SCHOLARLY ARTICLE

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Where "the Cloud" Touches the Ground: Electronic Poetry, Digital Infrastructures, and the Environment

Experiences in virtual online spaces are frequently perceived as intangible and abstract, or at the very least de-materialized. In the popular imaginary, these electronic interactions are powered by "the Cloud," which stores and routes personal data at super-human speed, via satellite systems. Over the last twenty years, this notion of digital impalpability, weightlessness, and velocity has been reinforced by a dramatic increase in the use of portable, lightweight devices. Smartphones, tablets, and laptops are, of course, only the wireless interfaces of the Internet's cabled infrastructure. Online meetings, streamings, and purchases rely on vast racks of plugged-in, stationary servers, situated in real places across the planet. These huge data farms are connected across continents via submarine fiber-optic cables (Starosielski 4). It is not a cloud but these cables—snaking beneath the oceans—that carry 99 percent of global Internet communications.

In *The Prehistory of the Cloud*, Tung-Hui Hu argues that artworks can powerfully "bring into focus key moments in the [C]loud's development," stimulating alertness to and "critique [of] the environmental and social impacts associated with its scale" (xii). The specific focus of this article is on *literature's* capacity to foreground these issues. To do so, it analyzes electronic literature that challenges the ideology of "the

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Cloud," an industry metaphor that occludes the materiality of digital media use (such as energy consumption and undersea cabling). This article makes a case for e-literature's ability to de-mythologize the further belief that "the Cloud" eludes human scale and the associated idea that it exists only as a massively distributed intangible elsewhere (such as in Timothy Morton's paradigm of the "hyperobject" as ungraspable (1)).

My focus is the web-based version of J.R. Carpenter's 2016–17 poem-essay, *The Gathering Cloud*.[1] This e-text offers a striking investigation into the environmental and social impacts of contemporary Internet use, mobilizing the poetic arts to show how naturalizing metaphors enable widespread disavowal of these impacts. The interactive digital components of Carpenter's work engage readers with the realities of infrastructural development, making palpable end-users' everyday complicity in digital geopolitics. This complicity includes our encounter with e-literature itself.

I offer a close reading of Carpenter's *The Gathering Cloud* (which lists Hu's critical work as a key source and embeds samples from it within its textual body). First, I analyze how Carpenter's layering and sedimenting of textual and graphic sources illustrates how old media physically undergirds new media (e.g. fossil technologies literally underlie cloud technologies and telegraph cables form the foundations of digital cabling). Secondly, I examine how her e-text's literary remediation of industry-generated language and imagery dismantles the illusion of cloud computing as a highly abstracted, fetishized non-place. Through attention to Google's carefully staged images and virtual tours of its colossal data farms—which invite consumers to experience "the magic" of seeing inside "the home of the Internet"—I consider how literary acts of re-materializing the unglamorous and hidden workings of "the Cloud" make discernible what might be called, following Bruno Latour, the "terrestrial" dimensions of Internet connectivity (i.e. non hyperobjectified) and what Susan Leigh Star terms its "backstage" elements (4; 327).

It is tempting to see this kind of creative work as trying to ground the "floating world" of the digital imaginary. Yet "the Cloud" is neither *up* (in the air) nor *down* (under the ground), but simultaneously both, as scholars and artists have often observed, from Starosielski and Hu to Trevor Paglen's investigation of the in/visibility of the Internet of Things in his exhibition *The Shape of Clouds* (2019) and Taylor Coburn's cycle of writings and data-center performances *I'm that angel* (2011–). It is not that cloud=false, ground=true. Rather, the positionality and motion of signal traffic is plural, hybrid, polydirectional.[2] Digital collage is one way of enabling readers to picture their own participation in these multiple informational "flows": up and down, over and beneath,

moving in clouded opacity, horizontally shifting, looped, stuck and interrupted (Parks 122). Such work visually and linguistically showcases the trans-historical crisscrossing of communication infrastructures, entangled cloud nomenclatures, and technological and artistic knowledge forms. It stimulates more embodied understandings of the seemingly abstract and immaterial role of end-users in cloud computing.

However, it is also worth considering a thicker conceptualization of the metaphor of bringing the Cloud "down to earth," along the lines Latour proposes (33). Latour argues for a planetary need for "terrestrial" ways of being: those which can pull human activity and desire away from the habits of "out-of-this-world" thinking (33). The latter is based on a philosophy of ever-expanding progress that negates the limits and pressures of reality, as might be seen in the early twenty-first century growth of climate change denial and appetites for extra-planetary expansion (e.g. space mining, space tourism, off-loading polluting industries, and waste to space). Carpenter's literary project resembles Latour's insofar as it recognizes the need for frameworks that foster non-violent and anti-colonizing *planetary co-existence with* ecological and environmental actors. This essay considers the ways in which her focus on the geopolitics of Internet use is integral to a collective terrestrial call to imagine better Earth systems, to participate in earth-bound practices that enable diverse planetary agencies, and to acknowledge humans' dependence on ecological agents (rather than a vertical exploitation of them).[3]

I will add one final word of introduction to the work of J.R. Carpenter, with which some readers may not be familiar. Operating across performance, print, and digital media, Carpenter is a Canadian-born, UK-based experimental writer, artist and researcher, whose reputation is growing considerably. Using the internet as a medium for creating and disseminating hybrid poetic-essayistic texts, Carpenter's work investigates topics including technological development and anthropogenic climate change, environmental violence, digital colonialism, and the politics of new media and internet history. Her critical-creative essays have also examined the intersections between media archaeology, digital literature, meteorology and mapping, performance writing, site-specific poetics, and locative narrative.

