ABSTRACT
The environmental impacts of Big Tech fall disproportionately on economically poor people and countries, meanwhile material wealth concentrates to the few at the top. This essay examines how cloud computing uses the logic of colonality and extractivism to conclude that ‘post-extractive modernity’ is a conceptual fallacy. Using Facebook’s sprawling data center in the ‘Node Pole’ region of Sweden as an example, we’ll find how the data center’s waste heat effectively serves as a foil to Big Tech’s promise of a post-extractive vision. Furthermore, this will challenge the country’s veneer of colonial neutrality by underscoring how the data centers subsist on the ore fields of Norrbotten, effectively staging their progression from an industry that widely contributed to colonization. In sum, this discussion highlights how cloud computing is a form of dissociation from the materiality of data, that creates distance from the impact of cloud consumption in deliberate, albeit dangerous, ways.
Thinking elementally about media infrastructure reveals how virtual space is enveloped in slippages of ecological, economic, and historical cosmologies. Elemental analysis is that which attunes us to media’s constituent parts, or as Nicole Starosielski (2019: n.p.) describes them, media’s “material and conditioning substrates.” In a similar vein, elemental thinking pivots one “toward understanding amalgams of natural and cultural objects through their chemical connections and relations” (Helmreich, 2021: n.p.). Unveiling, mapping, and theorizing about media elements is therefore both an ecological and political undertaking. As such, elemental analysis presents a foray into ecological issues “from an oblique angle,” writes Starosielski (2019: n.p.), “to refuse boundaries between human and environment, and to recast the terms of the conversation in environmental media studies.” This creates a productive space for the integration of ecological, decolonial, and political frameworks.
Shifting our perspective to the spectrum of mediation, the elements prime us to consider the finite materiality of media and our relation to it, from the social inequalities of production lines to the scarcity of mineral resources. An illustrative example of elemental media can be found in the infrastructure that keeps ‘the cloud’ afloat, which will hereafter be referred to as cloudfrastructure. As Mark Graham writes (Graham, 2014: 3):

The Internet is not an amorphous, spaceless, and placeless cloud. It is characterized by distinct geographies. Internet users, servers, websites, scripts, and even bits of information all exist somewhere. These geographies of information shape both what we know and the ways we are able to enact, produce, and reproduce social, economic, and political processes and practices.

As the infrastructure supporting the cloud is often strategically wrought to peripheries of the globe, it is understandable that the Internet is commonly perceived as “everywhere and nowhere in particular” (Carruth, 2014: 340), or as an “abstracted and generalized non-place” (Boellsdorff, 2010: 5). Considering cloudfrastructure through elemental lens helps one to better understand what it means for the Internet to exist anywhere at all. Data centers are sites “where the cloud hits the ground” (Vonderou, 2018: 9); in contrast to the immaterial expanse that the image of cloud computing conjures (Hogan, 2013; Hu, 2015), data centers are capital-intensive structures that impact, as they are impacted by, the more-than-human landscapes in which they are situated.

What is more, data centers are designed to function as containers, a form of enclosure and concealment that ironically shows “media at their most environmental” (Peters, 2015: 40). Extending this line of thought to thinking about our own bodies as containers, and elaborating on the elemental affordances we share with computers, Peters writes (2015):

Our bodies are fire containers, each cell an image of the vestal hearth. Heat control is one of the classic cybernetic processes that unite humans and machines, and it remains the central design problem for the chief medium of our time, the computer.

This emphasis on the relational signifiers across container technologies (as bodies, computers, and data centers) evokes the transcorporeal and transmedial principles that elemental analysis makes explicit. Starosielski describes global communication (powered by cloudfrastructure) in a similar light as moving ‘across and through
infrastructure, ecologies, and bodies’ (Starosielski, 2014: 2504). Another example of this is how Jussi Parikka considers the geology of media—including its minerals and its energy—as intertwined with the conditions and temporalities of the cloud (Parikka, 2015). In sum, thinking through elemental analysis enables one to recognize, theorize, and engage with cloud infrastructure as it impacts the planet and our increasingly digital lives.

