Chapter 5

Artistic research of ecosystems and digital infrastructure critique

aka

Universal Robots Searching for Radical Software

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Dilemmas of digital curation

Digitization and digitalization have become fundamental for memory institutions to transform their cultural role in the information society. Not only the collections of art and document archives, but the majority of social representations have turned to data formats. Digital media and institutional critique have transformed knowledge processes and organizational ecologies. Artists, academic researchers, curators, archives or galleries have become content providers for digital distribution channels. The quantity of digital content, reach and consumer engagement should be indicators of successful media communication strategies of cultural managers on digital platforms, whereby digital curation should provide the processes to make it happen. Nevertheless, the other side of this picture has revealed many ongoing and even enlarging gaps and problems calling for critical analysis. At the very heart of these issues are general questions of democracy and equal rights to social representation. The architecture of corporate digital infrastructures limits the discourse and our ability to represent non-majority societies, and more than human actors. Moreover, there are unresolved environmental and climate concerns in terms of the sustainability of digital transformation. Humanities in general and digital curation of media art are in the process of embracing new approaches.

The first stage of the digitalization of cultural heritage and the accompanying discourse within the digital humanities began in the 1990's. Scholars participating in projects of building research repositories and editing metadata were engaged in a wide range of discussions, from technical to philosophical, and they were getting acquainted with markup languages and creating model content types. Within that convergence of humanities and information engineering, the power of rhetorical arguments had been slowly embodied in information structures.[1] (Drucker 2012)

At the same time, the influence of poststructuralism and deconstruction called for the rethinking of digital archiving projects from the perspectives of the categories of identity, gender, race, nations, authorship, power relations, bodies, and subjectivity. Questions concerning what and why something is included and excluded in digital archives and represented in research, turns out to be political, or at least a matter of collection policies.

Despite all of the novel approaches to digital archiving, it always depends on the underlying information infrastructures the archives are built upon, which are not unbiased but again carry various burdens and presumptions. For example, communication channels, data modes, and visual rhetoric are borrowed from areas like commerce and business applications. As Miriam Posner put it: "We can do what we know how to do: visualize datasets that we inherit from governments, corporations, and cultural institutions, using tools that we have borrowed from corporations. Or we can scrutinize data, rip it apart, rebuild it, reimagine it, and perhaps build something entirely different and weirder and more ambitious."[2] (Posner 2016).

Jonathan Gray with colleagues draw attention to data infrastructures as they carry a normative force by producing data formats prioritising certain ways of knowing over others and thus can be also mal-aligned with publics interests.[3] (Gray et al. 2018) They emphasize our need of 'data infrastructure literacy', which goes beyond data as a resource of static and finished information to be utilised, by looking at how data infrastructures organise and materialize relations between people, things, disciplines and technologies. Data literacy does not just accessorize people with data processing skills, but cultivate sensibilities for data culture and data politics whereas infrastructures "make space for

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1   Johanna Drucker, Humanistic Theory and Digital Scholarship. In: Matthew K. Gold – Lauren F. Klein (eds.), *Debates in Digital Humanities*. Minneapolis: University of Minnesota Press 2012

2   Miriam Posner. What's Next: The Radical, Unrealized Potential of Digital Humanities In: Debates in the Digital Humanities 2016 Matthew K. Gold and Lauren F. Klein (eds.), University of Minnesota Press, Minneapolis London, 2016

3   Jonathan Gray - Carolin Gerlitz - Liliana Bounegru. Data infrastructure literacy. Big Data & Society vol. 5 no. 2, 2018 https://doi.org/10.1177/2053951718786316

collective inquiry, experimentation, imagination and intervention around data in educational programmes and beyond, including how data infrastructures can be challenged, contested, reshaped and repurposed." (Gray et al. 2018)

A page from Algorithms of Late Capitalism zine #3, 2020. Collectively created zine by Karla Zavala and Adriaan Odendaal reflects socio-cultural critique of tech, surveillance or AI.

Increasing volumes of digital data and centralization of information services marketed as 'cloud' negatively impacts ecosystems and has limited benefits for many organizations. Outsourcing information technologies to cloud companies was accompanied by unrealistic expectations. Cloud was ideal for speculative investment into 'startup' companies without infrastructure to achieve fast development and quickly evaluate their market value. The situation of memory institutions like archives and museums is quite different. Unfortunately, the digitalization of state and public institutions often lead to large-scale repositories with generic features and corporate design. Digital archives could easily fall under the rubric of research infrastructures financed with the aim of industrial development and competitive economy.

The immateriality of cloud was carefully crafted illusion. Expanding digital infrastructures and the growing amount of data are not without ecological consequences. According to the data of IDC (International Data Corporation)[4], there were 500 thousand data centres worldwide in 2012. In 2019 it was already 8 million, which counts for a 16-fold increase. By energy consumption 3% globally, digital media has already surpassed the airlines' industry, and the prediction for 2025 is a growth to 5-6% of worldwide energy consumption.[5] The building of server housing facilities, equipped with cooling systems and power generators, consumes large quantities of material even when using renewable energy. The underpinning infrastructure as well as transport and parking, it severely destroys natural landscapes and agricultural soil, producing extraordinary material and energy demands that never existed before. The area of server farms goes from an average of 1000 square meters to 12 hectares, with energy consumption up to 100 megawatts. We should see them as heavily smoking factories behind our websites and mobile apps. Average smartphone, during its lifetime, generates 33 times more energy consumption in operations in datacenters than in its own use. The energy mix in the power grids still contains a significant part coming from coal and gas.