The Gathering Cloud was first commissioned as a web-based text in 2016 by NEoN Digital Arts Festival (Dundee, UK), a platform that seeks to advance the understanding and accessibility of digital and technology-driven art forms. Carpenter's piece has subsequently been performed and presented in galleries, museums and at online readings around the world. It has also been published as a book-length

collection including a new extended first section with photographs, a foreword by new media theorist Jussi Parikka, and an afterword by poet Lisa Robertson.[4] The focus of this article is on the web-based iteration of *The Gathering Cloud*. For it is here that Carpenter's piece engages in *addressing electronic problems electronically.*

Making visceral the social and environmental impacts of "the Cloud" on which audience engagement with it depends, Carpenter's e-text engages readers in historical problems of power, access, and visibility that are inherent in cloud computing's development. Through its six interactive sections (a "Frontispiece" and five "Plates"), *The Gathering Cloud* presents the reader with a sequence of six GIF-animated digital collages. Each is composed of appropriated materials from publicly available sources. Each is a palimpsest that shifts one's gaze (and cursor) between contemporary tech mags and seventeenth-century meteorology, philosophy and theology, engravings and literary history, and more. One interacts with this composite work "through" its sedimented layers. As we will see, this process resembles an archaeological find and an electronic re-animation of historical shards. Readers are participants. We engage in digital acts of unearthing and salvage as the e-text invites us into its assimilative fabric, which grows out of and reworks its sources. *The Gathering Cloud* is a composite form that points to its own "prehistory" as well as that of the technologies underpinning it and our engagement with it (Hu xx).

Visualization

In its form and construction, *The Gathering Cloud* emphasizes a dimension of electronic poetics that still tends to take a backseat in Humanities-based literary scholarship (though it is well-documented in Social Sciences research). Research into e-poetry has often focused on genre, authorial production and reception, as well as encoding and textual interpretation. Conversely, Carpenter's piece stimulates attention to the complexly networked *means by which* its texts and images arrive on our screens: "An email may travel thousands of miles/and pass through multiple data centres/to send a photograph across the street" (*GC Print* 88). So too with her digital text. Routed through "[a]isles of servers with amber, blue, and green/lights flashing" (*GC*, Plate No. 3; see fig. 1), *The Gathering Cloud* emphasizes how it makes its way to its readers via data centers connected across continents.

Visually and linguistically, *The Gathering Cloud* emphasizes its dependence—as a work of e-literature—on data being cabled across a global grid. As Carpenter points out, this de-naturalizing approach to its "cloud formations" contrasts with the familiar metaphor of

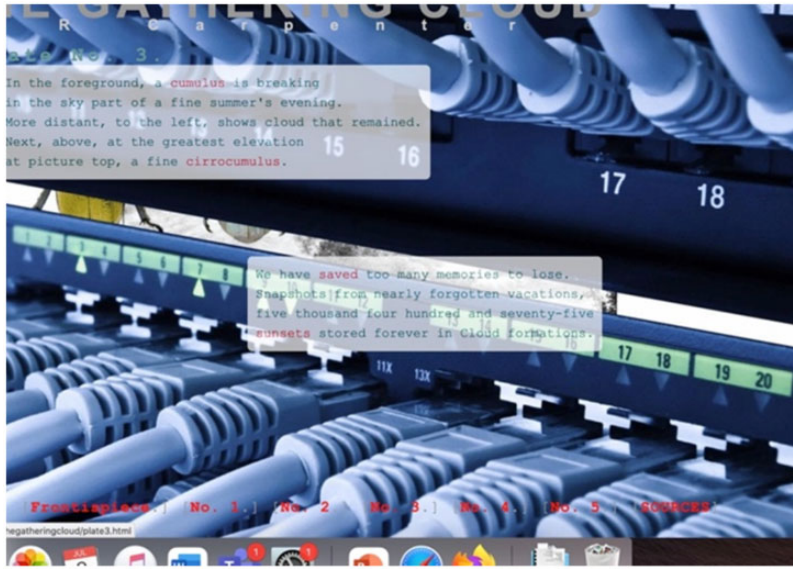

Fig. 1. J.R. Carpenter. *The Gathering Cloud*. 2016. Screenshot of Plate No. 3.

information carried by an atmospheric cloud, which belies data's physical reality:

> The Cloud is an airily deceptive name
> connoting a floating world far removed
> from the physical realities of data. (*GC*, The Frontispiece)

Carpenter investigates how and why the cyberinfrastructures end-users rely on have remained intangible to so many. In so doing, her work creatively addresses a question influentially posed by Nicole Starosielski in 2015: "Why have undersea cables, as the backbone of the global Internet, remained largely invisible to the publics that use them?" (*Undersea* 3) Part of the visual-conceptual barrier has been the scale of cloud storage and transmission. Planetary data flow exceeds the capacity fully to sense, experience or understand it. "The Cloud" is beyond human scale. Morton coins the term "hyperobjects" to point to such presences, which are "massively distributed in time and space relative to humans" (1), and thus are confounding (his examples include climate, global warming, oil). "Because it's distributed across the

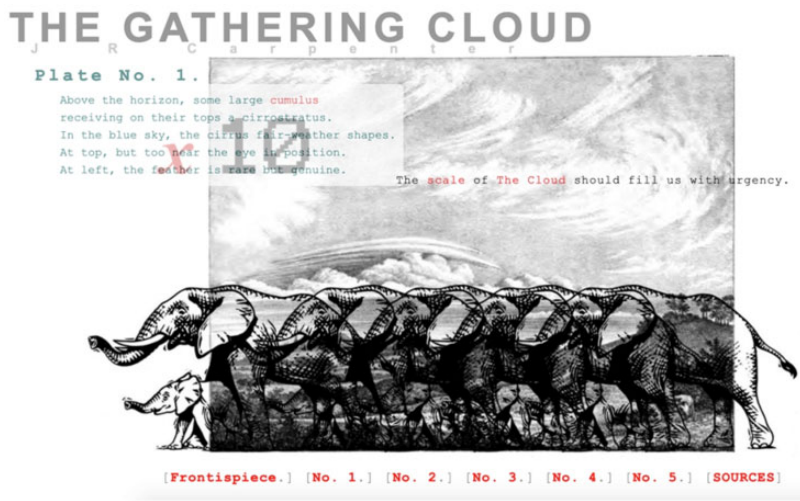

Fig. 2. J.R. Carpenter. *The Gathering Cloud*. 2016. Screenshot of Plate No. 1.

biosphere and beyond, it's very hard to see as a unique entity . . . it involves a massive, counterintuitive perspective shift to see it" (49). Morton is speaking of climate change, but the point might well apply to cloud computing.

