The Aesthetics of Decentralization

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Submitted to the Department of Architecture
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Art, Culture and Technology at the
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JUNE 2019

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ABSTRACT

This thesis explores ways in which decentralized network technologies are used to experiment with and design new modes of socio-technical organization. Drawing on an understanding of aesthetics as a "distribution of the sensible" and Jack Burnham's notion of "systems esthetics", an artistic engagement with society's technological modes of organization, I explore the ways in which the "aesthetics of decentralization" articulates a circuit of desire connecting technical systems, cultural metaphors and social forms. A key countercultural motif in the history of the World Wide Web, decentralization imagines that political objectives of openness, freedom and even libertarian self-sovereignty within a networked society can be achieved through the technical protocols. Chapter 1 examines the logics of the "stack" and the "platform" as the vertical and lateral organizational abstractions of this environmental matrix.

In seeking to negate this centralization of power over digital networks, the decentralized web is a multifaceted technological and cultural phenomenon with disparate agendas, but broadly seeks to reconfigure the technical organization of the web as a commons-oriented peer-to-peer framework. Chapter 2 examines in detail the primary concepts of the decentralized web, reading their propositions as an effort to reconstitute the terms of space, ownership and participation within the networked world. I argue that the decentralized web represents not so much a technical solution as a performative metaphor through which digital publics are called forth in order to denaturalize these hermetic socio-technical environments and imagine new spaces of possibility. In Chapter 3, I argue that the imaginary and aesthetic power of the decentralized web flows from the subjective experience of software as world-building, a process which imputes the rational consistency of synthetic "microworlds" upon the wider social domain. In conclusion, I suggest that the decentralized web falters as a political project because in seeking to build new forms of sociality through software, it fails to antagonize the structures of technological capitalist society. Nonetheless, the conceptual and performative metaphors engendered by these experimental systems call forth new technological discourses in which protocol serves as a guide, rather than a coercive armature, of a social imaginary.

Thesis Supervisor: Renée Green
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Contents

Acknowledgements

To my committee:

>   Renée Green, for teaching me that there is no audience — and that the conversation isn't over.
>   Caroline Jones, for your precision and generosity.
>   Arindam Dutta, for your rigor.
>   Orit Halpern, for your example.

To the ACT community:

>   Azra, Tobias, Marisa, Gediminas, Mario, Judith, and especially Nida, for your conversations and support.
>   Kevin, Drew, Hana, Marissa, John and Chelsea, for making everything happen.
>   Erin, Ringo, Rikas, and Zach, for pulling through.
>   Luiza, Nancy, Matt, Ryan, Rae, I hope you give yourself more time than I did.
>   Zach, Klara, Angus, for being around always.

To my family:

>   My mother and stepfather, always, for your love and your time.
>   My father, for being here, in your way.

To Kalli and Sam, Mindy, Sam, Dan and Melanie for starting me down this conversation.

To Egg House, especially Adam, for spirit and fire, and to Tarataki (the Fish), for smiling.

And of course, to Agnes.

Introduction: Systems Aesthetics in the 21st Century

In September 1968, critic and curator Jack Burnham published an essay in *Artforum* entitled "Systems Esthetics", declaring: "We are now in transition from an object-oriented culture to a systems-oriented culture. Here change emanates, not from *things*, but from *processes*."[1] Against the modernist formalism of the day, Burnham argued for "unobjects" which overflowed the conventional aesthetic circumscriptions of "art" as such, building resonances and efficacies within the socio-technical systems of the wider world. "*In an advanced technological culture*", he writes, "*the most important artist best succeeds by liquidating his position as artist vis-a-vis society* [...] scientists and technicians are not converted into "artists", rather the artist becomes a symptom of the schism between art and technics." (his emphasis).[2] Burnham positions the artist as an interstitial techno-cultural operator, through whose work the interrelations between culture, technology and society could be made visible through aesthetic experience. Art was to be a "symptom" of the organizational regimes of an ever-changing world, a critical observer and subject of its productive and structural interdependencies. Just as media theorists like Friedrich Kittler would later seek to "drive the spirit out of the humanities[3]" by rendering technical systems as the primary subject of history, Burnham anticipated a post-humanist emphasis on "matter-energy information exchanges", over and against hermetic bodies of meaning, which would characterize the cultural aesthetics of the information age.[4] An interlocutor of Hans Haacke and an inaugural fellow of Center for Advanced Visual Studies (CAVS) at MIT, Burnham identified this shift towards "systems esthetics" with the techno-centric milieu of cybernetics, the nascent computer science and socio-biological systems theories through which the world was increasingly calculated in terms of information.

Fifty years on, Burnham's intuitions remain incisive, though to say that we live today in a "systems-oriented culture" would be a truism that hardly scratches the surface of our entrenchment in

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[1] Jack Burnham, "Systems Esthetics," *Artforum*, September 1968, https://www.artforum.com/print/196807/systems-esthetics-32466.

[2] Burnham, 'Systems Esthetics', 31.

