood from dikes, and further back, sailing ships float on a body of water. The etching points to the fact that shipworm infestations across the Netherlands created a panic because they threatened the very infrastructures that literally kept the ocean at bay and offered protection from floods. This panic was accompanied by a moral panic around recently uncovered queer networks across the country, as Adam Sundberg shows in his 2023 article "Building the Social Cascade: Connecting Culture, Disaster, and Persecution in the 1730s." The shipworm crisis occurred at a time in Dutch history in which same-sex relations between men, at the time called sodomy, were persecuted in an unprecedented and deadly manner (Sundberg 2023, 38). Even though most trials happened prior to the discovery of the shipworm's hollowing of the dikes, "shipworms and sodomy" were described as "near-concurrent consequences of perceived social and moral decay within the Republic" by ministers, journalists, and writers of the time (30). The linking of Teredo navalis and homosexuality relied on earlier metaphors and metanarratives, in which homosexuality was described as a "worm that undermined the Republic's collective conscience" (40), sin was described as the sea itself, and the shipworm was later defamed as "Sodoms monster animal"

(46). In the years following the shipworm crisis, the wooden infrastructures of dikes were increasingly replaced with stones.

With the installation of the first telegraph cables more than a decade later, Teredo navalis developed an appetite for gutta-percha, which became a risk to cable-laying companies. The mollusk would "bore through the cable armouring and eat the jute and gutta-percha insulation, exposing the conductor and causing earth faults" (Parkes and Keeble 2016, 239), which resulted in very difficult and expensive cable repair missions. To stop the mollusk from boring into cables, a protection in the form of a metal tape was invented in the 1870s. In today's fiber-optic cables, as Larry Parkes and Alan Keeble explain, the animals create electrical short circuits when hollowing through a submarine cable's outer layers. Even though there are suggestions and inventions available to protect the cables from Teredo's teeth, the small mollusk continues to make trouble and literally cannot be kept out of the circuits that keep the internet running. Teredo does not just circlude cables, it eats through them. When queering the World Wide Wet and hollowing power relations, Teredo is a superstar.

As Parks argues and the actions of mollusks affirm, "the infrastructural then, is not a given, it is constituted through dynamic and hybrid materializations, which becomes most intelligible to us in instances of entanglement, relationality, and intra-action" (2019, 149). Considering animals as part of internet infrastructures makes it possible to learn from their non-compliancy and their queering practices, too: The materials that make internet infrastructure are involved in the games and digestion of nonhuman animals such as sharks and worms, as well as human skin care routines. Parks argues that understanding the infrastructural as an "economic ontology" makes it possible to "recognize the potential to (re)organize various kinds of materials/objects/bodies/resources into distributed entities that are sustaining" (145).

Imagining a Different Internet

To develop frictional imaginaries, I turn to Anna Lowenhaupt Tsing, who engages rubber as an example to explain her concept of friction. Tsing writes, "Industrial rubber is made possible by the savagery of European conquest, the competitive passions of colonial botany, the resistance strategies of peasants, the confusion of war and technoscience, the struggle over industrial goals and hierarchies, and much more that would not be evident from a teleology of industrial progress. It is these vicissitudes that I am calling friction" (2011, 6). Thus, frictional imaginaries are needed to counter dominant narratives of the internet as linear technoscientific progress: The stickiness of the tree sap of the 88 million gutta-percha trees chopped in the making of the telegraph network (Tully 2009, 575), the softness of Vaseline surrounding the cables and the electrical shortcuts caused by the tiny teeth of the mollusk Teredo navalis.

Friction is also a key term in Aimi Hamraie and Kelly Fritsch's (2019) "Crip Technoscience Manifesto." The manifesto quotes one of Fritsch's earlier texts on access as etymologically linked to connection and attack: "The etymology of the word *access* reveals two frictional meanings: access as 'an opportunity enabling contact,' as well as 'a kind of attack'" (Fritsch 2016, 23, quoted in Hamraie and Fritsch 2019, 10). Positioning "access-making as a site of political friction" (Hamraie and Fritsch 2019, 10), the authors analyze how disabled people creatively deal with policies and laws that aim to assimilate us into normative space. Hamraie and Fritsch show that access is frictional, never innocent, and often made possible through non-compliance. Access to the internet is frictional, as it cannot be untangled from the colonial violences that made and sustain it. While Tsing's understanding of friction is helpful when analyzing the material and labor interdependencies in global submarine cable networks, it is Hamraie and Fritsch's positioning of access as friction that allows for a reading of access to and within internet infrastructures as both contact enabling and assimilatory.

