C | O | P | E

Member since 2019
JM14485

Ewa Wójtowicz

https://orcid.org/0000-0002-8659-940X
Magdalena Abakanowicz University of the Arts Poznan
ewa.wojtowicz@uap.edu.pl

DEMYSTIFICATION OF THE CLOUD AS INVISIBLE TECHNOLOGY: AESTHETIC, SPATIAL AND AFFECTIVE ASPECTS IN ART AND CRITICAL INFRASTRUCTURE STUDIES

Abstract
The article examines the topic of the technological Cloud as one of the features of the Fourth Industrial Revolution. It focuses on the Cloud's ambivalences, discussing its various aesthetic, spatial and affective aspects. The methods for approaching the phenomenon of the Cloud are developed both in theory, in the disciplines of critical infrastructure (CI) studies and art studies as well as in visual arts practice. The main theoretical stances, from which the article draws on, are developed by Benjamin H. Bratton, James Bridle and Tung-Hui Hu. The article also briefly outlines the history of CI studies with its main areas of research (e.g data centre studies) and examples from the field of art. The issues addressed in the article include: the invisibility and inaccessibility of the Cloud (as a networked hyperobject and as a technological infrastructure), the architecture of data centres and the ambiguous relation that Cloud establishes with its users, as well as ecological concerns. The Cloud as invisible technology is discussed from many perspectives, from the one that supports its development straightforwardly, to those which attempt to demystify its seemingly immaterial image and indicate critically its relations with extractivism as well as suggest proposals of resistance.

Keywords:
The Cloud, critical infrastructure studies, invisible technology

INTRODUCTION – THE FOURTH INDUSTRIAL REVOLUTION
VS. CRITICAL INFRASTRUCTURE STUDIES

If the three essential features of the Fourth Industrial Revolution are identified as: velocity, breadth and depth, along with the cross-cutting impact on all systems (Schwab, 2016, pp. 7–9), then in the realm of Critical Infrastructure Studies (CI Studies) fairly similar categories are involved, in order to discuss technological aspects of contemporary culture[1]. However, the worldview perspectives are considerably different. This difference lies, firstly, in a critical approach in the CI research circles stemming from distrust of official global-economic rhetoric promising a better world based on technological progress. Secondly, the CI studies are often carried out with the significant help of art practice and art-based-research methodologies in which asking critical questions is inherently inscribed, and that significantly helps challenging theses too often taken for granted.

While Klaus Schwab defines the impact of the Fourth Industrial Revolution as "the transformation of entire systems, across (and within) countries, companies, industries and society as a whole" (2016, p. 9), various thinkers (academics, researchers, artists), such as Benjamin H. Bratton (2015), James Bridle (2018), Daphne Dragona (2019), Kyriaki Goni (2016), Mél Hogan (2023), Tung-Hui Hu (2015), Vladan Joler (2020), Metahaven (Vinca Kruk and Daniel van der Velden) (2012), Jenny Odell (2013, 2015), Evan Roth (2015), Nadim Samman (2023), and Liam Young (2019), seem to notice this process too. Their approach is less general and more situated though, to use the term once introduced by Donna Haraway in the context of knowledge (1988). The expressions of the critical debate taking place within this circle are transdisciplinary statements in various formats (theoretical reflections, curatorial concepts or artistic projects), and often they raise issues unnoticed in the official rhetorics of the leader of World Economic Forum. Expressing the anxiety shared by many users of new technologies, the CI studies scholars draw attention to the tangles of affective contradictions, states of perplexity and powerlessness, disorientation, alienation and exclusion, and even a feeling of entrapment, as well as a growing sense of confusion. Another difference from Schwab's conception is the notion, shared among critical infrastructure researchers (and the explorers from the field of art), that no industry is neutral. For it is associated with colonial extractivism and the insatiable capitalist exploitation of "ghost acreages" (Pomeranz, 2000), transforming everything into resources, no matter the scale; both people (Hu, 2015; Joler, 2020) and planet (Bratton, 2015).

---

[1] Critical Infrastructure Studies have a double meaning, referring primarily to studying infrastructure critically with the help of humanities, but also paying attention to critical infrastructures as such.

The Fourth Industrial Revolution also raises environmental anxieties, as many advanced technologies still depend on fossil fuel energy. New technologies, after all, also require infrastructure, at least in the form of cabling, which course often follows a trail that reveals colonial relations of power and (slow) violence. Technological acceleration not only affects the depletion of natural resources, but also results in so-called techno-progery, causing rapidly ageing equipment to end up in landfills and poisoning the environment already degraded by extraction of resources. All of this raises concerns about the effects of this technological (r)evolution and its invisible mechanisms, especially as, by succumbing to the encouragements typical of revolutionary rhetoric, by looking forward to the future, we lose sight of the present. Therefore, demystification of the technological infrastructures in the field of theoretical inquiry and artistic exploration is an example of recognising some problems of this uncertain and in a way overlooked present, as well as the impulse to take up the enquiry on its aesthetic, spatial and affective aspects. However, it is not an easy task, as the object of studies is mainly unseen or unavailable, but it may be undertaken with the help of art, as a discipline with a long tradition of dealing with the invisible, elusive and imagined.

With this in mind, the aim of this article is to discuss chosen examples from the circle of CI studies and related artistic attitudes, whose common denominator is a critical reflection on one of the most important elements of the infrastructure supporting, among other things, the Fourth Industrial Revolution – the Cloud[2]. It is understood as a technological hyperobject (Morton, 2013) or "a vast, discontinuous apparatus" (Bratton, 2015, p. 116), often represented in the form of a graphic symbol, most resembling the type of a cloud called cumulus.