[3] Friedrich A. Kittler and Universität Freiburg im Breisgau, eds., *Austreibung Des Geistes Aus Den Geisteswissenschaften: Programme Des Poststrukturalismus*, Uni-Taschenbücher 1054 (Paderborn ; München ; Wien ; Zürich: Schöningh, 1980).

[4] Burnham, Jack W. *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century* (New York: Braziller, 1987), 370.

expansive networks of information and capital. Burnham's call for art to center its discourse around the "systems viewpoint" and the "problems of organization" resonates with today's technological society; as does his acknowledgement of *environment*, both as an aesthetics of relationality and the exigencies of actual planetary ecology, concerned with "maintaining the biological livability of the Earth, producing more accurate models of social interaction, understanding the growing symbiosis in man-machine relationships, establishing priorities for the usage and conservation of natural resources, and defining alternate patterns of education, productivity, and leisure."[5] Indeed, Burnham's cybernetic ideals may appear naive from the ruined landscapes of contemporary technocapitalism, just as they likely raised eyebrows amidst the post-war antipathy towards computerized corporate managerialism.[6] "Systems esthetics", he opined, would fulfill the "esthetic impulse" missing from the technocratic developments of "advanced technological society"[7], aligning art with the civilizational priorities of "[creating] stable, ongoing relationships" in which "all living situations must be treated in the context of a systems hierarchy of values"[8]. While today's globe-spanning information networks have made such an system of planetary organization imaginable, "advanced technological society" has failed to produce the ordered yet organismic harmony of the "automated state" that Burnham envisaged, nor might such a state seem desirable under contemporary regimes of surveillance capitalism. Nonetheless, as our systems-oriented culture grows in scale and complexity, engagements with organizational structures and cultural techniques crystallized in Burnham's essay remain fundamental to any aesthetic program that seeks to engage with the networked, informatic, and processual landscape of contemporary life.

System evinces organization and control, while *aesthetics* follows it with a subversive shadow. In Jacques Rancière's use of the term, aesthetics relates to the "distribution of the sensible", a sensorial training through which we learn to acknowledge the world, and conversely, the techniques by which the world is "given" to experience. The way we see, the cultures we foster, and the technologies we build

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[5] Burnham, "Systems Esthetics", 31.

[6] Caroline A. Jones, "Artist / System" in *A Second Modernism: MIT, Architecture, and the "techno-Social" Moment,* Arindam Dutta, ed., (Cambridge, MA: SA+P Press: MIT Press, 2013), 534.

[7] Burnham, "Systems Esthetics", 35.

[8] Burnham, "Systems Esthetics", 31.

consolidate an aesthetics that discloses *what we think the system is*. Aesthetics, then, is the ordering of order, casting ontology in certain hues that are contingent upon the historical, political, and technical conditions of their formation. At each moment, aesthetics threatens to destabilize *system's* abstract co-ordinates. In this reading of Burnham's phrase, the "schism between art and technics" is also that which separates *systems* and *aesthetics*: both impose a desire on the world, to understand it as unified and coherent, while also seeking to reveal it through the shifting patina of history and experience. In an accelerationist mode, Burnham was at pains to align the pursuit of artistic knowledge with the organizational power of an emerging technological regime, pinning his hopes upon a synthetic moment which, as he wrote, "plainly ... extends beyond political realities of the present."[9] By embracing the technical and philosophical paradigms of systems theory, artistic endeavor would assume the "critical function" of guiding the technological society into new forms of meaning. Others were not so hopeful: William Irwin Thompson, then a professor at MIT, reflected upon the founding of the CAVS: "The technocrats were seeking the convert the artists into celebrants of the system: in making technological art possible, they were insuring the stability of their technological society."[10] Thompson's more cynical view rings true for us today, though one could suggest that contemporary "technological society" has thrived on an inscrutable state of instability, rather than any semblance of technocratic order. As Burnham himself would later admit, "Ultimately, systems theory may be another attempt by science to resist the emotional pain and ambiguity that remain an unavoidable aspect of life."[11]

I begin with Jack Burnham because I am tentatively invested in the symptomatic, self-liquidating space between art and technics that he ascribes to the role of artists in society — a space which affords art the critical potential to reveal and incarnate socio-technical complexities, while simultaneously threatening to subsume it entirely. As a researcher and practitioner, I am interested in the possibility for art to function as a parasite on the body of production: an activity that is fluent in the tools and techniques of technocapitalism, while antagonizing its productivist and imperialist agenda by posing counterfactuals, invoking experimental affects, and constructing speculative forms of sociality. In other words, I am

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[9] Burnham, "Systems Esthetics", 35.

[10] William Irwin Thompson, *At the Edge of History* (New York; Hagerstown; San Francisco: Harper and Row, 1979), 86.