In my collaborative design workshops on internet infrastructure, I work with participants on (re)imagining and co-inventing network structures. Engaging materials such as wool and Styrofoam, we follow and modify the rules that regulate today's internet infrastructures and use methods from game design and critical pedagogy to reimagine them. Friction and access are important to the ways in which we play the internet, and we pay close attention to the exclusions and problems that arise through specific material conditions and rules/protocols. The workshops presented in the following paragraphs address different layers of intervention: Starting from diverse locations such as a postindustrial and rural area near Leipzig, an academic conference in Hildesheim, the Indian capital New Delhi, and Bengaluru's streets and parks, they address the structures of networks as relational more-than-human performances that can be questioned, subverted, and speculated with. In the resulting other-configurations of internet infrastructure, I seek potentials for remaking the internet and follow what Orit Halpern describes as the "sensory, or aesthetic aspect" of data (2015, 37).

Following the Last Mile in Rural Germany

The Stadttfinden Festival (2017) took place in an abandoned glass factory in the postindustrial periphery of Leipzig. Jörn Röder, Lennert Raesch, Jasper Meiners, and I organized infrastructural walks with an interest in the so-called last mile of the internet: the spatial-temporal moment before an internet cable meets a router. Internet cables connect to houses in Germany via gray internet distribution boxes in the streets. Not every gray box is a cable distribution box, so it's worth looking at the identifier KVz 82 on the box, which stands for "Kabel Verzweiger" (cable splitter) and the registration year 1982. Within these boxes, copper cables are wired and distributed. The old factory had been abandoned in the economic aftermath of the dissolution of the socialist state German Democratic Republic and had no landline internet connection, and when we went on walks with other

festival participants to find cable distribution boxes, we only did so when we moved a few streets up towards the city center. In this situated confrontation, the cables showed that access to the internet in rural and former industrial areas is not a given, and points towards disparities between the historical East and West parts of Germany. Once we found some boxes, we connected them with yarn to make the cables running under the concrete of the streets tangible and to further trace their absences, placements, and densities. After a while, the threads led us to a building of Telekom, the main and privately-run distributor of internet communications in Germany. As we repeated these walks throughout a week, conversations with local participants of all ages emerged around internet access, cable ownership, and the learnings from placing strings as cable substitutes across the streets. Challenging the trope of immateriality by connecting boxes with yarn opened questions about who has control over the bits that traverse cables and who decides where new cables are (not) laid. Though not a perfect metaphor, threads of yarn are materially closer to the garden-hose-sized submarine cables or even the much thinner copper cables within distribution boxes than clouds.

Playing with Protocols in New Delhi

In January 2020 Jörn Röder, Ren Loren Britton, and I went on a similar infrastructure walk in New Delhi, where almost all the cables run above ground, from cable masts into houses. Our walk was part of the event #CODING that Berlin's Haus der Kulturen der Welt (HKW) and the Goethe Institute Delhi convened for The New Alphabet School. During our workshop, called Code, Layers, Infrastructures, we offered a physical game called MIAU ID in which participants played as the cats of the internet. The goal was to move through three different ways of sorting data transmissions: in centralized, decentralized, or distributed networks. Using wool, fixed rule sets, and "purrtocols"—purred protocols—each cat/participant got a number as their "ID" and could send messages/throw wool to other cats under certain conditions only. Each message/wool transmission had to be accompanied by a loud "MIAU" ("meow," in English).