Carpenter's animated GIF collages make clear that her e-text's own content—and our reading—depends on the often-invisible labor of energy-hungry data farms and cable infrastructures. *The Gathering Cloud* helps readers to visualize the circuitous terrestrial, aerial, and submarine routes that digital content takes: these pathways have frequently been considered "indiscernible" or have been tacitly obscured. Working across visual and textual media, the poem-essay makes palpable its networked dependency on undersea cables, "banks of generators" and server farms, as it digitizes and poeticizes its own "Cloud formations" (*GC*, Plate 3; see fig.1). These tangibles are reinforced through numerical and animal imagery, as mathematical and creaturely figures flash up. In Plate No. 1 (see fig. 2), adult and baby elephants rapidly flock the screen. Their too-fast digital multiplication and replication contributes to the sense of the enormity and weight of a "gathering" that should "fill us with urgency."

Star has described the functioning of digital infrastructure as "ecological," part of the "balance of action, tools, and the built environment" (377). Carpenter's e-text utilizes the literary arts to emphasize the "[im]balance" caused by a twenty-first-century reliance on

superfast route-making. Its focus on the media ecologies of the "built environment" on which the growth of data storage and ever-faster circulation depends also underlines poet and readers' own compromised positions within the nodes and circuits of the information economy.

Hovering a cursor over the word "scale" in Plate No. 1 calls up the following text:

> An estimated 1.8 trillion
> gigabytes of digital information
> are created and stored globally each year
> by ordinary consumers with no sense
> that data is physical and storing it
> has a direct impact on the environment. (*GC*, Plate No. 1)

These lines observe the "direct impact" of technological practices that create and store growing quantities of "digital information". From shopping, banking, streaming films, sharing photographs, reading or watching e-poetry, to engaging in academic research communities, cloud computing permeates daily activity for many in the global north.

But even when so-called "ordinary consumer[s]" realize they that their holiday snaps, or Zoom meetings are having "a direct impact on the environment"—on a scale comparable to air travel—the challenge is what to do about it. How to engage in less resource-intensive "energy practices" (Gabrys 2096)? During the first wave of the COVID-19 pandemic, I—like others—digitized innumerable hard-copy books and articles that were on undergraduate reading lists. Although many staff and students have been keen to get back into the physical library, access to digitized resources has remained an institutional priority. Adapted patterns of access are not always easy to reverse. At the time of writing, electricity-hungry "technological habitats" are the "new normal" of research and teaching (Peters 38).[5] Some have even interpreted this shift positively in terms of the HE carbon footprint.[6]

Carpenter is thinking, too, about the digital footprint of the art world and poetry industry. What are the ethics of an electronic poet's and reader's engagement through cloud computing, given the natural resources needed to power it, and the environmental waste it produces? If "[t]he term The Cloud refers to a cultural fantasy," as Carpenter observes, this fantasy has been common since at least the 1960s, when terms like environment, ecology, and ecosystem began to prevail as metaphors for the "life" or "death" of emerging technologies (*GC*, Plate No. 2).[7] Carpenter's e-text produces creative and critical friction

for habituated ways of articulating such relationships, by pointing to "the Cloud's" polluting, post-industrial reliance on chemical and mechanical production methods. The piece observes how big data involves the extraction of earth's raw materials and massive appropriation of its energy, as well as the production of toxic waste:

> Tech giants Apple, Amazon, and Microsoft
> power their twenty-first century clouds with
> dirty nineteenth-century coal energy. (*GC*, Plate No. 2)

> Data centres worldwide use thirty billion
> watts of electricity annually.
> Most of that is spent on avoiding downtime.
> Guarding against the event of grid failure
> banks of generators emit diesel exhaust. (*GC*, The Frontispiece)

The energy needs of the data cloud are leviathan. Amongst Carpenter's key source texts is a 2012 *New York Times* article by James Glanz, "Power, Pollution and the Internet," which observes that "a single data center can require more power than a medium-size town." He is quoting the industry expert, Peter Gross, who collaborated in the design of hundreds of such buildings. The *Times* 2011-12 investigation that Glanz's piece reports on—and which is cited by Carpenter—found that "data centers can waste 90 percent or more of the electricity they pull off the grid," and that "on average, they were using only 6 percent to 12 percent of the electricity powering their servers to perform computations" (Glanz). *The Gathering Cloud* further re-works (and visually materializes) Glanz's remark that the remainder of this electricity was mostly used "to keep servers idling in case of a surge in activity that could crash their operations," and that "[t]o guard against a power failure, they . . . rely on banks of generators that emit diesel exhaust." Carpenter translates into hendecasyllabic verse from an estimation of the International Data Corporation and the EMC (a company focused on the management and storage of data) that "more than 1.8 trillion gigabytes of digital information were created globally last year [2011]" (Glanz). Carpenter collages this (in *GC*, Plate No. 1) with shards of Glanz's comment: "About three-quarters of that data, EMC estimated, was created by ordinary consumers."

As Carpenter is aware, her text is by no means the first to reveal that the current scale of cloud computing can be environmentally deleterious.[8] In the years between 2012 and the publication of *The Gathering Cloud* in 2016, data centers were being increasingly targeted by environmental activists following the media's uncovering of their astronomical consumption of energy, including "dirty" (non-renewable) forms. By using poetry to collage industry sources and newspaper reports from this period, *The Gathering Cloud* primes readers to spot something easier to miss: the naturalizing language norms around signal traffic.[9] Reading Carpenter involves tuning in to the metaphors—visual and linguistic—used in the promotion of cloud computing and Internet products. This produces a new sensitivity to idioms deployed in journalistic exposés of the energy requirements of data farms, and in arguments against (and for) the rise of big data, both by industry professionals and laypersons.