[11] Burnham, Jack. *Great Western Salt Works: Essays on the Meaning of Post-Formalist Art.* New York: Braziller, 1974, 11

interested in the potential for art's entanglements in worldly systems to disclose other systems, and other worlds. As such, I appreciate Burnham's implicit injunction that art is never merely itself—"Art" with a capital "A"— but needs to acknowledge the "schism" that gives it meaning. This necessity seems all the more critical in today's social and technological context, in which the organizational logic of information networks informs every scale of activity. If "systems esthetics" articulates a desire to position the artist as poet, critic and prophet of an emerging technological culture, it is an ambition that has never been realized.[12] The architectural theorist Keller Easterling has lately called for practitioners to think in terms of "medium design", a call which echoes Burnham's insistence on the unboundedness and embeddedness of art within both the systems of culture and cultural systems. *Fewer things, more processes*: "medium design is less like making a thing and more like having your fingers on the faders and toggles of organization."[13] Easterling's metaphors evoke the ambient nature of the contemporary technologies, in which one can say that the internet has receded into the environment of everyday life as protocols which co-ordinate the organization of social, political and geographic space. To borrow from Stuart Hall, these information technologies are not everything, but they are a *dimension of everything*.[14]

The web has changed dramatically over its three decades of existence, expanding ever more pervasively and ubiquitously across the social domain. Lately, the regime of digital platforms, such as the "Big Four" of Amazon, Apple, Google and Facebook, has operationalized the environmental production of digital networks through the centralized design and co-ordination of the processes and interfaces of socio-technical production. If, as Burnham suggests, "systems esthetics" concerns a re-orientation of conceptual inquiry towards the "problems of organization" and the making of "esthetic decisions that ... control the quality of all life on earth",[15] then contemporary digital platforms are taking up this task wholeheartedly. Meanwhile, their monopolization of power over the networked environment has fissured the ideological narrative of the network as a "virtual" space of free and equal participation, revealing the

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[12] Burnham himself would later describe art and technology as "the panacea that failed".

[13] Easterling, Keller, "Indeterminacy" in *Medium Design* (Moscow: Strelka Press, 2018), 3.

[14] Stuart Hall, "Living with Difference: Stuart Hall in Conversation with Bill Schwarz", Soundings 37 (Winter 2007): 153. https://www.lwbooks.co.uk/sites/default/files/s37_15hall_schwarz.pdf

[15] Burnham, "Systems Esthetics", 35.

web as a political medium through which the meaning of identity, space, governance and civic participation are contested.

In this thesis, I explore ways in which decentralized network technologies are used to experiment with and design new modes of socio-technical organization. Rather than Burnham's hope that the artists, as "[*makers*] *of esthetic decisions*" would dictate the direction of technological endeavor, it is today's technologists, bolstered by speculative capital and network effects, who are building increasingly powerful, expansive and extractive environments of social, cultural and political enclosure — in short, the dominant systems and interfaces of everyday life. It is precisely the speculative character of contemporary digital technologies that aligns them with the questions posed by "Systems Esthetics". Given the immersion and enclosure of society by digital platforms, contemporary technical discourses are actively engaged in the speculation and design of new forms of society, with the increasing conviction that they have the agency, resources and the responsibility to build them. By examining the "decentralized web" in connection with the history of utopian discourses around information networks, I argue that technical diagrams and social forms affirm one another through the experience of using and designing networked software systems, an essentially *utopian* practice which allows one to build tangible metaphors for alternative infrastructures of communication and kinship. However, the seemingly abstract socio-technical relations imagined in these proposals also redefine complex and ambiguous social terms, such as "trust" and "community", while being themselves emerging *in media res*, entangled within the dystopian landscape of contemporary technocapitalism.

The "aesthetics of decentralization" denotes a worldview filtered through an emotion, a history and a technology. The emotion is the desire for control and freedom through the design of decentralized systems, a seductive power-knowledge regime that flows from metaphors of politics and ecology into the technical and discursive imaginary of computer networks. Through the visions and aspirations the decentralized web, this desire passes from discourse into code and back again, translating across theoretical, imaginary and technical domains. As network protocols blur into social fictions, I argue that the speculative intellectual project of "systems esthetics" is being taken up elsewhere, in the domain of programmers and developers seeking to determine, for better or for worse, our "systems-oriented culture".

On Decentralization

> 'If it were possible that industry could be concentrated on one point, there would rise within itself, and by its own movement, *an irresistible power of decentralization*'
>
> Frédéric Bastiat, *Popular Fallacies Regarding General Interests* (1849)[16]

Media scholar Nathan Schneider recently noted that the term decentralization is ever more prolifically used, while remaining woefully ill-defined, suggesting that this "lack of clarity that is functional, in that it enables people of varying ideological persuasions to imagine themselves as part of a common project."[17] Indeed, the polysemous character gives "decentralization" a peculiar power to invoke a sense of freedom and agency, since its deployment in socio-political discourse invariably resounds with a demand for equality through a redistribution of power, resources, control from the center, over *there*, to the people, over *here*. By virtue of its negative definition, *de*-centralization necessitates an image of organization, a collection of parts that interconnect (however inequitably) to make up the whole system. Amongst the earliest usages of the term is found in *Democracy in America* (1840), in which the French historian Alexis de Tocqueville wrote admiringly of the self-governing agrarian towns of the United States. Tocqueville noted that this form of governance was "not only of administrative value, but also a civic virtue", which engaged citizens and made them "accustomed to using freedom".[18] Meanwhile, Tocqueville's contemporary, the economist Frédéric Bastiat saw industrial decentralization as an "irresistible" entropic force, in an approving echo of Adam Smith's "invisible hand". From the beginning, decentralization takes on a liberal character in which the activity of the collective flows from the participation of sovereign individuals, while the forces of centralization (in Bastiat's case, industrial