Figure 1. Workshop participants play as cats to establish new "purrtocols." Credit: Annette Jacob

In the centralized network, cats had to pass all their messages/wool through a central cat to communicate/connect their wool to any other cat/participant. This made the network slow, and led to frustration, as the central cat did not always follow the wishes of the other cats/participants and would at times refuse to pass on a message/wool. In the distributed network, every cat/participant sent all their messages/wool to three other cats/participants simultaneously, which quickly became confusing, but also led to constant loud miauing and joy. The MIAU ID game figures the internet as a performance that is continuously (re)played, and offers ways of probing, understanding, questioning, shaping, and breaking existing rules. That power over internet infrastructure can be abused was anything but an abstract idea during these early 2020 days. The Indian government was using internet shutdowns to suppress protests against recent changes of the Citizenship Amendment Act that discriminated against Muslim populations. Delhi-based organizations such as the Software Freedom Law Centre (n.d.) and the Centre for Internet and Society (n.d.) monitored these shutdowns to initiate legal proceedings. While our game offered some space to imagine network structures differently and to build shared knowledge between participants with vastly different technical knowledges, the following discussions boiled down to ideas and tools of how to protect one another from state surveillance, and how to create friction in the current political networked realities through social and technical means.

Speculating Towards Other Networks in Hildesheim

As part of the non-institutional research group Maschinistisches Wahrnehmen's (Machinic Perception, with Ipek Burçak, Johanna Schaffer, N.B. Spiders, Lien Woywod) workshop Queer Weaving, Threading, Webbing, or: A Set of Speculative Interventions into Virtual Space at the Hildesheim conference Ethics of Curating (2020), I invited participants to play an Internet String Figure Game. During the workshop, we invented new ideas for building and distributing internet infrastructure. Two participants each were given game instructions, a planet in the form of a Styrofoam ball, wooden pins, pens, and yarn. Their first task was to come up with stories about the nonhuman and human animals, materials, states of matter, shared values, and conditions of this imagined world and to design the ball/planet accordingly. Was their imagined internet infrastructure hard, soft, malleable, stable, dry, wet, fragile, collective, alive, dead, in-between, or something else entirely? What did this internet infrastructure feel, sound, look, and smell like, and which political realities would it make possible or foreclose? In a next step, participants were prompted to discuss what kinds of internet might emerge from their planet, and how animals, entities, materials, and ideas would contribute or co-constitute to the material and conceptual conditions of such networks. Participants used pins to anchor internet nodes on the planet's surface and connected them with wool threads, which figuratively stood in for cables or other connecting structures. Some worlds that emerged through the game were, for example, a wet and flooded planet that was held together by cables, and another concept was a queer feminist Nipple Net, where the nipples of the imagined planet's inhabitants were connected through internet technologies. Participants invented critical designs for the distribution of the internet, and discussed networks as social, material, and ecological infrastructures that figured the internet as non-stable, generative, and more-than-human structures.

Networked Ecologies in Bengaluru

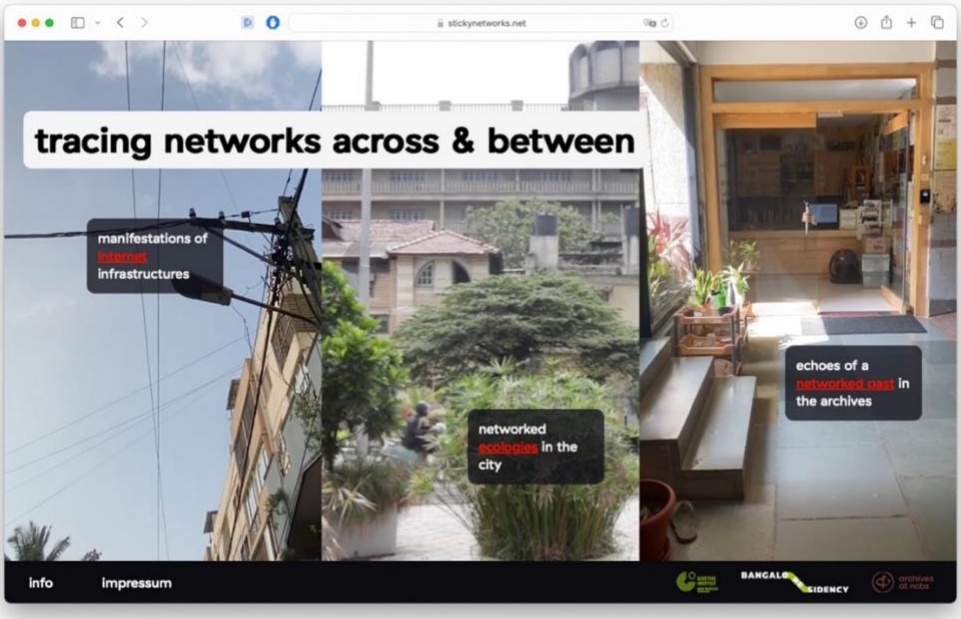

Figure 2. A screenshot of the website artwork stickynetworks.net shows three videos that introduce different storylines visitors can follow