METAPHORS AND PHYSICALITY OF THE CLOUD

The Cloud is an example of technology providing management of both data and human workers (Schwab, 2016, pp. 49-50), thus supporting the Fourth Industrial Revolution straightforwardly. However, it also produces a particular aesthetic that may bring ambivalent feelings and experiences, resulting from numerous contradictions and uncertainties. Even speaking of the Cloud in the singular is a misrepresentation, resulting from marketing rhetoric presenting it as an extraterritorial monolith. The most crucial feature of the Cloud is its invisibility,

---

[2] In this text I mostly follow Bratton's understanding of the Cloud, and in only selected cases I do not use capital C, when trying to indicate a slightly different meaning (e.g. the early days of cloud computing, before the Cloud in its contemporary version was developed) or within quotations.

taking place on at least two levels: as a hyperobject that escapes our perception through its scale and also because the infrastructure that supports it is not accessible to those unauthorised, including actually all of us – as mere users. This is more so because the popular narrative about the Cloud is based on maintaining the impression of its immateriality, since then the physical infrastructure and harmful environmental effects may go unnoticed. The Cloud is thus removed from view, and even when in plain sight, it still remains hermetically sealed in the likeness of a black box, a metaphor often used to refer to the implicitness in terms of infrastructures and the processes which underpin them (Galloway, 2010; Pasquale, 2015). When the course of action that leads to these outputs is unknown to users of such black boxes, they are in a way excluded and may feel disempowered, which raises if not fear, then at least anxiety of a technological kind. It should be added that the black box metaphor is still relevant today, only that it has changed scale to almost planetary, appropriately to the architecture of cloud platforms, and at the same time it is still scaled down to individual, in the context of users' alienation in their "crypts" (Samman, 2023). The Cloud not only belongs to "affective infrastructures" that Daphne Dragona (2019) writes about, recalling Lauren Berlant (2016). It is also a part of infrastructure in its most essential meaning, as something being "infra" (translated from Latin as "below"), then deeply hidden, even if it is "incorporating air-traffic and orbiting satellites" (Samman 2023, p. 25), as agents from the rather outer, than inner space of the Earth.

Hence, how to examine the Cloud from the perspective of art studies and artistic practice with the help of theory from the realm of CI studies? Seems like it would be difficult to find a more invisible object of research, even though, being users of both the Cloud as such as well as the platforms running on it, we have relatively free access to its interior. Nevertheless, being inside this virtual space, does not mean having a closer insight into it, but rather the opposite: it results in isolation, confusion and asymmetric relations with systemic procedures (Joler, 2020; Samman, 2023). It is equally difficult to see the Cloud from the outside, as it is hidden by the architecture of data centres, impenetrable and designed not for humans, often located in places that are difficult to access, classified as human exclusion zones (Young, 2019). Moreover, the outer shell of the Cloud, i.e. its material manifestation as a server farm, is actually as inaccessible, just as a black box. However, it is possible to observe attempts in this regard made in the field of CI studies, where both scholars and artists pay attention to the dimension of aesthetics, expressing their observations in verbal and/or visual forms.

Outlining the prehistory of the Cloud, Tung-Hui Hu (2015) points to a number of (sometimes deliberately perpetuated) misunderstandings that have accompanied its comprehension and promotion since the early days. Firstly, the concept of cloud computing itself is much older than the digital technologies and

services bearing the word "cloud" in their name, offered by commercial platforms that came into use a couple of years ago. Taking the origins of the Cloud as its graphical symbol used to describe irregular networks made up of infrastructure in the form of disks, servers and cabling, Tung-Hui Hu considers it to be the first example of full virtualisation, whereby a physically existing network is transformed into an icon in the shape of a stylised cloud (2015, p. XI). Such inaccuracies, ambiguities, and even cultural fantasies began to grow around the concept of the Cloud from the very beginning. The fictitious nature of these myths has never been actually corrected by the Cloud providers, being supposedly not in their interest, as it would have had a negative impact not only on the image of the product, but also on the myth of the "pure" and seamless technology. It would have also turned the spotlight to unpopular environmental and ethical issues. One of such problems would be the labour to sustain the vitality of the Cloud, because, as Hu mentions:

> By producing a seemingly instant, unmediated relationship between user and website, our imagination of a virtual 'cloud' displaces the infrastructure of labor within digital networks (2015, p. XII).

This labour is about everything that is removed from the sight of users at every level of the Cloud's existence, as much the devices in the server rooms as the moderation of sometimes drastic content on social media platforms performed by low-paid Third World workers for the convenience of consumers in the so-called First World.

That is why researchers of this technological phenomenon begin their critical discussion with the necessary demystification of the notion and seek to define the Cloud starting from questioning its stereotypical characteristics. For example, James Bridle writes:

> The cloud is not some magical faraway place (…). It is a physical infrastructure consisting of phone lines, fibre optics, satellites, cables on the ocean floor and vast warehouses full of computers that consume huge amounts of water and energy and reside within national and legal jurisdictions (2018, p. 7).

Similar definitions of the Cloud are provided respectively by Tung-Hui Hu (2015) and Benjamin Bratton (2015). In their views, the Cloud appears as a paradoxical hyperobject, made up of numerous nodes connected in a network with a potentially infinite flow of data, yet demanding huge amounts of energy and occupying a tangible physical space.

These constatations are the first and essential steps towards demystifying the Cloud. However, the widespread misrepresentation is still different; we tend to believe that the Cloud is neutral, extraterritorial and immaterial, and that belief increases the range of myths about it. Instead, it is geographically located and

subject to specific legal rules as well as requires certain territorial and substantial parameters to be met (Bratton, 2015; Bridle, 2018). Also Hu points out that

> The data center remains among the least studied areas of digital culture, with cloud computing producing a layer of abstraction that masks the physical infrastructure of data storage. Paradoxically, then, data centres exist at the border between the dematerialised space of data and the resolutely physical buildings they occupy (2015, p. 81).

Bratton makes the same point, putting it in the words of the paradox that a feature of the Cloud is "*the physicalization of abstraction* and *the abstraction of physicalization*" (2015, p. 29)[3]. This is also important because, "[o]ver the last twenty years, the Internet has been variously described (...) Each term brings with it an implicit politics of space (…)" (Hu 2015, p. XXIV) and that, in turn, brings along certain myths and stereotypes.