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[16] Frédéric Bastiat, *Popular Fallacies Regarding General Interests; Being a Translation of the "Sophismes Économiques" ... With Notes by G. R. Porter [the Translator].* (John Murray, 1846), 41

[17] Schneider, Nathan. "Decentralization: An Incomplete Ambition." *Journal of Cultural Economy*, April 17, 2019, 3. https://doi.org/10.1080/17530350.2019.1589553.

[18] Alexis de Tocqueville and Arthur Goldhammer, *Democracy in America*, The Library of America 147 (New York: Library of America : Distributed to the trade in the U.S. by Penguin Putnam, 2004).

monopoly) are an aberration of the "narrow and rigid theorist" against the will of nature and providence.[19] This ecological imaginary is extended in the swarming, bottom-up force of the self-organizing network, which alludes to the unbounded and emergent forces within the system, at once representative the natural order of things and an unknowable and evolving environment.

With the proliferation of network systems since ARPANET, the political connotations of decentralization were transferred to a technical diagram which promised resilience through redundancy and openness of access. As Tim Berners-Lee wrote of his conception of the World Wide Web, "it had to completely decentralized … that would be the only way a new person could start to use it without asking for access from anyone else."[20] Moreover, the decentralization of network infrastructures (such as Internet Protocol, TCP/IP) could be demonstrated with mathematical certainty, insofar as all nodes are treated equally within the operation of the system, to say nothing of how the system is actually used within the context of society. Idiosyncratically, decentralization at once demands to "take back power" for the parts over the center and implicitly commands a vision of the whole system through the coding of the sinews and protocols that hold it all together. As Alexander Galloway has argued, the technical decentralization of digital networks does not eliminate control so much as distribute it into never-neutral protocol, resulting in "*the most highly controlled mass media hitherto known*".[21] Far from eliminating authority, decentralized protocols totalize and harmonize the structures of control across the system. Nonetheless, the rhetorical potency of decentralization has made it the pet philosophy of the web's native political cultures, from cypherpunks to crypto-anarchists to cyber-libertarians, for whom technical diagrams of non-hierarchical organization mirror promise to operationalize a dream of a self-sovereign network utopia that would liberate individuals from geography and governments through the virtual realities of cyberspace.[22]

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[19] Frédéric Bastiat, *Popular Fallacies Regarding General Interests; Being a Translation of the "Sophismes Économiques" … With Notes by G. R. Porter [the Translator].* (John Murray, 1846), 41

[20] Marcus F. Franda, *Governing the Internet: The Emergence of an International Regime* (Boulder: Lynne Rienner Publishers, 2001), 6.

[21] Galloway, Alexander R. *Protocol: How Control Exists After Decentralization.* (Cambridge, MA: MIT Press, 2004), 147.

[22] John Perry Barlow, "A Declaration of the Independence of Cyberspace," Electronic Frontier Foundation, January 20, 2016, https://www.eff.org/cyberspace-independence.

For my purposes of exploring the socio-technical aesthetics of the decentralized web, I understand decentralization both as in a descriptive mode, invoking a system's organizational dynamics, and in an aspirational mode, an ambition for the collective to be structured otherwise.

Chapter One: Translation and Metaphor

George Lakoff describes metaphor as the cognitive process by which we conceptualize one thing in terms of another.[23] The ideologies of the internet and the World Wide Web emerged from a pre-existing desire to see the world as a holistic informational and ecological complex, a desire that was seemingly confirmed and operationalized by the technical possibilities of information networks. In this chapter, I argue that it is the fluidity of organizational metaphors such as system, ecology, and network across mental domains that have allowed the web to be championed in the name of so many competing political interests and social visions. Conversely, since the beginnings of the internet, this linguistic slipperiness has been accompanied by the expansion of a technological landscape in which information networks suffuse through manifold domains of social practice. In the manner of a self-fulfilling prophecy, the ecologically-inflected techno-utopianism that undergirded the "first cyberculture" of the 1970s has evolved into a contemporary landscape of network technologies which are substantively *environmental*: in the ambient ubiquity of their operation through mental and urban space, their drain on natural resources and the metaphors invoked to describe them, such as "surfing" and the "cloud". Where the network emerged from Cold War technologies and hippie counterculture as a *model* (of the whole system), its contemporary environmentality manifests rather as an infrastructural *medium*. As media theorist John Durham Peters notes, "media" in the 19th century referred primarily to the natural elements, yet today, "In a time when it is impossible to say whether the nitrogen cycle or the Internet is more crucial to the planet's maintenance ... we can learn much from a judicious synthesis, difficult though it be, of media understood as both natural and cultural."[24]

The acculturation of networked media as a pseudo-natural environment also suggests, conversely, the possibilities of synthetically engineering our everyday environments in increasingly granular ways. The discourses of "smart cities" and "ubiquitous computing" promise such a vision of fully designed, automated, and networked environments, with projects like Songdo International Business District in

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[23] George Lakoff, 'The Contemporary Theory of Metaphor', in *Metaphor and Thought,* ed. Andrew Ortony (Cambridge: Cambridge University Press, 1993), 202.