In 2024 I participated in Goethe Institut / Max Mueller Bhavan's BangaloREsidency and worked at the Archives at the National Center for Biological Sciences in Bengaluru, India, for two months. During this time, I traced how networked ecologies that intertwine telegraph, internet, and ecological structures emerge in the city and held interviews with scholars of internet and empire that are quoted earlier in the text. What resulted is the website artwork stickynetworks.net, which complicates/decompiles stories of technological development as supposedly linear, progressive, and frictionless. To activate the research in practice, mushroom cultivator Biplab Mahato and I hosted a public network walk titled "Writing Telegrams to Fungi, Sending Bytes Across Trees" at Cubbon Park in November 2024 to search for and trace networks in the ground, between trees, and across buildings. This walk started at the Central Telegraph Office, which closed its doors in 2013, and nowadays is a mostly forgotten ruin that is covered in internet cables. Using pen and paper, our group of twenty-five people traced the cables to a nearby tree that held cable reels. Following trees, we moved into the park where we measured the size of a hotspot by using yarn. We attached a phone with an open hotspot and the ends of long lines of string to a tree and then moved outwards in a circular shape while each carrying a piece of yarn. This way, we mapped the hotspot into the park. We then used the emerging circular space to search for other kinds of networks within this radius: mycelium and lichens. Biplab gave insight into how mycorrhizal structures interconnect trees, and used spray bottles to offer lichens on found logs some wetness so that we could watch them

bloom into colors with magnifying glasses. Connecting onwards, we took collected materials and fungi into the gallery space Art In Transit, which is located underneath the old telegraph office within the underground metro station. Turning towards my concept of the World Wide Wet, I presented a cloth onto which I had painted all known landing stations for submarine cables. Using yarn, embroidery, and found objects the group connected the dots in new ways through circles, messes and new lines of inquiry.

Conclusion

As widely used metaphors and imaginaries like the Cloud render the internet as supposedly immaterial, this article has followed cables to conceptualize the internet as an infrastructural performance that involves slippery and sticky materials, nonhuman animals, salt water, and more. As a conceptual figuration and playful provocation, the stories told in the first section of the article suggest that the internet might more accurately described as a World Wide Wet than as a Cloud. The figuration of the World Wide Wet offers us to rethink internet infrastructure as a web of cables that move not only through but with the material qualities of the oceans—that, in fact, have been developed in technoscientific traditions that engage in complex and ecologically devastating efforts to avoid direct contact with wetness. In the quest to keep wetness outside of cables, materials such as petroleum jelly and gutta-percha are in friction with the way the internet is commonly imagined. By thinking with the mollusk Teredo navalis, literal openings emerge in internet imaginaries as this small animal shortcuts circuits. Ecological relations and animal actions are not opposed to but co-constitute internet infrastructures, which shows not only that a different internet is possible, but also that the internet is already different than oftentimes imagined. To that point, Parks argues that infrastructures are as much mediated as they also mediate (2019, 151). If, according to her, infrastructure is "not a given" (149), how can internet infrastructures be reformulated in ways that account for current power imbalances and that open possibilities to imagine and build alternatives?

Performing and reimagining internet infrastructure and protocols in critical design workshops affirms that internet infrastructure is upheld through its constant usage and (re)performance, and can also be questioned, subverted, and speculated with. To counter the trope of immateriality in pedagogical environments, theories and practices of embodied knowledges can make for imaginaries of more just networks. Breaking open close-circuited imaginations of the internet and its deep-sea infrastructures opens space for critique of domination—and for questions: What kinds of internet infrastructures do we want, need, desire? Who should have access to the internet and under which conditions? Which values could guide participation? Who should have ownership of something as essential as global communication infrastructures? What would an internet not for some, but for all of us look, feel, buzz, smell, taste like?

Notes

[1] For more on the trope of immateriality, see an early and much shorter draft of this text developed in 2020 for the website http://r-calc.net/: https://r-calc.net/world-wide-wet/.