Babylon of experts

When we think of sustainable approaches, some deeper questions about our society arise. Natural resources are depleted by the extractive consumption economy, but obviously, there is a

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4   IDC's Worldwide Quarterly Server and Network infrastructure trackers 2008–2019

5   Lean ICT – Towards digital sobriety , The Shift Project 2018

cultural dimension of unsustainability related to behaviors, social conventions, institutions, values, worldviews and epistemological bases. [6] (Kagan, 2013)

In our society sensoric, hyper-consumerist rationality and technicist effectivity replaced other kind of rationality, the vertical, spiritual and substantive rationality, nurturing critical reflection. By historical developments of science our worldview is atomistic and individualistic. Things are distinct and measurable material entities, people are separated from each other and from their environment. Industrial and postindustrial western societies are the paradigms of economic progress and development. However, not only philosophers suggest that there might be something wrong with the modernist scientific thought and its application. Erwin Laszlo points out how this atomistic view, inherited from the modern scientific method, has its root in the fragmentation of our understanding.[7] An advocate of transdisciplinary thinking, Basarab Nicolescu calls it a "paradigm of simplicity", which is based on the binary character of classical logic and the rigid norms of truth in science, thanks to which "discipline can pretend to contain all knowledge within its own field entirely".[8]

During the pandemic of Covid-19 disease we could observe how the impervious boundaries of specializations limited any expert discussion. Journalists were often met with evasive answers from experts like: "I am a clinician, you have to ask epidemiologist", "I am an epidemiologist, you have to ask immunologist", "I am an immunologist you have to ask vaccinologist" and so on. Even the scholars of environmental subdisciplines, operating only on different scales, e.g. population biology and ecosystem ecology, were often not able to communicate with each other.[9]
Nicolescu describes this situation of narrow specialization of human knowledge as Babelisation: „The decision-maker becomes increasingly more incompetent regardless of his or her intention […] even a group comprised of the best specialists from all the various disciplines would only be able to develop a generalized incompetence, for the simple reason that the sum total of competencies is not competence: on technical level, the intersection between different domains of knowledge is an empty ensemble". (Nicolescu, 2002, p. 42) [10] Nicolescu also sees the technology as a main driver of the atomisation of scientific disciplines. The awaited benefits of specialized science turned to radically opposite

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6   Sacha Kagan. *Art and Sustainability*, transcript Verlag Bielefeld 2013, p.24
7   Erwin Laszlo. *The systems view of the world : a holistic vision for our time*, Cresskill: Hampton Press 1996, p. 11
8   Basarab Nicolescu. *Manifesto of Transdisciplinarity*. Albany: State University of New York Press, 2002, p. 33
9   Petr Kuneš, Vegetační změny v prostoru a čase. In: Živa 5/2020, Academia, 2020, Prague, p. 215
10 Ibid, p. 42

consequences: "a multischizoid, complex reality has replaced what should have been the simple one-dimensional reality of classical thought".[11] (Nicolescu, 2002, p. 37)

Despite all the scientific discoveries and knowledge, we've seen the growth of anti-scientific worldview. The number of Flat Earthers, rejecting any fact or rational argument, the Q-anon movement and other conspiracy theories that accumulated followers by offering easy answers to complex problems. What science cannot explain is replaced by magical thinking and slippery logic that home in on affective concerns and behaviors. Q-annon snowballed this way other social groups, being interested in holistic thinking, yoga, or wellness. Undermoderated social platforms of corporations just took advantage of situation they created amplifying affect and fear to monetize on and slipped out of any social responsibility.

We should learn from this situation or characterization of "Babelisation" of natural sciences, and to work for a more consistent, socially interconnected communication networks, that would prevent this in the domain of arts and humanities, where exclusive specialized knowledge has to be followed by additional levels of inclusive public discourse. The interfaces of public cultural repositories also have to take it into account, when designed.

In Art and Sustainability, Sacha Kagan[12] (Kagan, 2013) describes how Technological System, efficient and rational implementation of technology and technocratic decision throughout the whole society, is deeprooted in positivism of Enlightenment and accepts only one common logic where anything which cannot be represented by numbers, is illusion. The reason under the technical process has to be free of any mythical thought and becomes an instrument and universal tool in all-encompassing economical apparatus. Universal robots should've produced anything 'ad infinitum', without ethical or moral questions. Niklas Luhman, system sociologist remarks: "Technological progress lead to ecological disasters, which cannot be avoided however only through more advance technological progress and thus at the price of an even greater dependency of society to technology."[13] (Luhmann, 1999)

On the contrary, explains Kagan, the art does not fit into this system of the 'most efficient method' and artists as dreamers are part of quite opposite invention of 19th century. Romantic Order is where all intuition, imagination, attention to feelings and admiration of nature reside. Artists in Romantic Order are gifted to create works of exceptional beauty by their personal hands, they are

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11 Ibid. p. 34
12 Ibid, p. 37
13 Niklas Luhmann, Politique et Complexité. Les contributions de la téorie générale des sytemes. Paris: Cerf, 1999, p. 47

independent and free from influences from the others. This dichotomy, as a result, creates an artist, isolated outside of the Technological System, kept in their romantic world of individual genius as an escapist ghetto from structural hold of formal rationality.[14] (Kagan, 2013) Several art movements in 20th century were addressing issues of social dimension of technology and artists refused to stay silent to technocratic power in their supposed role of producers of esthetic objects.