Similarly, the architecture of the objects hosting the Cloud is not impressive, and is unlikely to serve aesthetic contemplation, with the commonness of the buildings, highlighted by Hu when he describes the (an)aesthetics of data centres with words and photographs, referring to the photographic works of Bernd and Hilla Bechers as well as Ed Ruscha (2015, pp. 73–77). The problem is that these objects are also usually guarded, monitored, prohibited from being photographed and treated as critical infrastructure facilities, even if they belong to commercial entities. They are also secured on the IT side. These data centres create a Cloud that transcends national borders, but one of the effects of the emergence of its virtual territory is the implosion of physical space, triggered in particular by large-scale popular platforms related to data handling, commerce or the maintenance of social relationships. James Bridle puts it straightforwardly that the Cloud has already absorbed

> many of the previously weighty edifices of the public sphere: the places where we shop, bank, socialise, borrow books and vote. Thus obscured, they are rendered less visible and less amenable to critique, investigation, preservation and regulation (2018, p. 7).

Tung-Hui Hu states it even more succinctly, that "the cloud has turned geography into the virtual flows of market capital" and recognises that it "represents a new reconfiguration of the relationship between place and placelessness" (2015, p. 4). This ambiguous nature of the Cloud results in confusion while reading reflections on it, due to writing alternately about either

---

[3] The italics after the author of the quoted text.

the material plane of the Cloud or its virtual character. It may be an inspiring circumstance, however, because "[b]y examining the physical geography of digital networks, we can see the spaces" (Hu, 2015, p. 2), where the course of the infrastructure of old and new media is almost identical, therefore "even as digital networks seem to annihilate or deterritorialise physical space, space seems to continually reappear" (Hu, 2015, pp. 3–4). The architecture of some of the facilities that house the Cloud is a case in point, as "a number of the data centers enclose data inside repurposed Cold War military bunkers" (Hu, 2015, p. XXVIII). Then comes "a reanimation of what is known as sovereign power within the cloud, power as dependent on or coterminous with a specific territory" (Hu, 2015, p. 92). This leads to a consideration of the relationship of power to a given territory and the presence of that power in the operating procedures inherent in the functioning of the Cloud; for example, the socio-technical protocols embedded in it.

Both Hu and Bratton write about the space produced by the Cloud using the notion of sovereignty, in a context which is rather absent in the rhetorics of Klaus Schwab. Hu points to the two models for thinking about sovereign power in critical media studies. The first and earlier is based on Michel Foucault's thought on the transition from societies of sovereignty to societies of discipline (1975). The second, developed in the decade preceding the publication of *A Prehistory of the Cloud*, is the model of the society of control derived from the ideas of Gilles Deleuze (1992). Hu, however, believes that this concept is already too obvious today and proposes to go beyond it, back towards Foucault, to arrive finally at the question of sovereign power, only that in a mutated form corresponding to networked dispersal. He describes "this new hybrid form the 'sovereignty of data'" (Hu, 2015, p. XVI). Bratton writes similarly about swapping positions between Clouds and national states, which is a result of emerging translocal, giant platforms as new subjects of sovereignty (Wolak, 2021, p. 175). This process contributes to creating so-called Cloud Polis, whose characteristics are, among others: "hybrid geographies, incomplete govern-mental apparatuses, awkward jurisdictions, new regimes of interfaces, archaic imagined communities" (Bratton, 2015, pp. 369–370). Its political system is Cloudfeudalism and its inhabitants are Users (all written with capital letters, according to Bratton), detached from specific locations, constantly migrating and held in instability, which can also be understood as a description of their precarious status. This can be compared to the concept of a human cloud introduced within the idea of the Fourth Industrial Revolution, with the mentioned negative aspect of establishing "unregulated virtual sweatshops" and potential exploitation of labourers (Schwab, 2016, p. 50).

STAGES OF RESEARCH ON SOVEREIGNTY OF THE CLOUD

At the beginning of the first decade of the 21st century, with the increasing crisis of cybercultural utopias, and even before the scandal caused by Edward Snowden's revelations, some comments and insights directing attention to the importance of telecommunication infrastructures began to appear in print (Chun, 2008). These have spanned from academic publications to popular journalism and – last but not least – art projects; the latter two categories are what infrastructure scholar Mél Hogan calls "interventions" (2023, p. 385). After the PRISM affair, a debate commenced of the advent of the post-digital age (in arts and humanities it was mostly the circle of artists and scholars taking part in transmediale 2013 and subsequent editions of this Berlin-based festival) and it was even announced that "the Internet no longer exists" (Aranda et al., 2015). All this contributed to the formation of an 'infrastructural turn' within Internet culture research and the development of interdisciplinary infrastructure studies. This has resulted in a proliferation of scientific texts on the so-called information architecture, which includes server rooms, data processing centres and other technical infrastructure facilities, such as fiber optics cabling, both by individual researchers (Blum, 2012; Starosielski, 2012 and 2015; Burrington, 2016), as well as in The MIT Press *Infrastructures series*, started in 2013.

In the history of research on the Cloud as a part of CI studies, two phases can be observed. The first is the introductory phase of Cloud research (2012–2018), with 2015 and 2016 being the most prolific years for reflection, which I propose to call the phase of 'geographical discoveries' regarding the territory of the Cloud and its topology as well as the resulting demystification processes. One of the earliest and significant texts is the overtly critical three-part article by the Metahaven artistic duo, which refers explicitly to "Cloud Hostages" (2012).

The second phase, which begins with the third decade of the 21st century, includes the already existing field of critical Cloud studies, which has emerged as a separate scope of research. It shares some common interests with data centre studies, developed as a research sub-domain of the aforementioned CI studies. They are primarily conducted in conjunction with environmental impact concerns and in relation to data issues, in the context of control and surveillance, which will probably result in a further diversification of the research focus in the future. A recent example is the Canadian research project Critical Studies of the Cloud led by Mél Hogan within the Environmental Media Lab, who acknowledges that "art could be woven into scientific argumentation, just as scientific arguments seem to be woven into art" (2023, p. 386). Appreciating this methodological decision as coinciding with my long-standing attempts to value art as a fully-fledged scientific statement, I am going to refer here to both selected artistic attitudes and theoretical views, mostly showing intentions to demystify the Cloud by visualising it applying various methods.