[24] John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago ; London: the University of Chicago Press, 2015), 2.

South Korea, as well as Google's Sidewalk Labs development in Toronto, taking a *tabula rasa* approach to the construction of "futuristic" urban environments. While Songdo was built "from scratch", on 600 hectares of land reclaimed from tidal flats in the Yellow Sea,[25] Daniel Doctoroff of Sidewalk Labs writes of building cities "from the internet up"[26], a decidedly dystopian prospect in which totalizing environments driven by data surveillance are determined by the interests of individual corporate actors and international finance capital. Meanwhile, the monopolization of web services and traffic by a handful of corporations has similarly colonized the forms of interaction on the internet's decentralized networks. In particular, the likes of Google and Facebook foreclose the possibilities of the web even as they open new channels of interaction: by offering access in return for selling attention, dominant platforms constitute online space through a feedback loop between users' behavior and advertisers' interests.

In what follows, I explore the metaphors of the "stack" and the "platform" as sociotechnical paradigms constitutive of the "vertical" and "lateral" organization of network society. Where the stack enforces the hierarchical logics of modularity and abstraction, the platform model reconfigures notions of social and civic participation within totalizing digital environments driven by the monetization of surveillance and the enclosure of the network commons. In particular, I argue that they figure as "operational environments", interfaces of an Umwelt in which interactions are always already instrumentalized and rendered "actionable", a circular motion which harnesses the power of network participation in order to accumulate data and attention as capital. As such, the cyberculture of the decentralized web emerges in a far more cynical view of networks than the hippie counterculture that came before. As these data-driven operational environments increasingly supplant areas of social infrastructure, they also denaturalize the ideology of free and open participation that has long underpinned the online imaginary, raising the prospect of overhauling its technical organization altogether through the design of commons-oriented tools and protocols.

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[25] Bethea, Ross Arbes, Charles. "Songdo, South Korea: City of the Future?" The Atlantic, September 27, 2014. https://www.theatlantic.com/international/archive/2014/09/songdo-south-korea-the-city-of-the-future/380849/.

[26] Daniel L. Doctoroff, "Reimagining Cities from the Internet Up," *Sidewalk Talk* (blog), November 30, 2016, https://medium.com/sidewalk-talk/reimagining-cities-from-the-internet-up-5923d6be63ba.

Chapter 1: The Web as a Whole System

> Since the destruction of a small number of nodes in a decentralized network can destroy communications, the properties, problems and hopes of building "distributed" communications networks are of paramount interest.
>
> Paul Baran, *On Distributed Communications*[27]

The global proliferation of the World Wide Web recapitulated an idea that captivated the counterculture of the 1960s and '70s: the consciousness of the world as a *whole system*. Within the tempestuous atmosphere of the cold war and the threat of planetary devastation, the counterculture developed alongside images and techniques of global interconnection: Cold War computer networks, such as SAGE and ARPANET, the anti-Vietnam War protest movement, and the birth of the environmental movement in the US, catalyzed by key moments such as the publication of Rachel Carson's *Silent Spring* (1962) and the launch of the Environmental Protection Agency (EPA) on the first "Earth Day" in 1970. This hippie counterculture would mutate into an energetic cyberculture, deeply influenced by the control theories of cybernetics, which saw the world as a planetary complex whose manifold physical, social and cultural interconnections could be understood through techniques of control and simulation. For example, communications scholar Fred Turner describes the influence of ecologist Paul Ehrlich on a young Stewart Brand at Stanford: "With an analytical framework drawn from ecology and evolutionary biology, Brand could simultaneously explain the threat of the Soviet Union to the United States and the threat of hierarchies to the individual."[28] In 1966, Brand campaigned for NASA to release a rumored image of the Earth seen from space by a satellite, the first of its kind, selling buttons that read "Why haven't we seen a photograph of the whole earth yet?"[29] Brand would use this image on the cover of the first *Whole Earth Catalog* in 1967, turning it into a symbol of planetary unity and ecosystemic holism, unmarked by political boundaries, behind which to a communalist, back-to-the-land movement could rally. The *Catalog*

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[27] Paul Baran, *On Distributed Communications, I. Introduction to Distributed Communication Networks*, Memorandum, (Santa Monica: Rand Corporation, 1964) 2. https://www.rand.org/content/dam/rand/pubs/research_memoranda/2006/RM3420.pdf

[28] Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*, 1. paperback ed (Chicago, Ill.: Univ. of Chicago Pr, 2008), 44.