Before further analysis how systems art and media art contribute to interdisciplinary dialogues between science, technology and society, it is worth mentioning how artistic research in general underlies inventive data practices and can question the default lines of inquiry which are built into data infrastructures, including re-assembling them in accordance with interests of publics.

Artictic research at the first place is grounded in practice led research as a distinctive feature of the research activity conducted by arts and humanities researchers. It involves the identification of research questions and problems while the research methods, contexts and outputs incorporate a significant focus on creative practice. At that interdisciplinarity means not only multiple disciplines involved (informatics, biology, ...), but also multiple base domains of inquiry. Graeme Sullivan[15] (Sullivan, 2009) defines those domains as

- *Interpretivist:* constructivist creation of meaning, network, dialogue, interdiscipline
- *Empiricist:* exploratory, conceptual, reflective, discipline-based
- *Critical:* positionality-change, contextual, perspective, question, transdiscipline

Art practice *is* meta-theoretical, practical, reflexive, post-discipline and makes use of visual systems accordingly. It also comes in coupled with abovementioned critical, interpretivist and empiricist domains in theory dimensions: Create-critique, Meaning-making, Enact-explain.

Entanglement of video art and systems art

In the September issue of Artforum in 1968, Jack Burnham wrote in the article *Systemic Aesthetics*: "Increasingly, products – either in art or life – become irrelevant and different set of needs arise: these revolve around such concerns as maintaining the biological livability of the earth,

14 Ibid, p. 70
15 Graeme Sullivan. Art Practice as Research. Inquiry in Visual Arts. Pennsylvania State University, USA, 2009

producing more accurate models of social interaction, understanding the growing symbiosis in man-machine relations, establishing priorities for the usage and conservation of natural resources, and defining alternative patterns of education, productivity and leisure." Burnham, art theorist, critic and curator, who established the field of systems art, continued: "In the emergent 'superscientific culture' long-range decision making and its implementation become more difficult and more necessary. [...] A systems viewpoint is focused on the creation of stable, on-going relationships between organic and non-organic systems be these neighborhoods, industrial complexes, farms, transportation systems, information centers, recreation centers, or any of the other matrixes of human activity."[16] (Burnham 1968)

The editorial of the first issue of Radical Software in 1970, pointed to an obsession with hardware in the form of land, labor, or capital, in contrary to software, i.e. an access to information and its dissemination. It is significant that the magazine, dedicated to independent video practices, had three sections, Hardware, Software, and Environment which differs its approach from McLuhan's technological determinism. In the argument, the 'techno-sphere' and cybernetics were placed on the same level as natural and organic systems, and the software was introduced as a realm of the real power, and thus as a place where the battle must be fought over information structures: "Unless we design and build alternative information structures that go beyond and reconfigure existing ones, then alternative systems and lifestyles will be nothing more than products of the existing process."[17] (Radical Software, 1970) Michael Shamberg, author of *Guerilla Television*, the major Radical Software publication, describes the word radical not in the sense of political revolution and physical disruption of the system, but as a post-political discontinuity with the past, the transition from the old consciousness to the new consciousness through open information tools.

Among the contributors were key Raindance Corporation members - Frank Gillette and Paul Ryan, as well as Gene Youngblood, Nam June Paik and Buckminster Fuller. The Radical Software as a communication platform developed the idea of media ecology as the study of communication media and their effect on other media and society. It played a crucial conceptual role in this regard. In conjunction with the then new cheap video technology, artists and activist groups formed local loops of community media. In opposition to the central control of one-way broadcasting of mainstream media, collectives such as Ant Farm, Videofreex, The Kitchen, and dozens of others, built grassroot systems of self-representation, and experimented with possibilities of the social integration of video and cybernetic

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16   Jack Burnham. Systems esthetics. Artforum September 1968, p. 30 https://www.artforum.com/print/196807/systems-esthetics-32466
17   Radical Software, Issue 1, Raindance Corporation, 1970, p. 1

systems. Together with the feminist video, like Martha Rosler and her **Vital Statistics of a Citizen, simply obtained** (1977) or numerous other women and feminist collectives, mark the era when feminist artists were using the video camera to interrogate the politics of representation in maintaining hegemonic power structures. Feminist video art practices from the 1970s and 1980s play an important role in reconfiguring norms and social conventions in cultural systems.[18] (Long, 2016)

In addition to the explicitly political urban New Left of the 1970's, there was also the New Communality movement, which tended to return to the countryside and to a model of transformative revolution focused on interpersonal relationships and consciousness. The Ant Farm collective, in addition to their media performances, researched alternative architecture practices and environmental design. Gyorgy Kepes, the founder of the *Center for Advanced Visual Studies* at the Massachusetts Institute of Technology in Boston, USA, in the *Arts of the Environment* in 1972, wrote: "Environmental homeostasis at the global level is now neccesarry for survival. Creative imagination and artistic sensitivity can be seen as one of our basic, collective, self-regulating devices that help us all register and reject what is toxic and find what is useful and meaningful." [19](Kepes, 1972, p. 6)