THEORY AND ART-BASED CRITICAL RESEARCH OF THE CLOUD

Following the issues that emerge from texts and art projects dedicated to the Cloud, four main problem areas can be identified. The first relates to the (in)visibility and inaccessibility of the Cloud on both virtual and material level, which hinders its investigation. The second relates to its foundational myths and the attempts at demystification made by the research and art communities despite the aforementioned obstacles. The third area of issues is its situatedness and the geographies it produces (including the theme of sovereign power that the Cloud represents and implements). A final, very important issue is the ecological impact of the Cloud. An appendix to these issues would be a description of attempts to address them at least in part on the way to "going off-the-cloud" (Dragona and Charitos, 2016).

Mél Hogan, discussing artistic practices relating to data centres, distinguishes four essential categories of attitudes: disclosure, assemblage, remix, and orientation towards possible futurities (2023, pp. 384–404). In this first category, Hogan recalls the example of *Landscape Series* (2015) by Evan Roth, a project dedicated to the exploration of infrastructural landscapes. In order to "see the Internet somewhere" (Small, 2018), the artist visited points where intercontinental fibre-optic cables emerge from the sea and cross onto land (or vice versa). This is the case, for example, at Porthcurno in Cornwall, where the FLAG fibre optic cable leaves the British coast and plunges into the Atlantic Ocean. The site is distinguished by a pyramid-shaped monument, comme-morating the so-called Wireless Point, where the first telegraph cable enabling a connection to America went beyond the Old Continent. It is thus an example of 'overwriting' (a metaphor from IT) or, as Tung-Hui Hu would name it, 'grafting' (a metaphor from horticulture) a newer communication medium onto an older one (2015, p. 7). Hu describes this using the example of "the immediate predecessor for the cloud's global fiber-optic backbone: submarine cables. As Nicole Starosielski has shown, these cables [are] designed to bind together British territories in the Pacific with England (...) avoiding landings on rival empires" (2015, p. 90; Starosielski, 2015, pp. 107–108). Roth is also aware of this process, reaching for the maps of colonial empires and the fact that the fibre-optic cable located on the site of the former telegraph are "not just carrying data, but also existing power structures" (Small, 2018). Therefore, Evan Roth's project inscribes the theme of the Cloud into a broader, both theoretical and practical reflection on infrastructure and the various layers of meaning that cast a shadow over its apparent neutrality. In this way, the artist addresses the myths about the immaterial and neutral Cloud, sustained through optimistic marketing rhetoric, but rather masking sovereign ambitions and colonial exploitation.

The Cloud, however, consists not only of popular platforms providing various remote data access and storage services. It also comprises numerous

(infra)structures that do not have a user-friendly interface, but are a part of the planetary hyperobjects that sustain communication, prediction or security systems, such as sensory networks. Hence attempts to map the Cloud, such as the *New Cloud Atlas* project, whose title refers to a meteorological *Cloud Atlas*, but which is an open, interactive map of the technological Cloud and at the same time an example of alternative, critical cartography in practice and an attempt to make it visible (Frid-Jimenez et al., 2014).

After all, if the Cloud is so invisible, how can we see it and then make at least its key features more apparent? One of James Bridle's proposed ways of seeing the Cloud would be

> to look where its shadow falls: to investigate the sites of data centres and undersea cables and see what they tell us about the real disposition of power at work today" (2018, p. 8).

For, as Tung-Hui Hu argues, recalling his personal experience of dangerous peering into a fibre-optic cable, the Cloud cannot be seen directly, as this would be akin to trying to find out what a film is about by looking into the beam of light from a cinema projector (2015, p. XX). Therefore, "[a]nalysing the cloud requires standing at a medium distance from it, mindful of but wholly immersed in either its virtuality or its materiality" (2015, p. XX). However, this is a difficult and complex task, not only because of issues already mentioned. Also for the reason that the unnoticeable, aesthetically unattractive, hidden objects are part of so-called policy of concealing that has much in common with the power relations inscribed in that infrastructure depending on its scale (Burrington, 2016; Bratton, 2015, p. 115). Although these facilities are not themselves invisible, their presence is hidden "whether in the landscape, or deploying boring aesthetics or no signage" (Hogan, 2023, p. 389).

One *way of seeing* (to paraphrase John Berger, 1972) that would fit into this middle distance postulated by Hu, would be to consciously *see* what is obvious but not very exposed in relation to the internal geography of the Cloud. All too often, it is presented as a form that is as abstract as it is monolithic and, like atmospheric clouds, capable of transcending national boundaries. This is not entirely true because, as Hu notes, the Cloud being "the dominant metaphor for digital space", is actually "a metaphor for private ownership" (2015, p. 147). He is echoed by James Bridle in pointing out that what evaporates from our field of vision. It is "agency and ownership: most of your [data] are in the cloud, on somebody else's infrastructure" (2018, p. 8).

A good example of artistic methodology applied to to illustrate this point is *Farm (Pryor Creek, Oklahoma)* (2015) by John Gerrard. After being refused entry to a server farm owned by Google, the artist hired a helicopter and took aerial photographs of the area, then transferred them to 3D modelling using

software used for video game set design. The result is hyper-realistic and the simulated camera ride along the hangars that shelter Google's data centre is confusingly reminiscent of a high-definition film image. These seemingly real moving images were created artificially, creating a tension between the strategy of a documentary and the applied tactics of the simulation. Therefore, the demystification of the Cloud in this project is not straightforwardly critical, exposing rather its ambivalences and myths inscribed in this technological phenomenon, resulting from the lack of access to its facilities. As a result, recognition is replaced by imagination.

Fig. 1. John Gerrard, *Farm (Pryor Creek, Oaklahoma),* 2015, research photo: Blake Gowriluk. Photo courtesy of the artist and PACE Gallery.