"It's staggering for most people, even people in the industry, to understand the numbers, the sheer size of these systems," remarks Peter Gross.[10] A key tension probed by *The Gathering Cloud* is that between qualitative and quantitative descriptions of twenty-first century data's functioning and impact. Drawing from popular and industry-led language, Plate No. 1 harnesses idioms of data measurement, citing the "1.8 trillion gigabytes" of information produced annually. It pulls up a statistic for a typical-sized cumulus cloud, which weighs "half a million kilos," a figure that is likened to the "weight of one hundred elephants." The structure of the simile is reminiscent of a statistical analogy in the *Times* report: "digital warehouses use about 30 billion watts of electricity, roughly equivalent to the output of 30 nuclear power plants," as well as a popular comparison between elephants and cloud weight: "the average cumulus cloud (1 km cubed in size) weigh[s] around 550 tonnes—the same as a herd of 100 African elephants," as a 2014 *Guardian* article reports.[11]

Why all these figures? What lies behind the proliferation of numerical data, as well as the plasticity of metaphorical comparisons between human and non-human figures? Carpenter's use of the elephant-cloud analogy hints at the conceptual hooks offered by creaturely scale in the presentation of "pure" numerical data. Numerical trillions and billions gesture toward the upper parameters of comprehensibility and countability. What does "half a million kilos"—as opposed to a million kilos—actually feel like? The graspable heft of the elephant helps flesh out the abstract numeric for cloud weight. It is an organic, qualitative comparison initially suggested by Peggy LeMone, a meteorologist and cloud researcher who worked with the US National Center for Atmospheric Research and began experiments in calculating cloud

weight in the 1990s. The enormous numbers and figures are incommensurate with lived experience and call out for a metaphorical or at least embodied marker.

Still, we might ask: to what extent can e-poetry—in combining graphic, visual, and literary arts—help make graspable the materiality of signal traffic? To what extent *should* Carpenter's text perform in this way? What problems lurk in the politics of visibility, and in the instrumentalization of the literary and visual arts to this end? Johanna Drucker, writing on the "practices of data visualization," has argued that the tools used in "visualization" are often treated as if the representations they render provide direct access to "what is" (*Graphesis* 125). The distinction between scientific observation ("the act of creating a statistical, empirical, or subjective account or image") and the phenomena observed appears to be collapsed (125). In short, a recipient is at risk of taking the representation literally.

In 2012, following the expose of the gargantuan energy consumption of data centers, a rigorous publicity and strategy was launched by many major tech companies—including Google, Apple, Facebook, Amazon—in response to questions about transparency, and visibility and accountability of their cloud computing operations. In the years leading up to the publication of *The Gathering Cloud*, public debates raged around the environmental impacts of cloud computing, and the opacity and impenetrability of the vast server farms used to power the Internet. In response, each company released a flood of data center imagery and information.[12] Google offered up technicolor photo galleries, 365-degree tours and video footage of their server farms. Facebook included on its corporate website dedicated pages detailing its energy impact, live graphic representations of energy usage in two data centers in North America, and dashboards that monitor and visualize its centers. Amazon produced high-definition footage of its "fulfilment centres" (digital warehouses) and short video interviews with workers. Microsoft made available QuickTime video tours of data centers.

These theatrics of transparency were accompanied by the promotion of corporate cloud infrastructures as embracing clean power. Some companies made available their year-on-year increasing rates of Power Usage Effectiveness (PUE) and Water Usage Effectiveness. Others publicly declared their objective to achieve 100 percent renewable energy at all server farms. Many produced extensive imagery and solicited news coverage of their new "green" data centers—often relocated in Nordic countries where the external temperature drives down the vast energy requirements of the effective thermocontrol of servers. Indeed, the websites of almost all large data centers today include an

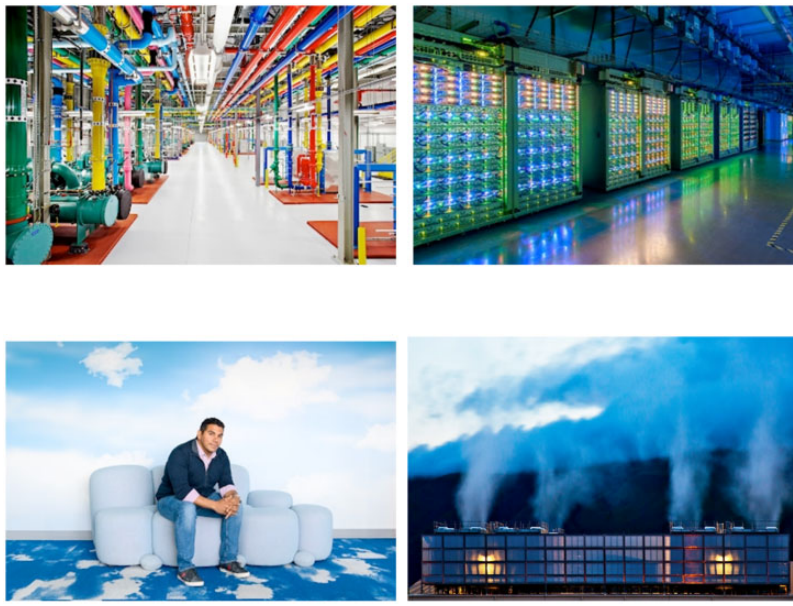

Fig. 3. Connie Zhou. Photos for Google's "Explore our Photo Gallery".

image gallery and virtual tour where glossy images of their otherwise impenetrable interiors can be accessed.

The "Explore our Photo Gallery" on Google's page offers photographs by Connie Zhou (fig. 3). Such images present an intense hyperstylization of glowing rows of server racks and color-coordinated pipes. They turn functionality into a kind of abstract art. There are shots of server farms nestled into natural vistas; glass buildings with billowing clouds above; fresh-faced employees seated on cumulus-shaped sofas against cloud-filled backdrops. But much is also inevitably kept out of sight. Such images do not show to a curious audience the unphotogenic backstage spaces where transformers, chillers and generators are housed, or the mechanical and technical dimensions of Google's infrastructure design and its energy use. They are not attempting a visualization of the protocols, constraints, and affordances that are built into networks in order to maximize performance and minimize costs. We are not encouraged to perceive these spaces as part of the regulation of plays in the global distribution of data from storage to consumer (e.g. the Internet Service Providers and Content Delivery Networks that have "peering" arrangements). There is nothing to

suggest the human labor that is required for laying and maintaining cables, and mining and recycling rare earth minerals.