Pulsa Group, an interdisciplinary collective, dealing with the differences between sociotechnological and biopolitical systems, can also contribute to emergence of systems art. 'Researchers in programmed environments', as they called themselves, proposed to correct systemic breakdowns by creatively expanding the interactive awareness of local media populations, which include feedback principles: environments, program events, cable television, tapes, movies. In one of their projects - **Harmony Ranch** (1966 – 1973) - they experimented with self-organized collective organic farming to find out about long-term growth rhythms and regenerative changes. Agriculture and the dynamics of group life were part of their ecology of cybernetic systems, whether focused on soil quality and vegetable production, or cooperative social forms and music production with acoustic and computerized instruments. [20] (O'Brien, 2016) Their connection with the media art scene of the time was maintained by visits of Nam June Pajk, Karlheinz Stockhausen or Steve Reich.

Thus we can conclude that since the emergence of media art, media ecology is both a condition and accompanying phenomenon of the natural ecology. Electronic media arts as socio-cybernetic

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18 Catherine Long, A feminist dialogue with the camera: strategies of visibility in video art practices. University of the Arts London, 2016, p. 19
19 Gyorgy Kepes (ed). Arts and the Environment. George Braziller, New York 1972
20 Kerry O'Brien. Communal Experimentalism in the Sixties: The Pulsa Group. New Music USA, 2016
https://newmusicusa.org/nmbx/communal-experimentalism-in-the-sixties-the-pulsa-group/

systems were created with intrinsic sensitivity to environmental sustainability in their very heart. We have also seen how software was at the center of attention. Not only the computer software we know today. As 'software' the discourse and whole body of social practice was understood.

Curating ecosystems

In 1990's, new media and digital art fit well into the narrative of innovation, where specialized knowledge is generated through experimentation, and then can be applied industrial society. The curatorial policy of the new media art avant-garde was suitable for art centers, subsidized by technology companies. The specialization in recognizable industrial domains went well along with the government's policies of funding art laboratories under the roof of centers of excellence. However, nowadays, this approach has already been criticized.

In a significant text on the curation of new media, Steve Dietz identified more than twenty labels being used as equivalents to new media, including computer art, electronic art, multimedia, digital art, software art, cybernetic art, next media", or variable media. [21](Dietz 2000) He noted that new media after 2000 lost their amazing novelty and curators, instead of looking for technologically advanced media, began to work with artists using obsolete media, low-tech and DIY tactics. The usage of the term media art subtly marks the shift from high-tech art, with its narrative of technological progress, to the rather context aware and critical investigation of digital and networked media. Media art is able to embrace a theory of systems and ecological thinking, which are integral parts of discourse surrounding video art as early as in 1960s.

Today, many of the media art projects representing the systemic and ecological ways of thinking and aesthetic preferences that Jack Burnham pointed towards in his essay, or which subsequently emerged, are of renewed interest to art critics, and curators. Eologically charged, technology oriented, and systemic aesthetics embodied art illustrates well, why it is necessary to consider the wider context when discussing media art conservation. It shifts our thinking from artefacts like moving images to artworks as open cybernetic systems involving social actors or living ecosystems.

We can compare one of the original works of Hans Haacke and follow with some contemporary examples. Hans Haacke's **Rhine-Water Purification Plant** (1972) at the Krefeld Museum, included a

21 Steve Dietz. Curating New Media. *Yproductions,* 25. 8. 2000, captured February 4, 2021. (http://perma.cc/L43W-2V67).

device for purifying water from the Rhine with functional chemical treatment and water filtration using activated carbon and sand. The purified water was pumped into a large transparent acrylic tank with swimming goldfish to demonstrate how it is possible to construct a life-supporting system technologically. However, the project also intervened behind the cosmetic patch of restorative eco-aesthetics. Haacke documented the extent of the pollution of the wastewater discharged into the Rhine in Krefeld, which amounted to 42 million cubic meters each year, and quantified the volume and types of industrial and domestic waste, listing the main polluters. The project addressed the need to restore the degraded ecosystem and pointed out the city's role in pollution, which attracted attention from the local media He called the political effect of this work "a real-time social system".[22]

Tega Brain's "Coin-Operated Wetland" (2011) recreates natural water purification circuit in a gallery. Image by Alex Davies.

Among Tega Brain's earliest artworks, based in environmental engineering and examination of issues of ecology, data systems and infrastructure is **Coin-Operated Wetland** (2011, 2021). A laundromat with closed water circuit built in a gallery consists of a soil and plant purification system for wastewater to return clean water back to washing machine which actually was operated by people.