Also, Jenny Odell showed a similar attitude in her work *Satellite Landscapes* (2013-2014), when she produced images of data centres and similar cloud infrastructure facilities, synthesising them from material available through Google maps and satellite views, among others. Her method reminds of tiled rendering, applied while composing the image of the Earth for the purpose of its visualization belonging to the so-called Blue Marble imagery. It is the same kind of a method, that Nicholas Mirzoeff identified

a standard means of constructing digital imagery. It is a good metaphor for how the world is visualized today. We assemble a world from pieces, assuming that what we see is both coherent and equivalent to reality. Until we discover it is not (2016, p. 23).

A likewise aesthetic is discernible in a work *Polymorphism (Data Centre Simulation)* (2015) by Kynan Tan, who explains that

[t]hey are highly restricted, massive buildings with no windows – a realisation of a 'black box'– an opaque system that has inputs and outputs but no way of knowing the internal workings. This work attempts to take something imperceptible and make it physical. (...) Data centres are ghostly entities that cannot be directly seen or felt, yet are constantly producing and reproducing the structures of society through algorithmic processes which in turn directly take effect on everyday life (Tan, 2015).

These images have been created from various pictures of data centres available online, which are de facto not confirmed as real photos, although they may be typical. So if the material for the project is actually the iconography of fiction, it paradoxically in this way confirms and reinforces the imagined picture as a true one.
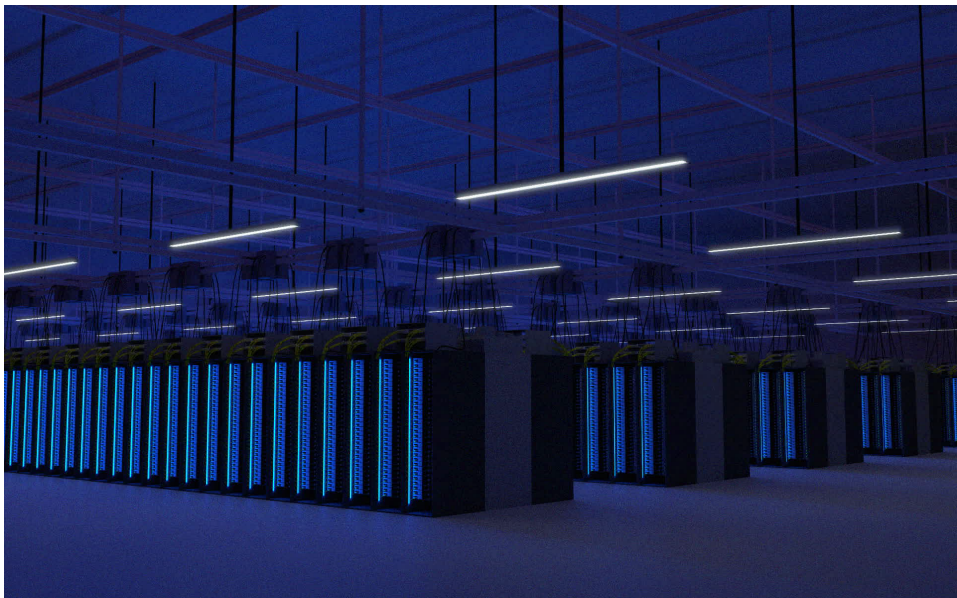

Fig. 2. Kynan Tan, *Polymorphism (Data Centre Simulation)*, 2015, projected computer-generated simulation, 2ch sound. Photo courtesy of the artist.

The above mentioned methods of artistic analysis of what is not meant to be seen directly are based on a hyper-distance and staying outside; but what if going inside doesn't help much anyway?

One of earlier examples is Timo Arnall's *Internet Machine* (2014), a cinematic triptych showing a panoramic shot of a server room space along with its "natural" (although it is actually synthetic) sound: the white noise of fans and buzzing electricity. These spaces appear perfectly sterile and even aesthetically appealing, yet uninhabited, reminding us of what Liam Young, writing about the data centre belonging to Facebook, notes: "It is a landscape filled with our digital avatars, but strangely absent of people" (2019a, p. 8). Arnall thus directs our attention to the aesthetics of the contemporary, post-industrial machine landscape, which is at the same time hidden from the eyes of those who work to co-create its contents: the users of the World Wide Web.

In an interview, Young explains the interest of artists and theorists in this kind of spaces by the inherent contradiction they bring with:

> [A]ll of these machine landscapes (...) structure our entire modern existence (...) but in terms of architectural space they're totally new because it's a space without people, it's architecture without occupants, it's a strange new phenomenon. But whether we like it or not, this is the typology that will define our time (Young, 2019b).

Therefore, according to Young, the data centre – a home to the Cloud – is an architectural object emblematic of the contemporary era, whereas in the past, these were successively: religious buildings, then factories (in the industrial age) and residential houses (as a result of modernists' dreams) and, in recent years, imposing edifices housing art institutions, rising almost all over the world.

An example of artistic analysis of such an object and its (an)aesthetics is provided by Emma Charles, in her film essay *Fragments on Machines* (2013), which takes up the theme of contemporary technical infrastructure "grafted" (Hu, 2015) onto a substance of industrial-era architecture. The camera guides the viewers' gaze along the trail of fibre-optic cabling running in the underground tunnels of New York City, to transmit the impulses needed to conduct high-frequency trading (HFT). Then, following the camera in a single long shot, we move from a clean and shiny, yet almost empty lobby in one of the buildings in the financial district, to the dark corridors of a technical back office housing dozens of servers and kilometres of cabling. During this cinematic journey we can experience the moment of transition between two different zones of machine landscapes: the so-called 'white'(representational) and 'grey' (utilitarian), respectively (Groen and Kuijpers, 2020). In both zones the presence of humans is highly limited, except for those whose activities are subordinate to the needs

of the machines, as their task is to keep the system running smoothly[4]. Those people "have to temporally re-calibrate their bodies to operate (…) providing companionship and care for machines" (Velkova and Plantin, 2023, p. 227).

The projects mentioned above direct the audience's attention to what is hidden behind the facade of the architecture of machine landscapes – the circulation of data that shapes our reality in its social, aesthetical and affective dimensions. This data is processed on a macro scale that exceeds the possibilities of our perception, similar to the hyperobjects described by Timothy Morton (2013).