Scholars in critical communications have made important groundwork analyzing cloud infrastructure in one particular region. A cluster of Swedish municipalities named for its proximity to the Arctic Circle, the ‘Node Pole’ has become a site of intense interest among scholars approaching cloud infrastructure elementally. As Asta Vonderau (2018) reveals, the Node Pole is a global hub for data traffic has become a widely promoted brand name that creates an imagined space of ‘post-extractive modernity.’ Vonderau (2019) similarly shows how local air is sold as a vibrant infrastructural matter —Nordic Climate—to match the cloud’s infrastructural needs. Mél Hogan (Hogan, 2013; 2016) likens Facebook’s data center to the ‘archive’s underbelly’ and casts a cautionary tale as Big Tech seeks to profit from melting icecaps. Julia Velkova (2016) writes about the computation process by which overheating can result in server failure and notes a gap in scholarly attention to offsetting this threat. This essay attends to
this gap in two ways: firstly, by explaining how the output problem of waste heat is built into the design of cloud infrastructure; secondly, by considering what this issue illuminates about the extractive approach of Big Tech.

This essay therefore aims to contribute to elemental scholarship about the Node Pole using the example of waste heat from Facebook’s data center in the town of Luleå. I will demonstrate i) how the process of extracting and storing data from the cloud not only perpetuates logics of coloniality, but is made possible by the infrastructure and principles of extractivism that are intrinsic to cloud computing; ii) how climate-controlled server halls are vulnerable to their own processing heat, therein emphasizing the elemental materiality of data; and iii) how waste heat is an extractive surplus. Moreover, these arguments will attend to another gap in existing literature; whereas recent scholarship has focused on the materiality of cloud infrastructure and cyber-colonialism (Castells 1997; Zureik 2020) as separate entities, there is a lack of emphasis on their shared dimensions. The incorporation of elemental analysis attends to this gap by further heightening the ecological tenets of (de)coloniality in its critique of extractive infrastructure. Only by emphasizing the (elemental) materiality of landscapes and livelihoods that cloud infrastructure impacts can we make better decisions as consumers of data. Ultimately, this essay advocates for an interstitial frame of decoloniality and political ecology as they are foundational to our digital spaces and experience.

A final detail worth stipulating here is the inclusion of artworks that do not correspond directly to the text, but offer alternate modes of viewing Sweden’s industrial regions. By including various local media and sites, I encourage the reader to visually prize open layers of social, environmental, and political currents as they arise in this reading. These images therefore serve to inspire new imaginings of an area that is, in many respects, hidden from view by its remote location and staging, or what Vonderau calls the (in)visibility of infrastructure. From the selection of images that follow—from an Indigenous artist, a 19th century lithograph, Google Earth street view, and photographs of extractive infrastructure, I hope to expand the reader’s understanding of the Node Pole as a still-extractive yet pluriversal place, thereby challenging the colonial reduction of former Sámi territory as terra nullius (‘nobody’s land’).
Extracting the Past from the Present

The aforementioned scholars explore the environmental and social entanglements of cloudinfrastructures within the Node Pole. In order to critically contribute to this body of work, one must draw a preliminary overview of the region, namely its natural resources, colonial participation, and industrial infrastructure; considering these features and their elemental bearing raises important questions about what the region’s future will inherit from its past. Since the 1600s, the ore fields of Norrbotten have played a decisive role in the world economy by providing excavating rare metals and widely contributing to colonization (Rosendahl, 2017). A telling elemental example

Mathisen, H. R. *Sábmi with only Sámi place names*, 1975. Source: Björn Strömfeldt. This map presents the Indigenous Sámi names for places claimed by Norway, Sweden, Finland, and Russia.
is Sweden’s role as a major supplier of iron chains used in the slave trade (Evans, 2018). As Roger Blomqvist (Blomqvist, 2020) argues, Sweden’s participation in the slave trade relied on a strategic ‘neutrality’ that offered competitive advantages to European superpowers at war. Colonial frictions have their domestic roots in the region as well: the discovery of silver in Lapland in the 1630s catalyzed the Swedes’ colonization of Indigenous Sámi to procure resources that are still extracted today. Mining interests continue to collide with reindeer herding and the settlements that remain.