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22 T. J. Demos. *Decolonizing Nature : Contemporary Art and the Politics of Ecology*. Sternberg Press Berlin 2016, p. 47

"We could only do one load per day because that's the pace at which the plants could consume the water. But if we're going to shift away from seeing ecosystems strictly as service providers and towards a more negotiated, reciprocal relationship with them, our systems are going to need a little more give."[23] (Brain, 2019)

Restoration projects should not be limited to technological structures and formal features. At the symposium Contemporary Art Conservation Revisited: 20 years later, held in 2022 at the Bern Academy of the Arts,[24] Coline Ardouin presented on the topic of managing and caring for living plants that are part of an art installation in a museum setting, which requires cooperation with experts from different fields, such as biology or botany. Example of such curatorial practice can be the **Beuys' Acorns** (2007 - 2025), re-enacting project of artistic duo Ackroyd & Harvey (Heather Ackroyd and Dan Harvey) involved trees grown from acorns collected from Joseph Beuys' **7000 Oaks** (7000 Eichen, 1982-1986) famous social sculpture. For transdisciplinary readers not familiar with Beuys' work I can shortly explain some of it's aspects. With 7000 Oaks, Beuys wanted to turn Kassel, 'city of administration' to the 'city of trees' by planting oak trees and other tree species in public spaces. Each tree had a basalt column planted into the ground next to it. Organisationally and financially ambitious project begun in 1982 with the Documenta 7 exhibition by bringing all the columns to one place forming a huge sculpture from where they were distributed. The basalt mass and planting was met with disfavour and obstacles. Planting carried on by number of people and groups for several years, until finally the material sculpture disappeared, turning into the invisible social sculpture. While Beuys' artistic vision was to transform consciousness so that the biosphere, as a healthy, biological and essential atmosphere, would be consistent with human and multi-species needs, the re-enactment of this ecological project, The **Beuys' Acorns** materialized into a tour with discussions of these topics through French cities in advance of the United Nations Conference on Climate Change in Paris in 2016, and continued through various institutions across United Kingdom. The saplings have acted as both artwork and catalyst for a public discussions on climate change carried out in galleries and exhibitions. In 2021, the trees were exhibited at Tate Modern in London and as part of Beuys' legacy, seven of the oak saplings was permanently planted in the local area. The artists aim to plant the remaining trees by 2025.[25]

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23 Hack the Planet: Tega Brain on Leaks, Glitches, and Preposterous Futures. Logic, 2019
https://logicmag.io/nature/hack-the-planet-tega-brain-on-leaks-glitches-and-preposterous-futures/
24 Contemporary Art Conservation Revisited: 20 years later. Bern Academy of the Arts, 2022
https://www.hkb.bfh.ch/conscare
25 In response to the climate emergency, artists Ackroyd & Harvey have installed *Beuys' Acorns,* a group of 100 oak trees, on Tate Modern's South Terrace. Tate Modern, 2021
https://www.tate.org.uk/whats-on/tate-modern/beuys-acorns

Art of digital communities and open public infrastructures

In 2010, in a lecture named Freedom in the Cloud for the Internet Society New York, Eben Moglen recapitulated the development of networks. From the original ideas of all peers on the same level, changing gradually to omnipotent servers in the cloud and monitored 'users' under the secretive economy of data mining. He called it the architecture of disaster. An increasing concentration of power has emerged without any discussion of the long-term social consequences. The asymmetry between thin clients against strengthening servers also means the increasing impotency of people who own the client devices. You can't play what you want on your phone, just what the monopoly music publisher allows. It is no longer the case of software companies, but management of platform business models.[26] (Moglen, 2010) The lecture happened to be the starting point leading to the development of public social networks, critique of using the word 'user' for humans and Moglen's idea of small internet device, a personal mobile server, having all the apps to facilitate the communication among people, called **Freedom Box**, became a reality ten years later.[27]

Moglen's lecture inspired four students of New York University to a crowdfunding campaign. At the end of 2010, they released the first version of **diaspora***,[28] which was to replace Facebook with a decentralized network, sponsored by a public institution and not owned by anyone. Diaspora was a media hit before a line of code was written. The youth, inexperience, high expectations, and bugs of the first version left an indelible mark on the project and later would sink further huge difficulties. As a 'startup', it failed, but the community prevailed and today it is second largest open social network.

In decentralized social networks, there is no one central website. There is many of them, with different names, with different individual or organizational providers. These nodes create a connected network by using a common protocol, based on standardized message types, understandable to all nodes. If it sounds faintly familiar, that's exactly how internet was designed to work.

Perhaps the very first node of the independent social network was **identi.ca** in 2008, based on the StatusNet software and the OStatus protocol. It focused primarily on the free software community. Ostatus, standardised in 2010 by Evan Podromou is the extension of RSS/Atom web publishing

26 Eben Moglen. Freedom in the Cloud, Internet Society New York, 2010 https://isoc-ny.org/1338
27 Freedom Box. https://www.freedombox.org/
28 Diaspora* https://diasporafoundation.org/

protocol, which is still popular in the form of podcasts. With a reader app for RSS or a podcast, anyone can collect interesting news from various internet places by subscribing without needing to visit each site again and again. But you cannot comment, share, or interact and that is why events, and their actors were the extension introduced in Ostatus. Evan Podromou continued his work on various social projects and is a co-author of **ActivityStreams,**[29] a major open format specification for activity protocols, which are used to syndicate activities taken in social web applications and services, already widely used by websites, and decentralized social media hubs, called Fediverse.[30]