[2] For an interactive visual where you can move a slider to overlay a telegraph and internet cable map to witness their similarities, visit https://stickynetworks.net/maps.html.

[3] Zeeman's 1731 print can be found online at the Rijksmuseum's website: https://www.rijksmuseum.nl/nl/collectie/object/---79f5362256f5cabc37f5d6901483 7e37.

References

Adamczak, Bini. 2016. "Come On." *Missy Magazine*, March 8. https://missy-magazine.de/blog/2016/03/08/come-on/

Arun, P. 2024. "An Interview with P. Arun on Telegraphy and Surveillance." In *Sticky Networks* by Iz Paehr. https://stickynetworks.net/telegraphy-and-surveillance.html.

Barlow, John Perry. 1996. "A Declaration of the Independence of Cyberspace." *Electronic Frontier Foundation*, February 8. https://www.eff.org/cyberspace-independence.

Blanchette, Jean-François. 2011. "A Material History of Bits." *Journal of the American Society for Information Science and Technology* 62 (6): 1042–57. https://doi.org/10.1002/asi.21542.

Behrouz, Kamran, Ren Loren Britton, Iz Paehr, and Jörn Röder. 2020. *Code, Layers, Infrastructures* (workshop). Common Room New Delhi, India with Haus der Kulturen der Welt, Berlin and Goethe Institue Delhi, January. https://www.hkw.de/en/programm/projekte/veranstaltung/p_161524.php.

Brake, Doug. 2019. "Submarine Cables: Critical Infrastructure for Global Communications." Information Technology & Innovation Foundation. https://www2.itif.org/2019-submarine-cables.pdf.

Burçak, Ipek, Iz Paehr, Johanna Schaffer, nicole voec, and Cilian Woywod. 2020. *Queer Weaving, Threading, Webbing, or: A Set of Speculative Interventions into Virtual Space*. Workshop at the Ethics of Curating Conference, Hildesheim, Germany, February.

Burrington, Ingrid. 2018. "A Rare and Toxic Age. A Journey into the Complex and Parallel Mythologies of Modern Technology and Rare Earths." "Increment," *Energy & Environment*, no. 4. https://increment.com/energy-environment/a-rare-and-toxic-age/.

The Centre for Internet and Society. n.d. "How to Shut Down Internet Shutdowns" Accessed March 8, 2025. https://cis-india.org/internet-governance/events/how-to-shutdown-internet-shutdowns.

Choudhury, Deep Kanta Lahiri. 2010. "The Telegraph and the Uprisings of 1857." In *Telegraphic Imperialism: Crisis and Panic in the Indian Empire, c. 1830–1920*, 31–49. Palgrave Macmillan. https://doi.org/10.1057/9780230289604_3.

Ensmenger, Nathan. 2018. "The Environmental History of Computing." *Technology and Culture* 59 (4): S7–S33. https://doi.org/10.1353/tech.2018.0148.

Fritsch, Kelly. 2016. "Accessible." In *Keywords for Radicals: The Contested Vocabulary of Late Capitalist Struggle*, edited by Kelly Fritsch, Clare O'Connor, and A.K. Thompson, 23–28. AK Press.

Gabrys, Jennifer. 2011. *Digital Rubbish: A Natural History of Electronics*. University of Michigan Press.

Gibbs, Samuel. 2014. "Google Reinforces Undersea Cables After Shark Bites." *The Guardian*, August 14. https://www.theguardian.com/technology/2014/aug/14/google-undersea-fibre-optic-cables-shark-attacks.

Godfrey, Helen. 2018. *Submarine Telegraphy and the Hunt for Gutta Percha: Challenge and Opportunity in a Global Trade*. Brill.

Halpern, Orit. 2015. "Cloudy Architectures." *Continent* 4 (3): 34–45. https://web.archive.org/web/20200716131146/http://continentcontinent.cc/index.php/continent/article/view/205.

Hamraie, Aimi, and Fritsch, Kelly. 2019. "Crip Technoscience Manifesto." *Catalyst: Feminism, Theory, Technoscience* 5 (1): 1–33. https://doi.org/10.28968/cftt.v5i1.29607.