Many dimensions of signal traffic are hard to visualize. For example, the fraught jurisdiction of the data that is processed, circulated and transmitted among millions of data centers globally every second. Google is also understandably not keen not to expose the technical details of its servers or its networking capabilities, in the interest of security and competition. Nevertheless, the supposedly "behind the scenes" images that *are* released help divert public attention from what Star calls the "boring" and "backstage elements" of signal traffic (the ethically sticky environmental challenges of cloud computing) ("Ethnography" 377). These might include the green routing problem (how to find the best path to carry a job from the user to its destination), or the scheduling problem (determining green energy resources between data centers and grid network). The management of all these complex factors—and more—is a crucial part of what enables me to take a 365-degree tour of—say—a Google data center from my office desk. Being encouraged to look at aesthetically pleasing (and easily graspable) images of pipes and racks helps divest me of curiosity about the invisible aspects of my everyday internet use. Such as, where precisely am I storing my personal data when I save it to "the Cloud"? It is perplexing to try to imagine a destination: numberless, undisclosed locations, using servers that I will never be able to see. What also remains opaque in relation to my routine online access are its relations with issues like rising energy demands, rare earth mining, global regulatory tools (which often fall short of what is necessary to maintain current policy goals effectively), the processes of labor and global labor relations, and the distinction between public and private communicative contexts. More accurately visualizing these dimensions of Internet traffic would be tricky, but also, what would incentivize Google to encourage people to consider it at all?

Instead, "[b]y disguising infrastructure as part of the natural environment" as Lisa Parks observes in "Around the Antenna Tree", "concealment strategies keep citizens naive and uninformed about the network technologies they subsidize and use each day." The result is an impoverishment of "infrastructure literacy" in the very moment that many people pride themselves on being members of a "networked society." Clearly, Google's data center photographs do not really "reveal" to the public the "home of the Internet" (as the company has frequently dubbed its server farms).[13] Even as the photographs gesture toward the ideal of transparency—glass, reflections in the lakes, blue skies, etc.—they conceal the "boring," complex, corporeally dangerous, and ethically dubious aspects of cloud computing.

Many corporate images of data centers thus carry out a form of hiding in full view, insofar as they encourage audience fascination with spectacular spaces (at the expense of "infrastructure literacy"). Glossy, shiny, well-organized, technicolour, vast data centers: the viewer voyeuristically delights in being granted an exceptional peek into what is usually physically off-limits, high-security, not within view. The "reveal" enables me to peer "behind" the walls of these immense spaces, and "come inside" the Internet's vast "home," as Google's corporate website invites the public. (All this is more thrilling than the gray cables and black router boxes of my domestic setup.) Onlookers are ushered into a fantastic elsewhere, which has been compared by Google's visitors—and indeed employees—to "Willie Wonka's chocolate factory."[14]

Carpenter's Plate No. 3 (fig. 1) draws our attention to the politics of this public relations push. Her GIF inverts voyeuristic enjoyment of forbidden spaces: the colorful screen dominated by server racks parts to reveal . . . a (largely) grayscale poetic text, and the issues of cabled infrastructure. The literary work suggests how the viewer's excited exploration of data farm "interiors" hinges on a desire for denied access. Yet the images on show are not "transparent": the pleasure written into looking/wandering involves strategically divesting the object (wire, switch, pipe, router) from its real purpose and transforming it into what Brian Larkin calls an "excessive fantastic object that generates desire and awe in autonomy of its technical function" ("Politics" 333).

These image repositories and video tours of data farms encourage a visual fetishism that, as Alan Liu writes, "subtracts the need to be conscious of the geography, physicality, temporality, and underlying history of the links between nodes" (Pound and Liu). The so-called "home" of the Internet isn't static: it is *distributed* and *in motion*. This is why, rather than encouraging readers to imagine that the Internet can be "visited" at the node of the data center, Starosielski describes it as emerging continually across sites, as signal traffic *moves* and "get[s] tangled up in coastal politics at landing points, monitored and maintained at cable stations, interconnected with transportation systems and atmospheric currents, and embedded in histories of seafloor measurement" (2). Carpenter brings these shadowy geographies into the picture, sedimenting them as material, but only half-perceptible: ghost presences. These encounters flicker uncannily onto our screens. *The Gathering Cloud* posits the Internet as a thingly and multi-agental "gathering" place, which relies on imperfectly visible systems, and not-quite-graspable exchange.

Google's podcasts repeatedly use the term "magic" to describe Internet operations.[15] *The Gathering Cloud*, in contrast, offers a

counterpoint to out-of-this-world rhetoric. Carpenter's work also pushes back against the hypervisible corporate imagery used to visualize *some* parts of cloud computing (enabling *most* of its relations to fall into obscurity). Holt and Vonderau describe as this as an all-too-familiar "mode of governing that disavows itself while at the same time constantly overexposing its material designs" (81). The visual and lexical politics of overexposure-as-disguise—which enables public and scholarly *disavowal*—has resulted in data centers and digital media infrastructure being extremely "difficult to research," not only in the humanities but also in the fields of archaeology and media studies (76). I have been suggesting that Carpenter's poetic approach enables a flourishing of imaginative practices that whets the appetites of ordinary readers—and scholars across disciplines—to imagine new vocabularies for such technologies. It also foregrounds how the current (institutionalized) visual domain does not work in the public interest. A key question such poetic work raises is: how might creative practices aid public understanding of the impacts of the current scale of computation on issues of social, ecological, and environmental justice?