By the time Diaspora* was in its infancy, Mike MacGirvin wrote the DFRN (Distributed Friends and Relations Network) protocol. Connections to Status.Net via their OStatus protocol, as well as Twitter and Facebook, worked. He later studied the source code and packets of Diaspora*, and thanks to Ilya Zhitomyrsky, succeeded in creating a functional federation module for the Diaspora. Mike MacGirvin has been dealing with decentralized protocols for decades. In the 1980s, he wrote federated software for bulletin boards that provided several services, file downloads, email, games, and news. It was able to send federated messages to FidoNet, Bitnet and ARPAnet. Now farming in rural Australia, Mike manages the development of projects for decentralized social networks. He is working on an ethical replacement for toxic online sites, dropping any project branding and roadmaps. Unless fighting wildfires, goes to throw hay to his horses and listen to what they want to say to him, then responds on the support forum to the issues of online community.[31]

Of course, the power and money dominated culture of 'tech-bros' of Silicon Valley, is rejected also by feminist and cyberfeminist collectives. **The systerserver (2005-)**[32] is a physically situated server run by women to be their own space and medium of expression. They intentionally avoid proclaimed 'ease-of-use' of commercial services for the similar reasons as (Drucker 2012) and (Posner 2016) in digital humanities. Communities of techno-feminist practice are informed by Donna Haraway's 'situated knowledges'.[33] (Haraway 1988) The idea concerns how concrete practices of particular people make truth. Cyberfeminists from KRYSS Network explain how to understand the notion of feminist server: "An informal group of feminists have been imagining a more autonomous infrastructure that puts human well-being at the core of technology and governance, to ensure that the

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29 ActivityStreams 2.0 W3C Reccomendation, 2017 https://www.w3.org/TR/activitystreams-core/
30 Federated networks. Monoskop https://monoskop.org/Federated_networks
31 From personal online experience of the author.
32 Systerserver. 2005 https://web.archive.org/web/20050408091620/http://systerserver.net/
33 Donna Haraway. Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. Feminist Studies Vol. 14, No. 3 1988, p. 575-599

data, work and memory of feminists are better accessible, preserved, managed and controlled in ways that allow for the promotion of human rights and the exercise of online freedoms of opinion and expression, and of assembly and of association, of rights to information and privacy, and of how the concept of consent is clearly defined."[34]

Leaf node9. Solar-power designed field server for forest livinglab with Livinglabs zine. Ecosystems and biodiversity are supported with sensitivity to local resources, measured by environmental sensors. During Covid-19 wintertime when sunshine conditions limited outdoor presence, Leaf's social network and camera intermediated environmental art experiments from closed exhibition in Entrance Gallery in Prague. Source: author

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34   Serene Lim - Angela M. Kuga Thas. Feminist server. https://en.ftx.apc.org/books/small-stories/page/feminist-server

Bibliotecha Varia. In Rotterdam, artists, media students and theorists formed around the Varia space placed an unusual electronic book into their bookshelve. Bibliotecha proposes an alternative model of distribution for digital texts. It allows specific communities to form and share their collections, through a single-board computer running free software to share books over a local WIFI hotspot. No server farm required. Source: varia.zone

In response to the dystopia of global corporate surveillance megastructure and geopolitical architecture, which Benjamin Bratton called The Stack,[35] (Bratton, 2016) **Waag** Society formulated a mission for digital public spaces called the Public Stack in 2019. [36] The difference between the Stack and the Public Stack is in the core values embodied in the principles the latter rests upon, and the design process it encourages. The Public Stack departs from the private and state-centric conception of The Stack described by Bratton. While The Stack is built on closed design process resulting in proprietary technology, the base layer of the Public Stack orbits around common values of fundamental rights and socioeconomic considerations, which are embodied in the open design processes involving all stakeholders to provide democratic governance of digitalisation. The resulting tech layer is open-source and ethical. There are no users, but digital citizens. A broad coalition of media and academic institutions was also formed in Nederlands under the name Public Spaces,[37] supporting public transition to an open software based on civic values.

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35   Benjamin Bratton. The Stack: On Software and Sovereignty, MIT Press 2016
36 Public stack. https://publicstack.net/
37 Public Spaces. https://publicspaces.net/

Waag Society (lately renamed as Waag Futurelab) in Amsterdam was founded in 1994. It is informed by the ethos of of the feminist hacker movement, as Marleen Stikker, its director, is one of the founders of **The Digital City**[38] (De Digitale Stad, 1994), the first virtual community introducing free public access to the internet in Amsterdam. Digital City in 1994 was one of the first free internet providers and also the place where political parties and newspapers made their first digital steps. The municipality of Amsterdam opened its entire administrative information system, becoming the first open government.

With The Digital City, as well as other online communities, the line between public infrastructure and art project is unclear. In 2011, archival work was started under the name of re:DDS project[39] to make the heritage part of the Amsterdam Museum. Trying to retrieve as much as possible of the early days, being hardware, code and files, and media headlines as 'web archaeologists excavate a digital city'[40] the gathered material became part of the permanent collection of the museum. In 2016, under the name 'The Digital City Revives', the search for old material and the preservation of our digital heritage continued and the case study was honoured with a Digital Preservation Award.[41]

The examples of The Digital City, The systerserver, Node9 and many other online digital communities, which merge art, activism, cultural infrastructures and community care exist on the internet more than twenty years, preceding coprorate services we face today. From their modes of operation and resilience, memory institutions can learn for their digital cultural infrastructures and preservation efforts much more than from corporate models. Given the fluid nature networked art Annet Dekker speaks of 'authentic alliances'.[42] (Dekker, 2016) The net creates an environment in which communities are formed of real people, where is constituted through technical, social and cultural matter. From the perspective of the conservator and other professions involved in the preservation process, it is necessary to to work with speculative and procedural approaches and "becoming part of a 'network of care' in which a collaborative approach is important to comprehend the complexities of net art".[43] (Dekker, 2016)