Thus, widely promoted as a fundamental foundational myth, the invisibility of the Cloud interacts with the belief in its limitless space, which Hu compares to the Earth's atmosphere and the "belief in the air as the endless" one (2015, p. 66; Connor, 2010, p. 275). This can be linked to the metaphor of the Ouroboros applied by Bratton to express ecological concerns about the Cloud's energy needs and its negative impact on the environment (2015, p. 9, 93), noticed already a decade ago and not only by this author. Also James Bridle comments similarly: "The cloud is a new kind of industry, and a hungry one. The cloud doesn't just have a shadow; it has a footprint" (2018, p. 7), and of course it is a carbon footprint. It is in relation to this that Benjamin Bratton declares quite categorically that "the *Cloud* is not virtual; it is physical (...) There is nothing immaterial about massless information that demands such energy from the Earth" (2015, p. 29). This energy makes it possible to dispense with the use of paper (which Bratton calls the "dead tree medium", the term introduced around 2006 in the context of press publishing), but it adds to the already massive carbon debt, which, at the time of writing this by Bratton, has already exceeded that of the aviation industry (2015, p. 94). Bratton, Bridle and Hu allude to the carbon footprint resulting from the Cloud's energy requirements, as well as the need to access water to cool the equipment and the emission of water vapour returning to the atmosphere in the form of anthropogenic clouds, with subsequent impact on the planetary climate. The weight of the carbon footprint can be determined by the location of a data centre, which was and still is powered by coal-based energy, therefore: "The long term consequences of the cloud are worlds away from the seductive 'now' produced by its real-time systems" (Hu, 2015, p. XXIV). The Cloud can be 'dirty' indeed, and the same problem of siting the technical infrastructure that sustains its viability is pointed out by both Bratton (2015, p. 116) and Hu (2015, p. 179). All these site-specific parameters have consequences for where the Cloud infrastructure is implemented, as well as affecting the realm in which the Cloud operates, that is the affective space of human life. It is pointed out by Vladan Joler in his concept of New Extractivism (2020), and earlier by Hu, when he noted that:

---

[4] That is probably why the artist refers to Marx in the title of her project, although this is not an issue to be discussed in this text.

the cloud is a resource-extractive (...) technology, converting water and electricity into computing power (...). But it also turns human labour into a resource, (...) reveals the slow violence of the information economy, which extracts the naked life out of ist 'human resources' (2015, p. 146)[5].

More recently Nadim Samman's remarks similarly and rather bluntly:

The Cloud is a Green Zone, a Mac Store, a white cube. Everything else is earth, littered with bodies and discarded junk, scarred by terraforming and a War on Terror – to keep the wells open and the mines producing (2023, p. 30).

This remark proves clearly that the ambivalence of the Cloud is still present.

The theme of feeding the cloud with our life, attention and energy, and the emotional aspects of this process, is also present in Jenny Odell's project *Natural History* (2015), in which the artist combined images of a weather cloud and an interface element of a familiar social media platform in a simple collage. The invisible, yet affective aspects of the Cloud are also hinted at in Kyriaki Goni's work *Megastructures* (2016), with viewers looking at images of clouds on a screen that turn out to be a kind of Venetian mirror.
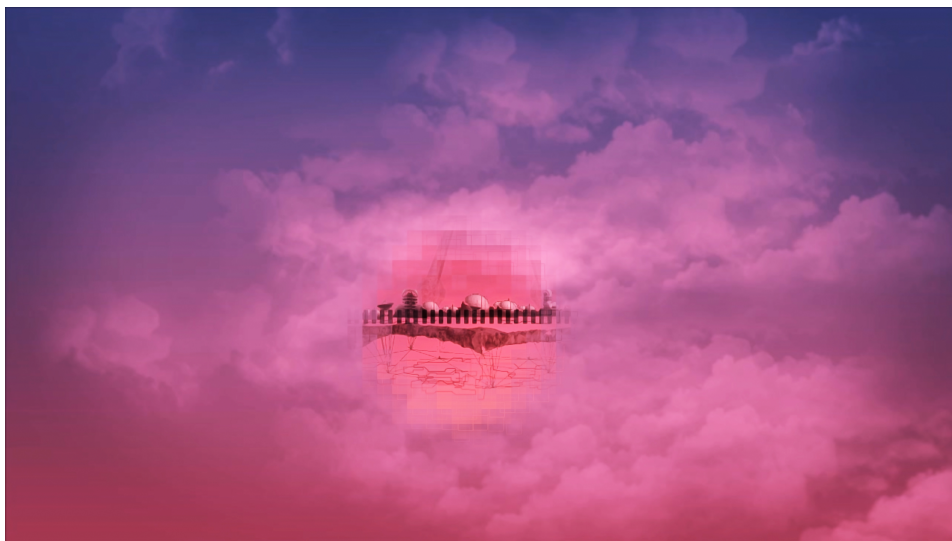

Fig. 3. Kyriaki Goni, *Megastructures*, 2016, 2019, screenshot. Photo courtesy of the artist.

---

[5] Apart from the reference to Agamben, the terms like: resource, slow violence and extraction belong to the vocabulary used mostly in connection with colonial occupation, when „violence is largely displaced elsewhere" (Hu, 2015, p. XXIX).

While people watch the installation in the gallery, oculographic examinations are made and the image of the person viewing the project is recorded. Then the Cloud reciprocates the human gaze, seeing even more in us than we are able to see in it.

CONCLUSIONS

Considering all this, we might be left with some doubts: what is the purpose of investigating the Cloud by exposing and demystifying things that seem obvious, neutral and without a hidden second bottom, like material infrastructure? Does it really help to gain any knowledge on the Cloud and its mechanisms? Especially when the "epistemology of exposure" often seems to be an ineffective method of operation, as Tung-Hui Hu points out, paraphrasing Eve Kosofsky Sedgwick (2015, p. 143). Nevertheless, it can be assumed that there is a cognitive value in this slightly forensic process itself, particularly when it is motivated by distrust of what constitutes the official image of a Cloud phenomenon and the narratives that support it. Maybe because, recalling one of the crucial theorists of media studies,

> the hidden aspect of media are things (...) that have uncontrollable power when they are invisible. If these factors are ignored, they remain unseen and then have absolute power over the user (McLuhan, 1977, 4'44").