Technological Ghosts: Strata, Cover, and Excavation

> "[F]rom where do our notions of materiality
> stem, and what is their ground?"
> (Parikka. *A Geology of Media* 3)

"New infrastructures do not so much supersede old ones as ride on top of them, forming physical and organizational palimpsests—... over time these pathways have not been diffused, but rather etched more deeply," writes architectural historian Kazys Varnelis ("Centripetal City"). In a "Sources" section, Carpenter explains that the images comprising *The Gathering Cloud* were "appropriated from publicly accessible cloud storage services," and that her e-text is composed of "animated" collages of diverse textual and visual sources (*GC*, "Sources"). Aggregating different knowledge modes and technologies, Carpenter layers up the links between found texts across media. Her e-text is an anti-chronological constellation of forms, moving in a (cloud-like) state of perturbation, turbulence, emergence.

This section focuses on Carpenter's poem-essay as a diachronic investigation of the workings of cloud computing. I consider what is at stake in the way that *The Gathering Cloud* traces the interconnected evolutionary paths of contemporary and pre-existing media forms, as well

as their development from earlier infrastructures.[16] This compositional hybridity not only provides a shared contact zone between science and art, and textual and visual cultures, but also creates palimpsest-like Plates that overlay specimen photographs from scientific research papers and digitized atmospheric sketches; mathematical formulae and modified textual fragments from classical antiquity to now (including the atmospheric hypotheses of Aristotle and Lucretius, meteorological studies of the Enlightenment and Industrial Revolution, twenty-first century news articles, and the digital marketing of media technologies). These busy interactions show multiple temporal elements plotted at once: the work is striated in ways that slow down the "flow" of digital encounter.

On the one hand, *The Gathering Cloud* ensures that readers grapple with phrases and forms that are in motion. We see sliding, linked textual objects, images, bodies, symbols, and lines. On the other hand, reading involves engaging with a range of situated (but weirdly peripatetic) historical artistic, technological and scientific artifacts. Carpenter's image-texts mobilize their heterogeneous subcomponents, and exhibit the time-stamp of particular systems of thought.

Take as example Carpenter's Plate No. 4 (see fig. 4). It yokes elements from the literary, visual and plastic arts with specific moments in the history of meteorological and technological development. In the foreground is the static poetic text. Hovering a cursor over the individual words that appear in red allows the reader to access further short stanzas of linked poetic material. The background comprises a digitized image of a particular 17th-century cloudscape: a lithograph of the common cumulostratus cloud that was first identified, sketched, painted and named by the pharmacist and amateur meteorologist Luke Howard. The image is derived from Howard's *Essay on the Modification of Clouds* (3rd edition, 1865) as "Plate No. 4" of five Plates. First proposed in an 1802 lecture to the Askesian Society, Howard's influential classification of clouds into key types—mobilizing the Latinate terms stratus, cumulus, cirrus, nimbus—offered a nomenclature still used by meteorologists today (see fig. 5).

Each of Carpenter's five Plates (and The Frontispiece) digitizes one of the images from the definitive 1865 book publication of Howard's essay and lecture. These cloudscapes were derived from the watercolors that he produced during *in situ* cloud observations. Howard had been working in collaboration: "The picture is by Kenyon; the sketch was by L. H., in a fine evening, after showers" Howard writes, in the "Explanation of Plates" section (xv–xvi). Howard utilized the visual arts to capture the patent materiality of different cloud forms. He also

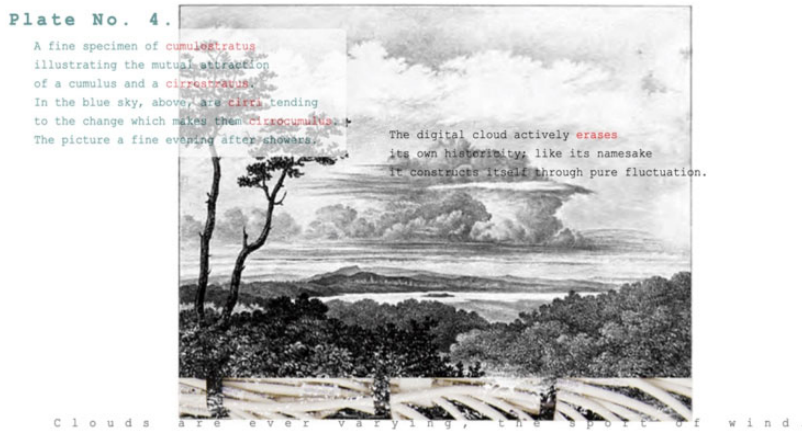

Fig. 4. J.R. Carpenter. *The Gathering Cloud*. 2016. Screenshot of Plate No. 4.

Fig. 5. Luke Howard. *Essay on the Modification of Clouds*: Cumulostratus. 1865.

harnessed painterly vocabulary to promote this new cloud nomenclature to experts and the public. Leveraging the generic conventions of picturesque painting enabled Howard to suggest the rigor and wider

Fig. 6. J.R. Carpenter. *The Gathering Cloud*. 2016. Screenshot of Plate No. 4.

applicability of his system, which won him the approval of the international scientific community. It is an outcome suggestive of the interdependence of scientific objectivity and aesthetic classification.

As one looks at Carpenter's Plate No. 4 (see fig. 6), the initial unclouded view of Howard's skyscape is swiftly impeded by white cables that inch up from the base of the screen. The cables partly obscure the text. From the left, a golden USB fish crosses the screen, moving toward the upper right. The cables come to rest at the top of the Plate, where they morph into spectral technological cloud cover. Whilst at the base of the screen the landscape is "revealed," Howard's cloudscape remains, flocked with cables.

It is tempting to read this aspect of Carpenter's work as supplanting earlier technologies by the most recent developments. Her e-text, however, shows the vitality of older media. "That *new media remediates old media* seems an intuitive way to understand this cultural situation in which notions of old and new at times become indistinct," Jussi Parikka argues (*What is Media* 3). Oral public address, print and writing infrastructures feed "new" media forms. The ghosts—or what Parikka calls the "living dead'"—of older technologies haunt the present piece, leaching into the twenty-first century media landscape (2). As Carpenter makes clear, these techno-zombies also stimulate it.