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38 De digitale Stad. http://www.medienkunstnetz.de/works/digitale-stad/

39 Tjarda de Haan. Project: re:DDS, Digital Archeology https://digital.library.unt.edu/ark:/67531/metadc1610915/

40 Peter Teffer. In Amsterdam, web archaeologists excavate a digital city. The Christian Science Monitor, 2014 https://www.csmonitor.com/World/Europe/2014/0329/In-Amsterdam-web-archaeologists-excavate-a-digital-city

41 The Digital City revives: A case study of web archaeology https://www.dpconline.org/events/digital-preservation-awards/the-digital-city

42 Annet Dekker. Collecting and Conserving Net Art: Moving beyond Conventional Methods, New York: Routledge, 2018, p. 14.

43 Ibid. p. 164

Near future transitions

In the past years, there was a heated political debate over private big-tech platforms and their obligations and right to moderate content versus censorship versus free speech. We are in the situation of internet, still as emerging medium without regulation, brings back an example from history of the telecommunication industry during its maturing days in the 1970's. At some point, only phones devices manufactured by the telecom operators themselves could connect to their network. Users of YouTube cannot talk to users of Facebook because it does not fit the interest of corporations. Imagine we would need different TV sets for each TV channel because broadcasters used proprietary signals to compete. Imagine we could not call a phone number from one network provider to another network. Public institutions and their policies should be more concerned about the situation of the open internet turning in large part into a proprietary domain. This should be taken into account when choosing platforms for digital archives of cultural heritage. Corporate content platforms failed to provide a place for cultural discourse or education. They strenghtened as tabloid attention-driven advertisement services instead. As private walled gardens, they deliberately lack transparency and interoperability based on technical standards. Even if history is showing us that the walled gardens are disappearing and in the long term are replaced by open ecosystems that eventually bring more value, this is often the best way to have the most profitable business in the early days of any industry.

Although information infrastructures had undergone a long development from monolithic and isolated systems to modular and interoperable, the general use of prefabricated and presumptive tools still inevitably interferes and inhibits critical, independent, thinking. As Johanna Drucker puts it: "The cultural authority of digital technology is still claimed by the fields that design the platforms and protocols on which we work. These are largely fields in which quantitative, engineering, and computational sensibilities prevail. Tools for humanities work have evolved considerably in the last decade, but during that same period a host of protocols for information visualization, data mining, geospatial representation, and other research instruments have been absorbed from disciplines whose epistemological foundations and fundamental values are at odds with, or even hostile to, the humanities. Positivistic, strictly quantitative, mechanistic, reductive and literal, these visualization and processing techniques preclude humanistic methods from their operations because of the very assumptions on which they are designed: that objects of knowledge can be understood as self-identical, self-evident, ahistorical, and autonomous. "[44] (Drucker, 2012)

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44 Drucker, 2012

Digital curation should be aware of these threats and work forward to become a humanistically conscious theory and the practice of critically *making* the media architectures at the level of computing, design, technology, information modeling, data structures, interface, and protocols. Tools of digital curating and preservation should allow critical reading, qualitative approaches, support paratextual apparatus, invite wide performative interaction and discussion as key principles on cultural platforms.

Media artists and free software developers, previously the first inhabitants and thinkers of the empty internet space, continue to create and shape ethical networks. There are already several open social protocols being used by websites to talk to each other, which could connect archive repositories and collection systems. Open public standards in federated social networking already provide solutions without the controversies of deplatforming or dividing corporations. And digital curation is starting to incorporate them into digital art infrastructures. Social networking can connect communication and events in thousands of repositories across memory institutions and their culture preservation strategies. Aware of the fact that what determines art is often found in relation to broader social alliances, Annet Dekker pointed out, that it is not uncommon for networks to form around artworks that are not collected by museums, large institutes, or private collectors:

"I suggest that such a network could evolve into a network of care that maintains or conserves (parts of) an artwork, consists of a combination of experts and non-specialists, and introduces knowledge from a variety of fields and backgrounds." Conservation thus "is less about conserving materials and more about the preservation of social information and relations" (Dekker, 2018, p. 14) [45]

However, carbon imbalance measures the time to rethink long-term preservation strategies because the only digitization and long-term preservation projects possible are those within the limits of sustainability. The trustworthy repositories and curatorial practice should be seen from the perspective of their ability to maintain art together with the biological livability of the environment.