Hence, the work of artists practising critical studies of infrastructure allows us to see it anew, including the smart metaphors that sustain false beliefs, especially in the context of the Fourth Industrial Revolution and its rhetorics.

Less than a decade ago Daphne Dragona and Dimitris Charitos traced artivistic (both artistic and activistic) initiatives to the search for alternatives, whose goal they saw as the possibility of "going off-the-cloud". However, these attempts, made through tactical media art and explained by hacktivist methodologies, did not provide a viable answer to the range of problems that the Cloud and the data centres that store it, generate. Nowadays, it is apparent that little has changed in this regard, despite various efforts to make the Cloud a more transparent and inclusive structure. Imperial metaphors, ecological objections and a growing sense of confusion, aptly described by Bridle as the dawn of a "New Dark Age" (Bridle, 2018; Gail, 2016), are still being applied to the Cloud[6]. Whereas simple gestures of refusal, such as abandoning the plat-forms offered by the Big Tech giants with a monopoly on most Cloud services is not easy in practice, there are some proposals of resistance and collaboration

---

[6] The term is taken from an article by US meteorologist William Gail (2016) identifying the "new dark ages" with the increasing difficulty of predicting weather and the unpredictability of climate phenomena despite advanced data interpretation techniques.

towards a different vision of a Cloud. Underlining the Cloud's overwhelming role in most of the processes that determine the functioning of the global "weightless economy" and considering seamlessness as its key feature, it is worth posing the question of possibilities of resistance and the search for alternatives to the monopolism of contemporary cloud infrastructures. Also, the impact on the environment begs the question of confronting this extractivist model and the possibilities of decolonisation of the Cloud. Is there a possibility of building something different, "able to accommodate multiplicity and difference and allowing us to be with each other in common, moving beyond relations of sovereignty" (Dragona 2019)? Due to the efforts of CI studies the Cloud that helps in developing the Fourth Industrial Revolution is at least more exposed, although it is still "a particularly silent piece of infrastructure" (Hu, 2015, p. X). Also, as James Bridle noted several years ago:

> By understanding the way the figure of the cloud is used to obscure the real operation of technology, we can start to understand the many ways in which technology itself hides its own agency – through opaque machines and inscrutable code, as well as physical distance and legal constructs (2018, p. 8).

Critical infrastructure studies, including artistic format of analysis, reveal the invisible but brutally real extractivism of 'naked infrastructure' masked by generic architecture of the Cloud and inscribed in the smartly designed aesthetics of the user-friendly interfaces.

BIBLIOGRAPHY

Aranda, J. et al. (2015). *The Internet Does Not Exist*. London: Sternberg Press.

Berlant, L. (2016). The commons: Infrastructures for Troubling Times. *Environment and Planning D: Society and Space,* (34) 3, pp. 393–419. https://doi.org/10.1177/0263775816645989

Blum, A. (2012). *Tubes: A Journey to the Center of the Internet*. Toronto: HarperCollins Canada.

Bratton, B. H. (2015). *The Stack. On Software and Sovereignty*. Cambridge, MA – London: The MIT Press.

Bridle, J. (2018). *New Dark Age. Technology and the End of the Future*. London: Verso.

Burrington, I. (2016). *Networks of New York: An Illustrated Field Guide to Urban Internet Infrastructure*. Brooklyn: Melville House.

Connor, S. (2010). *The Matter of Air: Science and Art of the Ethereal.* London: Reaktion Books.

Chun, W. H. (2008). *Control and Freedom: Power and Paranoia in the Age of Fiber Optics*. Cambridge, MA: The MIT Press.

Deleuze, G. (1992). Postscript on the Societies of Control. *October*, 59, pp. 3–7.

Dragona, D., and Charitos, D. (2016). Going off-the-cloud. Artistic practices and initiatives for an offline sharing world. *Alternative Internets, Journal of Peer Production*, 8. Available at: http://peerproduction.net/issues/issue-9-alternative-internets/peer-reviewed-papers/going-off-the-cloud/ [Accessed: 20.06.2024].

Dragona D. (2019). Affective infrastructures. *transmediale journal*. #3, 31.10. Available at:

https://archive.transmediale.de/content/affective-infrastructures-0 [Accessed: 20.06.2024].

Foucault M. (1975). *Discipline and Punish: The Birth of the Prison*. New York: Vintage.

Frid-Jimenez, A. et al. (2014). *The New Cloud Atlas*. Available at:
http://newcloudatlas.org/#3/39.80/-30.60 [Accessed: 20.06.2024].

Gail, W. B. (2016). A New Dark Age Looms. *The New York Times*, 19.04. Available at:
https://www.nytimes.com/2016/04/19/opinion/a-new-dark-age-looms.html [Accessed:
20.06.2024].

Gerrard, J. (2015). *Farm (Pryor Creek, Oklahoma)*. Available at: http://www.johngerrard.net/farm-pryor-creek-oklahoma-2015.html [Accessed: 20.06.2024].

Goni, K. (2016). *Megastructures*. Available at: https://kyriakigoni.com/projects/megastructures
[Accessed: 20.06.2024].

Groen, L., and Kuijpers, M. (2020). Automated Landscapes and the Human Dream of
Relentlessness. *Strelka Mag*, 3.03. https://strelkamag.com/en/article/reporting-from-automated-landscapes [Accessed: 13.04.2020].

Haraway D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of
Partial Perspective. *Feminist Studies*, 14 (3), pp. 575–599. https://doi.org/10.2307/3178066

Hogan, M. (2023). „Environmental media" in the cloud: The making of critical data center art.
New Media & Society, nr 25 (2), pp. 384–404. https://doi.org/10.1177/14614448221149942

Hu, T.-H. (2015). *A Prehistory of the Cloud*. Cambridge, MA–London: The MIT Press.