[29] Stewart Brand, ed., *Whole Earth Discipline: Why Dense Cities, Nuclear Power, Transgenic Crops, Restored Wildlands and Geoengineering Are Necessary* (New York: Penguin, 2010), 214

provided an annually compendium of tools and ideas for the ideology of an interconnected, ecologically-minded world, and the utopian counterculture that embraced its ideals. As Steve Jobs, the founder of Apple, would later recall, "[the *Catalog*] was sort of like Google in paperback form, 35 years before Google came along."[30]
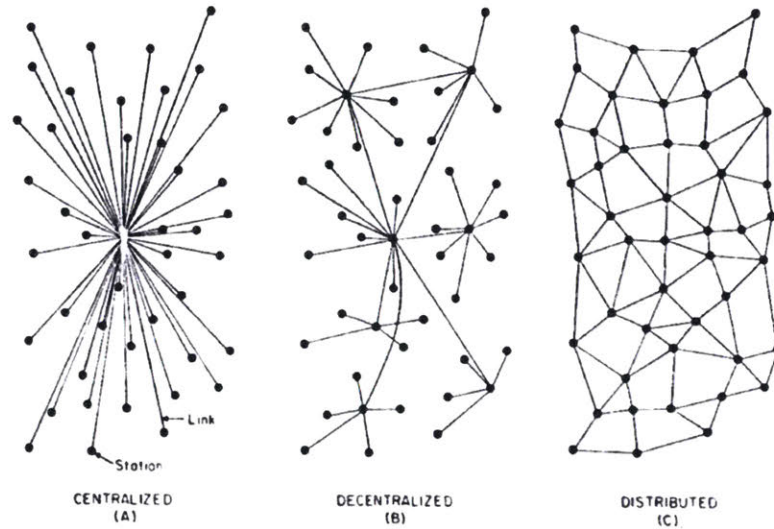

Figure 1. Paul Baran's network diagrams for RAND Corporation.[31]

The "whole earth" was an polyvalent metaphor which lent itself to a wide range of diagnostic and representational approaches. The late 1960s also saw the popularization of "Spaceship Earth", a planetary imaginary of the Earth as a whole and finite system, by the likes of Buckminster Fuller and Kenneth Boulding. As Boulding wrote, "The closed economy of the future might similarly be called the 'spaceman' economy, in which the earth has become a single spaceship [...] man must find his place in a cyclical ecological system[32]." In 1972, the Club of Rome reiterated these existential concerns in *The Limits to Growth*, a Malthusian report on the sustainability of global population and resources projected by the "World3" model, a computer simulation of the earth as a complex system. These holistic imaginaries

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[30] Stanford University, "Text of Steve Jobs' Commencement Address (2005)," Stanford News, June 14, 2005, https://news.stanford.edu/2005/06/14/jobs-061505/.

[31] Paul Baran, *On Distributed Communications, I. Introduction to Distributed Communication Networks*, Memorandum, (Santa Monica: Rand Corporation, 1964), p. 2. Accessed online: https://www.rand.org/content/dam/rand/pubs/research_memoranda/2006/RM3420.pdf

[32] Kenneth Boulding, "The Economics of the Coming Spaceship Earth," in *Environmental Resource and Economics.*, ed. Henry Jarrett (Baltimore, MD: Johns Hopkins Press, 1996), 7.

characterize an increasing consciousness in the postwar period of the world as a holistic and interconnected system. In the events described above, the "whole earth" is at turns conceptualized as a living organism, a fragile nature, a computable network of supply chains, and a harmoniously networked global community. With the development of computer networks, these metaphors of interconnection became increasingly bound up with the communicative realities of digital information. What was *whole* and *interconnected* about the worldly phenomena in question was envisaged and affirmed by the growing technical capabilities of computer networks. In his influential account of computer technology in the political imaginary of the American Cold War, Paul Edwards refers to "closed-world discourse", which

> ... through *metaphors, techniques, and fictions*, as well as equipment and salient experiences, linked the globalist, hegemonic aims of post-World War II American foreign policy with a high technology military strategy, an ideology of apocalyptic struggle, and *a language of integrated systems*. (my emphasis)[33]

Through "metaphors, techniques and fictions", the world was conceptualized as an interconnected whole, while in turn, the new computer networks made the world in this image by realizing these connections as an information flow. In many ways, the communalist counterculture represented by Brand and his generation was the ideological obverse of this tensely computerized world-system, in which "every thought, word, and action is ultimately directed back toward a central struggle."[34] As it turned out, both worldviews — the technologically empowered free-wheeling individual and the the world as geopolitical schism — would use the computer as a source of ideological power. Between the 1960s and 1990s, the computer transformed from a metaphor for subjugation and imprisonment into a symbol of freedom from the very same. For the student-led Free Speech Movement of the 1960s, the military-industrial underpinnings of the research university and the new "information economy" meant that the individual was "little more than an IBM card".[35] Just three decades later, the ideology of the personal computer and the libertarian narratives of the early web recast the world of the computer as a decentralized association

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[33] Paul N Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, Mass.: MIT Press, 1997), 8.