One of the strategies of datacentre operators is increasing efficiency and optimisation. That is relatively easy to do, saves money and does not change too much in the current system. Hyperscale, utilisation control and AI are marketed as something what makes datacenters green. But that is nothing new and nothing what can seriously tackle greenhouse emmissions. Efficiency is a factor, which is already present and alarming energy consumption growth continues despite of regular efficiency improvements. With growing number of devices, we need several stages of ten-fold decrease steps in consumption and big downgrades also in terms of raw material use to make the exponential curve of

45 Annet Dekker Collecting and Conserving Net Art Moving beyond Conventional Methods, Routledge, 2018, p. 14

carbon emission go flat. Datacentre buildings have embedded enviromnental impacts which cannot be offset planting trees somewhere else easily or at large scale. The datacentre transformation will follow the the transformation of electricity grid. Centralised power distribution is being replaced with renewables in the decentralised grid of many local sources. In the near-future grid residential houses not only produce energy, but also contain virtualised computing infrastructure, where waste heat is used for heating rooms and warm water. Distribution of computing workloads, household or transportation needs will be coordinated by smart control protocols balancing energy and computation resources availability with immediate demands. Some workloads will need to shift to different timeslots not to be colliding with responsive workloads or priority energy flows. The 'cloud' marketing wave passed and the 'edge' is already here. Now the trend is local microdatacenters, edge servers and making better use of endpoint devices. IDC states that carbon-neutral datacenters need 'holistic community planning' and their operators will engage in long-term urban planning. Within the long-range vision the datacenters should even become the platforms for more sustainable ecosystems.[46] That would require urban development not only include microdatacenters in places where needed, but also their integration to blue-green infrastructure of water and plants.

In Sweden, Triple Green certification of datacenters[47] was introduced by Bahnhof AB. Certification requires not only renewable energy, but also waste heat use for nearby households and heating must replace other energy sources, while everyone profits in the process. Heat pumps need warm air to operate, looks like ideal place for residential datacenter. Industry always used energy responsibly, heating was standard byproduct of many infrastructures and was included in the design from beginning. It is only surprising, that big-tech did not take the trouble yet, releasing waste heat into the air.

The publishers of **Low-Tech Magazine** have launched a solar version of their website in 2018 on a 2.5W microcomputer board powered by a solar panel and a small battery.[48] They spent a lot of time redesigning the pages to keep the code as small as possible, and the images in monochrome. The site has an indicator of whether the sun is shining and how much energy is available. If the weather is bad for a few days, the website will shut down. You can come another day. Little single-board computers with low demands on resources and low consumption are suitable for a sustainable operation model.

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46 Datacenters and Sustainability Goals. IDC InfoBrief 2020
47 Triple Green http://triplegreen.net/
48 About this website. https://solar.lowtechmagazine.com/about.html

The sustainability mindset is about to be extended to large institutional systems requiring robustness and high availability. Even that is being achieved with embedded devices. Free software is increasingly easy to manage and self-host, and recently a major shift happened in small-tech clustering technologies, able to connect lots of computing, storage, sensor and other IoT (Internet of Things) units together. A little supercomputer is still consuming a fraction of electric power and materials compared to an old generation server, which can compel us to consider choosing small-tech infrastructures for public sphere projects. The potential of small-tech solutions lies in a large number of interconnected publishing and curatorial nodes, contributing to the building of the organizational model of cooperation between small independent galleries and major cultural and memory institutions which can mutually back up and temporarily or permanently represent each other in their functions. In Organization After Social Media, Geert Lovink and Ned Rositter describe how organized networks have changed the practices of many types of small institutional forms as they progress from casual friendship and 'networking' to stronger decision-making ability social technologies based on enduring time. [49] In so doing, your library server can live in symbiosis next to your room plants in your office.

49 Geert Lovink, Ned Rossiter. *Organisation after social media,* 2018

List of images

Num.	Title	Author
Figure 1	Algorithms of Late Capitalism	various
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Figure 3	Leaf node9	Michal Klodner
Figure 4	Bibliotecha Varia	Varia collective, used with permission

List of quoted artworks

Karla Zavala - Adriaan Odendaal, *Algorithms of Late Capitalism zine #3* **(2020)**

https://algorithmsoflatecapitalism.tumblr.com/zines

Michael Shamberg, *Guerilla Television (1971)*

https://openlibrary.org/books/OL5222193M/Guerrilla_television

Martha Rosler, *Vital Statistics of a Citizen, Simply Obtained* **(1977)**

https://www.vdb.org/titles/vital-statistics-citizen-simply-obtained

Pulsa Group, *Harmony Ranch* **(1966-1973)**

https://archive.org/search.php?query=subject%253A%22Pulsa+Group%22

Hans Haacke, *Rhine-Water Purification Plant* **(1972)**

https://www.academia.edu/3801912/All_Systems_Go_Recovering_Hans_Haackes_Systems_Art

Tega Brain, *Coin-Operated Wetland* **(2011, 2021)**

http://tegabrain.com/Coin-Operated-Wetland

Joseph Beuys, *7000 Oaks* **(1982-1986)**

https://www.tate.org.uk/art/artworks/beuys-7000-oak-trees-ar00745

Heather Ackroyd, Dan Harvey, *Beuys' Acorns* **(2007-2025)**

https://www.ackroydandharvey.com/beuys-acorns-tate-modern/

Evan Podromou, *identi.ca* (2008-)

https://en.wikipedia.org/wiki/Identi.ca

systerserver collective, *The systerserver* **(2005-)**

https://systerserver.net/

Michal Klodner, *Leaf node9* **(2020-)**

https://webs.node9.org/channel/leaf

Varia collective, *Bibliotecha Varia* **(2016-)**

https://networksofonesown.varia.zone/Bibliotecha/

Marleen Stikker et al., *De Digitale Stad* **(1994-)**

https://waag.org/en/project/digital-city-dds/