Headrick, Daniel. 2010. "A Double-Edged Sword: Communications and Imperial Control in British India." *Historical Social Research* 35 (1): 51–65. https://doi.org/10.12759/hsr.35.2010.1.51-65.

Jue, Melody. 2020. *Wild Blue Media: Thinking Through Seawater*. Duke University Press.

Kumar, S. Prashant. 2024. "Telegraphy and Time." In *Sticky Networks* by Iz Paehr. https://stickynetworks.net/time.html.

Mahato, Biplap, and Iz Paehr. 2024. "Writing Telegrams to Fungi, Sending Bytes Across Trees: A Network Walk at Cubbon Park." BangaloREsidency at the Archives at NCBS, Bengaluru, November. https://www.goethe.de/ins/in/en/ver.cfm?event_id=26199706.

Malekian, Kamran. 2024. "Investigating Cable Jelly Compound, Its Characteristics, and Uses." Navid Noor Polymer, June 15. https://www.navidnoor.ir/cable-jelly-compound-its-characteristics-and-uses/.

Mattern, Shannon. 2018. "Scaffolding, Hard and Soft: Critical and Generative Structures." In *The Routledge Companion to Media Studies and Digital Humanities*, edited by Jentery Sayers, 318–26. Routledge.

Microsoft. n.d. "What Is Cloud Computing? A Beginner's Guide." Accessed May 26, 2025. https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-cloud-computing.

Meiners, Jasper, Iz Paehr, Lennert Raesch, and Jörn Röder. 2017. *urbARn city walks*. Stadttfinden Festival, Leipzig, September.

Negroponte, Nicholas. 1995. *Being Digital*. Knopf.

Newland, Cassie. 2022. "Economic Object: Gutta Percha." In *Cultural History of Objects: Age of Industry*, edited by Carolyn White, Dan Hicks, and William Whyte, 57–76. Bloomsbury Academic.

Palma, Paola, and L.N. Santhakumaran. 2014. *Shipwrecks and Global "Worming."* Archaeopress. https://doi.org/10.2307/j.ctv1zckz9j.

Parkes, Larry, and Alan Keeble. 2016. "The *Teredo* Worm and Subsea Umbilicals: Risks and Recommendations." *Underwater Technology* 33 (4): 239–43. https://doi.org/10.3723/ut.33.239.

Parks, Lisa. 2019. "Mediating Animal-Infrastructure Relations." In *Being Material*, edited by Marie-Pier Boucher, Stefan Helmreich, Leila W. Kinney, Skylar Tibbits, Rebecca Uchill, and Evan Ziporyn, 141–53. MIT Press.

Pellow, Daniel Naguib, and Lisa Sun-Hee Park. 2002. *The Silicon Valley of Dreams: Environmental Injustice, Immigrant Workers, and the High-Tech Global Economy*. NYU Press.

Software Freedom Law Centre, New Delhi. n.d. "India's Shutdown Numbers." *Internet Shutdowns*. Accessed June 25, 2023. https://internetshutdowns.in/.

Starosielski, Nicole. 2015. *The Undersea Network*. Duke University Press.

Sundberg, Adam. 2015. "Molluscan Explosion: The Dutch Shipworm Epidemic of the 1730s." Environment & Society Portal, *Arcadia*, no. 14. Rachel Carson Center for Environment and Society. https://doi.org/10.5282/rcc/7307.

Sundberg, Adam. 2023. "Building the Social Cascade: Connecting Culture, Disaster, and Persecution in the 1730s." *Journal for the History of Environment and Society*, no. 8, 29–57. https://doi.org/10.1484/J.JHES.5.142449.

Thorat, Dhanashree. 2019. "Colonial Topographies of Internet Infrastructure: The Sedimented and Linked Networks of the Telegraph and Submarine Fiber Optic Internet." *South Asian Review* 40 (3): 252–67. https://doi.org/10.1080/02759527.2019.1599563.

Tsing, Anna Lowenhaupt. 2011. *Friction: An Ethnography of Global Connection*. Princeton University Press.

Tully, John. 2009. "A Victorian ecological disaster: Imperialism, the Telegraph, and Gutta-Percha." *Journal of World History*: Vol. 20, No. 4: pp. 559-579.

Vaseline. n.d. "Our History." Accessed March 8, 2025. https://www.vaseline.com/us/en/who-we-are/our-history.html.

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