Carpenter's GIF-animated USB fish—a living-dead storage device—hitches a life with meteorological and cloud-based media across epochs (*GC*, Plate No. 4; see fig. 6). Digitized image, watercolour, printed essay, sketch, flash drive, cumulostratus etching, poem, cable technology are visible through and under one another. Carpenter does not offer a temporal hierarchy in the layering. *The Gathering Cloud*

Fig. 7. J.R. Carpenter. *The Gathering Cloud*. 2016. Screenshot of The Frontispiece.

shows the sedimentation of technological and artistic inheritances. Comparably, its use of hendecasyllables points to the strata of ancient and modern experiments in rebarbative metrics. (The reworking of Catullus' signature form—for rebuking hostile critics and puncturing the arguments of naysayers—by Tennyson, Swinburne and Robert Frost involved twisting Latin hendecasyllabics into English to perform modern ripostes to "indolent reviewers" and "metricists").[17] These calculatedly awkward English metrical disruptions ghost Carpenter's use of hendecasyllables as counterargumentive form. The poem-essay presents a genealogy of mediated experience, of old and new, codex and digital, metrical, and informational, which disrupts the linearity of modernization and progress narratives.

The Frontispiece (fig. 7), for example, presents: "A sky full of peculiar specimens/of dense clouds shrouded in a gloomy distance." These aerial specimens are visible in the greyscale visual field behind. Carpenter's cloudscape corresponds to the description and illustration provided by Howard's study dated March 1849 and entitled "Forms assumed by clouds when gathering for a thunderstorm." At the same time, as is clear by hovering a cursor over the word, "specimen" refers to the photographed birds that colorfully occupy the foreground of the screen. The Frontispiece displays nine of the bird species catalogued and held at "[t]he Division/of Birds at the Smithsonian in Washington," which "contains [. . .] six-hundred and forty/thousand . . . ." birds. The nine labeled specimens in the photograph are from a

selection of species from New Zealand and Australian, acquired by the Smithsonian Institute between 1872 and 1938. In 2014, they were used in a study of novel, non-destructive Raman spectroscopy methods to examine the carotenoid pigments in plumage (its findings eliminated the future need to pluck the feathers of rare species).[18] This work was conducted by a research team from the Smithsonian and Arizona State University and published in 2014, with the accompanying photograph of the nine birds. It is their image that we see inching toward the top of The Frontispiece as we read Carpenter's cloud specimen poems.

When Carpenter asks: "How many more birds have been/captured and tagged and stored in The Cloud?" she alludes to the power of numbering, counting, labeling, fixing, and the ethics of these actions. I am drawn back to an earlier moment in The Frontispiece: "The Division/of Birds." The line break emphasizes how this "Division" has relied on dismembering creatures as part of the pursuit of knowledge, dividing bodies from themselves. Comparably, Carpenter's attention to "The avian skin collection" points to the violent lexicon of scientific and curatorial processes that reduce formerly animate beings to "skins" labeled "captured, tagged and stored."[19] In the museum collection or the specimen-gallery of the laboratory, to "hold" the birds is to own, perhaps for the purposes of experimenting or exhibiting, preserving or studying, educating or showcasing the existence of a repository of knowledge. Carpenter's lines hint at the compromised embodied sense of creaturely "hold[ing]" that may result. Through her layering up of poetic, scientific and curatorial knowledge systems, the notion of a "sky full of . . .] specimens" is suggestive of the datafication of innumerable "forms" of dead, truncated birds.[20] We gaze on an occluded knowledge of birds as things arranged, ordered, accessed, labeled.[21] This includes all those creatures "captured and tagged and stored in The Cloud" in uncountable quantities:

> The avian skin collection held at the
> Natural History Museum in London
> contains almost seven-hundred and fifty
> thousand specimens of birds representing
> ninety-five percent of the world's nine-thousand
> and six-hundred known species
> [. . .]
> How many more birds have been
> captured and tagged and stored in The Cloud?
> (*GC*, The Frontispiece)

Such work investigates the ethics of "capturing" the intersecting bodies and institutions, knowledge processes, research practices, and the cyberinfrastructures that enable it. Although the Frontispiece shows how easily corporeality can be exploited across a range of contexts—the lab, gallery, archive, and digital cloudscape—the space of the poetic work is not portrayed as neutral.[22] As Carpenter makes clear, *The Gathering Cloud* is also given rise to through historically extractive approaches to the manifold bodies and agencies that populate its Plates: from rare birds to common cloud specimens, spectroscopy scientists to amateur meteorologists, skin collectors to cat-enthusiasts uploading photos to social media.

Why create this magpie-like aggregation of different cloud knowledges? In one sense, it stimulates readers to move among sites and agencies that would not usually be encountered together. This is why Carpenter's e-text—in layering scientific objects, textual and visual artifacts, clouds and cables, and part-details of machines and bodies—is so effective in rendering graspable what might have seemed dimly related, such as the connected historicities and materialities of internet traffic. Through this visual field we see, as if engaging in poetic-archaeological excavation, what Brian Larkin calls "the layering of . . . infrastructures over time" (*Signal* 5.) Through the colorful images of contemporary "banks of generators," Carpenter lets us glimpse what media archaeologists and anthropologists have sometimes described as the "deep time" of digital sedimentation (*GC*, The Frontispiece).[23]

An approach sensitive to the deep time of cyberinfrastructure involves, of course, recognizing cloud computing's forerunners. One needs to know that "[e]arly telegraph networks were mapped over colonial geographies, and the majority of companies that laid telephone cables through the 1980s were government-owned or -affiliated monopolies . . . these extensive investments shaped the contours of cabled environments and provided traction for Internet infrastructure" (Starosielski 12). However, media archaeology also necessitates reappraisal of the unlikely and forgotten connections among machines, technologies, accidents, and errors that feed "development." For Siegfried Zielinski "[m]edia are spaces of action for constructed attempts to connect what is separated." His work traces, for instance, the hidden links between a sixteenth-century theater of mirrors in Naples, a seventeenth century automaton for musical composition, and an eighteenth century electrical tele-writing machine. For Carpenter too, surfacing neglected moments in the historico-technological record—and revealing their surprising resonances with contemporary signal traffic—alerts readers to the happenstance, nonlinear development of today's super-connected environment. This

highlights how "the Cloud" does not evolve from simple tools to complex systems: it is generated through multiple fractural moments. In *The Gathering Cloud* we see the uncanny life of the old in the new; the "living dead" of the USB in the GIF; the ninteenth century specimen bird "animated" in the eighteenth century cloud.