[34] Edwards, *The Closed World,*12

[35] Turner, *From Counterculture to Cyberculture,* 12.

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of free agents, politically enabled and physically unencumbered by the immaterial affordances of cyberspace, rather than cogs in the "machine" of the information economy. The tie-wearing IBM employee would be a longstanding symbol for a staid, top-down, masculine-coded bureaucracy which would literally be shattered by the liberating individualism of the personal computer, as represented by an athletic young woman in Ridley Scott's well-known 1984 commercial for the first Apple Macintosh. As Turner shows, the libertarian idealism of computerdom was not a "corruption" of the utopian idealism of an earlier counterculture, but a cultural partnership in which "members of the two worlds could come together and legitimate one another's projects".[36]

With the emergence of the World Wide Web, this image of planetary interconnection found expression in a host of new, consumer-friendly metaphors. These included William Gibson's "cyberspace" and Al Gore's "information superhighway", while web services like Geocities and eWorld took Marshall McLuhan's notion of the "global village" literally by representing user's websites as part of little online towns. Memorably, Alaska Senator Ted Stevens referred to the Internet as a "series of tubes",[37] a much derided remark which turned out to be a far more salient conception of the internet's infrastructural nature than the rhetoric of virtuality. Frequently, this utopian rhetoric imagined the web as a radically alternative kind of social space, where relations are established by means of intellectual activity, a "world brain" ambivalent to the physical plane. As in Gibson's original description, cyberspace is

> A consensual hallucination experienced daily by billions of legitimate operators [...] Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding...[38]

Gibson's influential science fictional account was closely linked to the political declarations made by early techno-utopians, such as Timothy C. May's "Crypto-anarchist Manifesto" (1988) or the Electronic Frontier Foundation's "A Declaration of the Independence of Cyberspace." (1996), in which John Perry Barlow began,

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[36] Turner, *From Counterculture to Cyberculture*, 8.

[37] "Series of Tubes," in *Wikipedia*, April 4, 2019, https://en.wikipedia.org/w/index.php?title=Series_of_tubes&oldid=890989327.

[38] Gibson, William. *Neuromancer* (New York: Ace Books, 1987), 67.

Governments of the Industrial World, you weary giants of flesh and steel, I come from Cyberspace, the new home of Mind. On behalf of the future, I ask you of the past to leave us alone. You are not welcome among us. You have no sovereignty where we gather.[39]

The techno-determinist faith that Barlow and others held in decentralized information networks turned out to be fundamentally misplaced. The decentralized and distributed network famously visualized by Paul Baran in 1968 at RAND corporation was supposed to turn communication between nodes into a rhizomatic affair, equalizing hierarchies while remaining resistant to "destruction" through redundancy. Furthermore, it enabled virtual presence alongside the nomadic geographic freedom of the "digital native" living and working on a laptop, "anywhere and nowhere". In reality, as the web grew increasingly important to the mediation of everyday life, it became ever more powerfully centralized and subject to the control of a small number of corporations and state institutions. As recent developments such the Chinese Great Firewall or the Snowden leaks attest, national governments exert a powerful influence over the internet's communication networks, from control over technical infrastructure to the governance of internet companies.

If the rhetoric of the web as an alternative, radical and virtual space seems dated today, it is largely because of its banality. As artist Hito Steyerl suggested a few years ago, the internet is "dead" because it has "walked off screen" and into the real world. Instead of being in some far-off place, contemporary metaphors for the web reflect its infusion into the mundane processes of the everyday social practice. One could argue that the internet is today more usefully described as a historical context and a planetary substrate within which society functions, rather than a discrete technology that humans use — an image of ubiquity that returns us to a metaphor of wholeness. The imbrication of ecological, technological and societal *whole systems* can be found in the language of "the cloud", which imagines the heaving machinery of terrestrial network infrastructure as an ethereal medium, ever accessible, imperceptibly permeating the Earth's atmosphere with information flows.

The aforementioned metaphors were popularized during the first two decades of the web, during which its popular imaginary was fueled on a heady mixture of political idealism and accelerated

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[39] Barlow, John Perry. "A Declaration of the Independence of Cyberspace." Electronic Frontier Foundation, January 20, 2016. https://www.eff.org/cyberspace-independence.

commercial expansion. Driven by technological boosterism, these terms sought to represent of the web as an experiential effect, rather than as a material infrastructure or as a technical phenomenon. Of course, it is this always-partial imperceptibility of the network which allows it this imaginary quality. The "cloud" is a virtual representation of a real but amorphous thing. As Tung-Hui Hu writes, to call it the cloud "not only make things easier on users and computer programs, but also allows the whole system to withstand the loss of an individual part."[40]

As networked computation has become integrated into the world at large, its disciplinary and technical language has also integrated with the metaphors used to describe the multi-layered systems of the world system. In particular, the "stack" and the "platform" are technical and economic frameworks originating in computing parlance which are now commonplace metaphors for understanding the multi-scalar functionality of the software and hardware that govern the world system. In what follows, I examine the role these metaphors play in rendering the world as an operative networked environment, bringing with them an epistemic structure by which the social and political domain can be understood in terms of technical processes.