Joler, V. (2020). *New Extractivism*. Available at: https://extractivism.online/ [Accessed:
20.06.2024].

Metahaven (2012). Captives of the Cloud: Part I. *e-flux journal*, 37. https://www.e-flux.com/journal/37/61232/captives-of-the-cloud-part-i/ [Accessed: 20.06.2024].

Mirzoeff, N. (2016), *Jak zobaczyć świat*. Translated by Ł. Zaremba. Kraków–Warszawa:
Wydawnictwo Karakter, Muzeum Sztuki Nowoczesnej w Warszawie.

Nixon, R. (2011). *Slow Violence and the Environmentalism of the Poor*. Cambridge, MA: Harvard
University Press.

Odell, J. (2013). *Satellite Landscapes* (2013–2014). Available at:
https://www.jennyodell.com/satellite-landscapes.html [Accessed: 20.06.2024].

Pasquale, F. (2015). *The Black Box Society: The Secret Algorithms that Control Money and
Information*. Cambridge, MA: Harvard University Press.

Pomeranz, K. (2000). *The Great Divergence: China, Europe and the Making of the Modern World
Economy.* Princeton: Princeton University Press.

Roth, E. (2015). *Red Lines*. Available at: https://www.evan-roth.com/~/works/red-lines/#hemisphere=east&strand=119 [Accessed: 18.09.2022].

Samman, N. (2023). *Poetics of Encryption. Art and the Technocene*. Berlin: Hatje Cantz.

Schwab, K. (2016). *The Fourth Industrial Revolution*. Geneva: World Economic Forum.

Small, Z. (2018). A Net Artist on Why the Cloud Is a Bad Metaphor for the Internet.
Hyperallergic.com, 12.11. https://hyperallergic.com/460796/a-net-artist-on-why-the-cloud-is-a-bad-metaphor-for-the-internet/ [Accessed: 20.06.2024].

Starosielski, N. (2012). „Warning: Do not dig": Negotiating the visibility of critical infrastructures.
Journal of Visual Culture, 1, pp. 38–57.

Starosielski, N. (2015). *The Undersea Network (Sign, Storage, Transmission)*. Durham, North
Carolina – London: Duke University Press.

Tan, K. (2015). *Polymorphism (Data Centre Simulation)*. Available at:
https://kynantan.com/polymorphism/ [Accessed: 20.06.2024].

Velkova, J. and Plantin J.-Ch. (2023). Data centers and the infrastructural temporalities of digital
media: An introduction. *New Media & Society,* 25(2), pp. 273–286.

Wolak, J. (2021). Uziemienie. Filozoficzne marginalia do *The Stack* i *O antropolizie* Benjamina
Brattona. *Praktyka Teoretyczna*, 41(3), pp. 169–190. https://doi.org/10.14746/prt.2021.3.9

Young, L. (2019a). Neo-Machine. Architecture Without People. *Architectural Design*, 89 (1), pp. 6–13. https://doi.org/10.1002/ad.2381

Young, L. (2019b). Landscapes of the Post-Anthropocene: Liam Young on architecture without people [interview by T. Zolotoev]. *Strelka Mag*, 29.03. Available at: https://strelkamag.com/en/article/landscapes-of-the-post-anthropocene-liam-young-on-architecture-without-people [Accessed: 13.04.2019].

Media

Arnall, T. (2014). *Internet Machine*. [Trailer]. Available at: https://vimeo.com/95044197 [Accessed: 20.06.2024].

Charles, E. (2013). *Fragments on Machines*. [HD-Video]. Available at: https://vimeo.com/68769316 [Accessed: 20.06.2024].

Galloway, A. R. (2010). *Black Box, Black Bloc*. [Lecture]. New School. New York, 12.04. Available at: https://cultureandcommunication.org/galloway/pdf/Galloway,%20Black%20Box%20Black%20Bloc,%20New%20School.pdf [Accessed: 20.06.2024].

McLuhan, M. (1977). *Marshall Mcluhan Full lecture: The medium is the message – 1977 part 2* [Television programme]. Interviewed by the audience. ABC Television, 27.06. Available at: https://www.youtube.com/watch?v=a11DEFm0WCw [Accessed: 10.05.2025].

DEMISTYFIKACJA CHMURY JAKO NIEWIDZIALNEJ TECHNOLOGII: ASPEKTY ESTETYCZNE, PRZESTRZENNE I AFEKTYWNE W SZTUCE I STUDIACH NAD INFRASTRUKTURĄ KRYTYCZNĄ

Streszczenie

Artykuł podejmuje temat technologicznej Chmury jako jednej z cech czwartej rewolucji przemysłowej. Koncentruje się na ambiwalencjach Chmury, omawiając jej różne aspekty estetyczne, przestrzenne i afektywne. Metody podejścia do zjawiska Chmury są rozwijane zarówno w teorii, w dyscyplinach studiów nad infrastrukturą krytyczną (CI) i naukach o sztuce, jak i w praktyce sztuk wizualnych. Główne stanowiska teoretyczne, z których czerpie artykuł, zostały opracowane przez Benjamina H. Brattona, Jamesa Bridle'a i Tung-Hui Hu. Artykuł przedstawia również pokrótce historię studiów nad CI wraz z ich głównymi obszarami badawczymi (np. studia nad centrami danych) oraz przykładami z dziedziny sztuki. Kwestie poruszone w artykule obejmują: niewidzialność i niedostępność chmury (jako hiperobiektu sieciowego i infrastruktury technologicznej), architekturę centrów danych i niejednoznaczną relację, jaką chmura ustanawia ze swoimi użytkownikami, a także kwestie ekologiczne. Chmura jako niewidzialna technologia jest omawiana z wielu perspektyw, od tej, która wprost wspiera jej rozwój, po te, które próbują zdemistyfikować jej pozornie niematerialny obraz i krytycznie wskazać jej relacje z ekstraktywizmem, a także zasugerować propozycje oporu.

Słowa kluczowe:

Chmura, krytyczne studia infrastruktury, niewidoczna technologia