Uncovering a layering of variations, the kinetics of *The Gathering Cloud* shows technical, social, and aesthetic systems as intertwined. It also foregrounds how artifacts (including digital literature) are "imbricated in infrastructural, legal and commercial strata" in ways that are not always apparent (Larkin 5). As Carpenter observes: "The Cloud is an increasingly essential/element of infrastructure powering/ industry, government, finance and commerce –/as fundamental to us as plumbing and roads" (*GC*, The Frontispiece). However, the "element[s]" that have become "fundamental" to many people are controlled by "tech giants Amazon, Apple and Microsoft," as well as Google and Facebook (*GC*, Plate 2). Such lines suggest that global, institutional, and social uses of "the Cloud" are shaped by normative modes of capitalist resource accumulation.

In response, *The Gathering Cloud* spotlights fraught moments in habituated use. Whilst the acquisition and use of everyday material objects (USBs, tablets, digital cameras, "the Cloud") enables users to disavow their participation in ecologically destructive and socially violent processes, the poem-essay points to how humans and their devices are inextricably intertwined.

Carpenter's e-text tracks the circuitous paths that digital content takes—including the environmental and social toll of its route-making—and the politics and economics of its delivery, including who has access to digital culture, and on what terms. How far does such poetry suggest the capacity to salvage new connotative potentials from circulating material? One might think of Carpenter's project as engaged in the labor of piecing-together as part of the politics of re-constitution. The work tests out how writers and readers form surprising and uncustomary orientations through their digital activities. By creating assemblages from these data environments, the piece engages in both *sabotage* and *salvage*. The e-text layers these materials so that earlier medias shine through. In reading, I am made painfully part of the "*different and uneven conditions* that shape and characterize media infrastructures around the world as well as the *labor, maintenance, and repair* required to build and sustain them" (Parks and Starosielski 7). Might such recognitions motivate Carpenter's audiences to make more informed choices about their media consumption? Could engaging with such poetry motivate people to push for a more distributed, resilient, and equitable network?

The Gathering Cloud stimulates an environmental imagination capable of reorienting a view of cloud computing as a steadily evolving, progressive technology. It disrupts linear accounts of development. It also allows readers to dig into the haphazard genesis of the Internet, connect this to ecological realities, and reflect on their participation in one of modernity's more mind-bogglingly complex mega-infrastructures. The collaging and layering techniques of *The Gathering Cloud* visualize how technologies coexist with—rather than ride over or obliterate—what came before. The e-text's striated form also emphasizes the ease with which end-users can slip between layers, disavowing their knowledge of—and contribution to "the Cloud's" material environmental, ecological, and social impacts. As such, the literary work encourages public and scholarly consideration of key issues in the use and study of cloud computing. This article has focused on two dominant metaphors in the discourse of cyberinfrastructural politics and its opacity: its visibility (making transparent) and its layering (excavation), in relation to what is disavowed, unknown or concealed. What Carpenter's work also enables—particularly through its appreciation of the deep time of media infrastructures—is a much-needed holding space for audiences and practitioners to regard these systems, in relation to one another, in all their cloudy opacity.

NOTES

1. Carpenter. *The Gathering Cloud* (2016), accessible at http://luckysoap.com/thegatheringcloud/ and referred to in-text as *GC*. Portions of the poem-essay were first performed during the South West Poetry Tour (August 2016). See its print book manifestation *The Gathering Cloud*. Uniformbooks, 2017, referred to as *GC Print*.

2. See contrasting language in Parks ("Satellites" 122), and Graham and Marvin (*Splintering* 12).

3. For comparable critical approaches in poetics that consider the role of poetry in addressing ecological and digital media issues–albeit *print* poetry–see Ronda, *Remainders*, and Keller, *Recomposing Ecopoetics.*

4. See Carpenter. *The Gathering Cloud* (2017), thirty-two photographic illustrations, and seven digital collages.

5. See Mizruchi, ed. *Libraries*; Falk. "Weighing."

6. For a counter-argument, see Naicker and Cohen (68).

7. Maxwell, et al., eds. *Media* xii; Maxwell and Miller. "Propaganda Machine" 294.

8. See Carr. *The Big Switch*.

9. Comparably, Timothy Donnelly's earlier (print) poetry collection *The Cloud Corporation* (2010) de-naturalizes pervasively corporate and prefab discourses through insistently appropriating them into his poem.

10. Qtd. in Glanz. "Power".

11. Ravilious. "Weatherwatch".

12. This push toward increased visibility was politically motivated. Documents leaked by Edward Snowden in 2013 revealed partnerships between government mass surveillance projects and tech companies who enabled organizations to access data in their centers as part of surveillance programs. Releasing images of their data centres was designed to restore public trust. See Taylor. "Technoaesthetics".

13. See Jones. "Where the Internet Lives"; Holt and Vonderau also quote Google's phrasing in their title.

14. See Alderson. "Connie Zhou's Photos"; Holt and Vonderau. "Where the Internet Lives."

15. "Episode One: You Use Data Centres."

16. See Parikka. "Deep Times" (Parikka considers the 'geology' of media).

17. Tennyson, in Ricks 652; Frost. *Letters* 250. See also Glaser 201; Talbot 73–76.

18. Thomas, et al. "Non-destructive descriptions."

19. See Wehner. "Towards an Ecological Museology"; Poliquin. *Breathless Zoo* 5.

20. Kenneth Cukier and Victor Mayer-Schönberger coined the term "datafication" in 2013; see van Es and Schäfer, eds. *Datafied.*

21. See Waeber, et al. "On Specimen Killing."

22. See Domínguez Rubio. *Still Life*.

23. Zielinski, *Deep Time*; Mattern, *Deep Mapping*.

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