Blomqvist (Blomqvist, 2020: n.p.) draws a line of continuity in Swedish neutrality from the colonial era to the multinational companies developing the Node Pole. In their search for rare metals and cheap electricity, these companies greenwash the material scourge of their operations as environmentally and socially beneficial because “Swedish environmental protection and working conditions are superior to Chinese ones.” In this pitting of lesser and greater evils, Blomqvist points out cogently that the Sámi have no say in the discussions that decide the parameters and conditions of their backyard. The “higher standards” translate into strategic advantages in the global competition for natural resources that can result in catastrophic environmental and community degradation. One example is that of a massive sinkhole caused by a former iron ore mine that is forcing the relocation of 18,000 inhabitants of Kiruna (Vonderau, 2018: 18). These vignettes— the iron slave chains and the expanding sinkhole—show how the Swedish Crown’s colonial past is imbricated within the economy’s extractive present.
In addition to the ore fields, other natural resources are exploited for cloud infrastructure development. The churning rapids of the Lule river are a critical source of hydroelectric energy, involving major plants and dams initially built for heavy industry. Another resource is as invisible as it is incentivizing for cloud-computing: the Arctic climate. The cooler air has contributed to the transformation of former industrial towns into international hubs of server halls. Across the region one can find examples of high-tech extractivism (Rosendahl, 2017): there is Boden, where some of Europe’s largest Bitcoin facilities mine digital currency at the expense of vast amounts of energy; further north is the sinking town of Kiruna, where mining and space expeditions dive deep into the earth and beyond the sky; and Luleå, where Facebook’s most extensive European data center shares its address with the Northland mining company on a road aptly named Datavägen.
‘Afterlives’ of the Node Pole

The example of Datavägen demonstrates how the infrastructural relations of the Nord Pole collide with the mining industry, hydroelectric power, colonial neutrality, and the server halls, in a constellation of 21st century extractivism. In other words, the exploitation of resources for the sake of capital continues unabated in the server halls of data centers. This continuity perpetuates what Walter Mignolo (2011) calls the logics of coloniality. The term ‘extractivism' can therefore refer both to the literal extraction of natural resources and to the economic superstructure on which capitalism sustains itself. Mignolo describes modernity as trapped within a “colonial matrix of power... of which historical colonialisms have been a constitutive, although downplayed, dimension” (2011: 2). Sean Cubitt (Cubitt, 2014) incorporates this definition into his critique of capitalism as the dissociation of consumption from the environmental and social injustices it entails. In other words, modernity is so enmeshed in colonial relations of power that it only envisions universalist frameworks of limitless economic growth, even as the climate depends on radical social transformation and decolonization.

Screen-capture of Datavägen, Luleå, as encountered through Google Earth.
Kathryn Yusoff (2018) strengthens this emphasis of our earthly plight in her reading of geology as an inherently extractive discipline. As a methodology, it works to ‘cut’ natural resources and labor from their constitutive relations. Yusoff reveals how the grammar of geology designates matter as property and in this process of splitting, how it uproots the relationality between subject and mineral from sociological and ecological fields. In the Node Pole, we see ‘afterlives’ of this process manifest in the the ongoing politics of settler colonialism: from the dispossession of Sámi land and the expansion of drilling into the Arctic, to the mining of iron ore and the extracting of personal data in server halls. Such activities displace matter and people from their relational entanglement by elevating a certain kind of human (white, European) over what modernity designates to be subcategories: reducing natural resources and displaced communities to surplus entities designed to marginalize and exploit; as the extractive operations in the Node Pole circle show, these operations are not mutually exclusive. What modernity can marginalize is often that which it exploits.

This scenario of spatial exclusion, “of place, land, and person,” can be found across all unequal power relations spanning the globe; it is visible in the movement of people and objects, and with them, their racial and material categories (Yusoff 2018: n.p.). Through this extractivism, we see the continuity between what Yusoff describes as various forms of fossilization: mining, extraction, waste, and extinction, “in which movement of energy between enslaved bodies... and industrialized labor [are both] a geochemical equation of extraction in the conversion of surplus.” As with the process of fossilization, timescales in the Node Pole are multidimensional: embedded within cloud infrastructure are the colonial sediments that determine our computational present. This reveals how companies such as Bitcoin and Facebook gesture toward the dynamic of coloniality in their extraction of data and expenditure of waste heat. What follows is an analysis of waste heat as surplus in which I discern the colonial matrix of power. This same matrix is inhered within all forms of infrastructure; in other words, infrastructure is the how of settler colonialism (LaDuke, 2020).
Waste Heat: ‘It has everything to do with being cold.’

Scholars looking at the media environments of cloud infrastructure must consider the extensive cooling processes required to diffuse computation heat. As one Facebook infrastructure director has said of cloud infrastructure: “This has nothing to do with clouds. It has everything to do with being cold” (Blum, 2012: 258). Donal Lally (2019) explains that a computer server processes electricity in three ways: the majority is converted into (surplus) heat through computation, another portion drives fans to push heat away from the server, and what remains is used to drive electrons or photons on the network interface. Therein lies the anomaly of the data center, namely that its threats are self-generating: as the processing power accelerates, offsetting the heat of its own production is critical to its functioning.¹

This phenomenon is revelatory for the elemental analysis of cloud infrastructure for two reasons. Firstly, it departs from traditional thinking about the transmissibility of
temperature. As Starosielski (Starosielski, 2014: 2505) explains, the cold has often been described as inferior to heat because it lacks the ability to transmit information: “for a medium, to be cold is to be off.” For data centers, the very opposite is true—the possibility of overheating means that a “deep freeze” is sought (Hogan, 2016: 52).

Secondly, the susceptibility to overheating illustrates that computer servers are designed to waste more energy than they use. A mechanism that is designed to produce its own surplus therefore performs what Yusoff (2018: n.p.) describes as “a geochemical equation of extraction in the conversion of surplus.” This indicates the capitalistic and extractivist determinism inherent within cloud infrastructure, as with any system that extracts value to generate surplus.

The issue of waste heat thus articulates the interlinkages between media culture and a variety of material agencies (Parikka, 2015). More specifically, waste heat reveals a colonial matrix of consumption, dissociation, and wastage that designates waste not merely as the by-product of consumerism, but as fundamental to the production of consumer capital. Cubitt demonstrates how energy industries were designed to waste power even before the privatization of national energy grids, as they were formed by distancing the division of labor between suppliers and consumers. With the move to electrical power, the distances increased. Today, this takes various forms from waste produced by the economic model “new debt for new sales” (Cubitt, 2014: 82), to the structural waste produced by industries such as electricity and transmission.
The Node Pole is an example of this latter process with its hydroelectric resources far removed from population centers and reachable along transmission lines. There is thus a strategic formula to this effect, in which wastage becomes intrinsic to the management of electrical industries. As Cubitt (2014: 82) writes, “for every kilometer of transmission, there is a corresponding loss of energy, converted to heat, waste, magnetic fields, and noise.” What this inbuilt waste achieves for corporations is the guaranteed profit over heat that cannot be consumed. In the case of cloud infrastructure, waste heat is no longer released at the point of production but over the networks as a whole. In the context of data centers, then, the environmental function of integral waste is amplified; once dispersed into the commons, waste heat is then disregarded as economic externality.

As Donal Lally (2019: n.p.) explains, data centers are “a stable source of exhausted heat” since they are constantly in operation. In order for a data center to be truly sustainable, both the input and output electricity sources have to be managed in renewable ways. In the context of Facebook’s data center in Luleå, the hydroelectric plants achieve the input requirement; however, the persistent output issue of waste heat has yet to be solved. Conversely, Facebook’s data center in Denmark more efficiently manages waste heat (Lally, 2019) and research is ongoing to improve heat recycling by injecting thermal energy into a local district heating network (Lucchese, 2019). For Luleå, the desire to reduce waste heat has been less pronounced. This was disclosed in a report published by the Länsstyrelsen (County Board) of Norrbotten that stated waste heat would only be addressed insofar as it created “conditions for innovation, leadership and growth while creating a strong confidence in the region for investors and to attract businesses” (Vié, 2017: 23). In other words, Luleå’s issue of waste heat prevails for lack of economic incentive to fix it.
Data Extraction as Behavioral Surplus

When analyzed through the lens of decoloniality, Facebook’s data center portends a dubious motive: the desire to connect the world bears striking resemblance to colonial ambitions. This scale of infrastructural ambition echoes Enlightenment philosophies of free exchange and liberal economics as they formed the vision of a perfectly connected world (Johnson, 2019; Larkin, 2013; Mattelart, 2000). In addition to this, there is the undeniable fact that although former colonies have achieved independence in the new global order, they remain methodically bound by the colonial matrix of unequal power relations. For example, formerly colonies (especially in the Majority World) now rely heavily on foreign company investments in order to participate in global trade. Furthermore, the economic structures that ‘invisibly’ serve the same function are, as Blomqvist (Blomqvist, 2020) notes, more cost-efficient that owning empires.
These new forms of extractivism (as linchpins of an economic logic) now implicate various scales of social life. Consider, for instance, the threat of surveillance capitalism. As Shoshana Zuboff (2019: 16) writes, Facebook “unilaterally claim[s] human experience as free raw material for translation into behavioral data [which] are declared as a proprietary behavioral surplus,” that is processed through “machine intelligence,” and fabricated into prediction products to be traded in “behavioral futures markets.” Hogan similarly describes Facebook as a global surveillance empire, implicating the cloud as a giant surveillance apparatus of personal data. And as this essay has shown, wherever the cloud hits the ground, the communities, minerals, and warming climate that precariously surround it are also impacted. Echoing once more the writings of Yusoff (2018: n.p.), our virtual selves are currently becoming the surplus of both mineralogical and data-based extraction. This dissociation, or cutting, from our imagined space of privacy reveals the cloud as the ultimate denominator in its delegation of the human to “the inhuman... across categories, material and symbolic, corporeal and incorporeal, intimacies cut across life and nonlife in the indifferent register of matter.” This, yet again, allows the settler-colonial mindset to thrive in digital spheres.

**Conclusion**

In a world of rising inequalities, where material wealth is ever more concentrated in fewer hands, and the environmental impacts of Big Tech fall disproportionately on the planet and its poorest people, there is an escalated need for decolonial reckoning (Cubitt, 2014: 279). Elemental analysis, as that which underscores the ecological and political currents of cloud infrastructure, can assist in this process of reparation and remediation. This essay has examined Sweden’s colonial history to reveal how patterns of extraction tessellate across the space of data centers under the opaqueness of the cloud. The introduction of data centers to the Arctic have not achieved Big Tech’s post-extractive promise; rather, cloud infrastructure is built upon, and engrained with, processes and principles of extractivism. In this context, waste heat does more than present a foil to a post-extractive future; it reveals in elemental ways how the cloud economy is mechanized for profit.

This essay has thus demonstrated how the concept of ‘post-extractive modernity’ is a conceptual fallacy using the example of Facebook’s sprawling data center in the Node Pole. I endeavored to unsettle Big Tech’s claims of post-extractivism by conjoining key
concepts in elemental media theory, cloudfrastructure studies, and the school of (de)coloniality. This discussion interpolated the region’s colonial neutrality, industrial infrastructure, and climatic conditions in an effort to reconfigure ‘extractivism’ in the context of an increasingly digital age. Furthermore, I revealed the links drawn between the mining, storing, and processing of rare minerals and personal data both conceptually and concretely. This highlighted the ways in which the Swedish Crown’s checkered past of colonial neutrality and heavy industry is veiled in public debate, allowing for its contemporary renown of ‘high standards’ to proliferate.

The Node Pole, as a brand, was further articulated in the context of the global competition to control natural resources, secure market shares, and therefore capitalize on the cloud. The extractive blueprint of cloudfrastructure was further demonstrated through the example of waste heat as economic surplus and, as briefly mentioned, the cloud as an apparatus for surveillance capitalism. In sum, this discussion problematized the immaterial framing of cloudfrastructure in cultural awareness, and highlighted how this form of dissociation from the materiality of data works to create distance from the impact of its consumption in deliberate ways.

In thinking about the juxtaposition of Big Tech and climate change in the Arctic, where incentives for tax breaks and deregulation pose a stark contrast to the reality of rapidly melting icecaps, data centers are compelling sites of inquiry. Most importantly, they underscore the urgent need to flip the equation in how we approach the environment in a digital world (Hogan, 2016: 53). Instead of viewing the cloud as outside of the environment, the task instead becomes to consider the place of its infrastructures within the environments they inhabit. Only when we approach infrastructural spaces as complex media ecologies can we begin to imagine their post-extractive future. Approaching the environment extractively is “a broken formula for progress” (Hogan, 2016: 53). This essay therefore joins with a chorus of media and decoloniality scholars whose rallying cries to address coloniality build with the crescendo of a warming planet and swelling social inequality. It is of paramount importance that we flip the equation in our assessment of the environment to reify ecological and social collapse lest our planet spirals further into feedback loops of haunting register.
Works Cited


Footnotes

1. Other causes of server failure are overtly elemental, such as electrical problems and water leaks.

2. As Mel Hogan (2016) writes, this is “more than analogy for Big Tech’s quest to store and preserve memory.

Citations