The Stack Metaphor

It was the science fiction writer Bruce Sterling who first brought the "stack" to wider theoretical attention in 2013. In a conversation for the Whole Earth 'Lectric Link (WELL), when he observed,
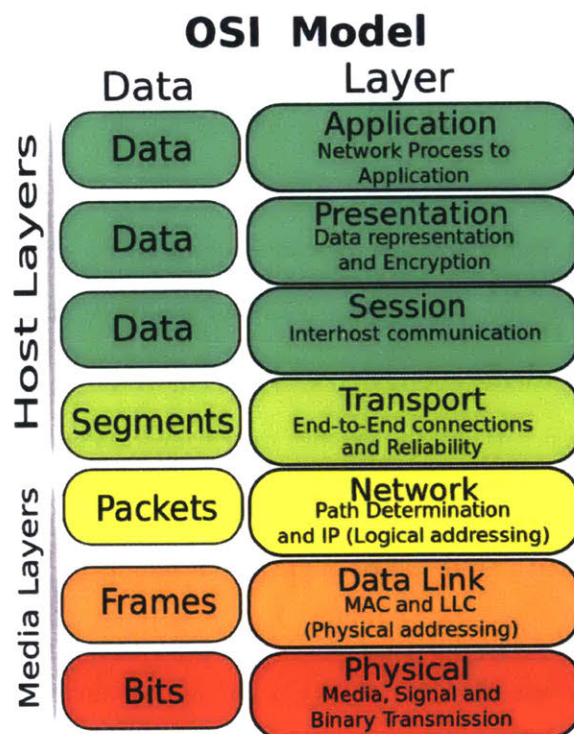
> Stacks. In 2012 it made less and less sense to talk about "the Internet," "the PC business," "telephones," "Silicon Valley," or "the media," and much more sense to just study Google, Apple, Facebook, Amazon and Microsoft. These big five American vertically organized silos are re-making the world in their image[41].

What does it mean to be a stack? A ubiquitous term in software development and networking systems, a stack is a layered structure which enables a complex organization of processes like software to

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[40] Tung-Hui Hu, *A Prehistory of the Cloud* (Cambridge, Massachusetts: The MIT Press, 2015), X.

[41] Alexis C. Madrigal, "Bruce Sterling on Why It Stopped Making Sense to Talk About 'The Internet' in 2012," The Atlantic, December 27, 2012, https://www.theatlantic.com/technology/archive/2012/12/bruce-sterling-on-why-it-stopped-making-sense-to-talk-about-the-internet-in-2012/266674/.

be organized into nested hierarchy of abstraction. A given stack describes the series of technical operations which communicate the instructional input of a given computational interaction to the physical machinery of the computer. For example, in the software stack of an app, the top layer is the user interface, the highest level of abstraction from the computer's point of view, meaning that it is the furthest removes from the binary operation of logic gates on the motherboard. This movement of electrons moving across transistors, processing digital bits via machine code, is computation in the "purest" physicalist form (although one could also understand computation oppositely as pure logical abstraction, hence the theory of a computational universe). The binary transmission instructed by machine code sits at the "lowest" level of the stack, and is furthest from natural (human) language. It is in this sense that programming languages like Python are "high level", operating closer to natural language, while "low level" programming languages like C are "closer to the metal". As Wendy Chun writes, echoing Friedrich Kittler, "User control dwindles as one moves down the software stack; software itself dwindles since everything reduces to voltage differences as signifiers [...] software cannot be separated from hardware, only ideologically"[42]

OSI Model

	Data	Layer
Host Layers	Data	**Application** Network Process to Application
	Data	**Presentation** Data representation and Encryption
	Data	**Session** Interhost communication
	Segments	**Transport** End-to-End connections and Reliability
Media Layers	Packets	**Network** Path Determination and IP (Logical addressing)
	Frames	**Data Link** MAC and LLC (Physical addressing)
	Bits	**Physical** Media, Signal and Binary Transmission

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[42] Wendy Hui Kyong Chun, *Control and Freedom: Power and Paranoia in the Age of Fiber Optics* (Cambridge, Massachussetts London: The MIT Press, 2006), 19.

Figure 2. Representation of the OSI stack. Internet protocol (TCP/IP) sits at the Transport Layer (4).[43]

The protocol stack most relevant in the present discussion of the web, is the Open System Interconnection (OSI) stack, a standardized model for network communications which manifests the technological infrastructure of the internet. At the top is the *application layer*, which specifies the standards by which hosts in the network interface with one another. When one user messages another over the web, the message travels down the stack, through the *presentation* and *session* layers down to the *transport layer*, which comprises the internet protocol suite (TCP/IP), a protocol for distributed network transmission which defines the internet. Here, the message is broken down into "packets" of data and sends them across the *network layer*, which forwards packets across a network of routers. It is worth noting that it is here that the internet is fundamentally decentralized: routing is ambivalent to the content of the message, and packets simply are routed according to the principle of "Open Shortest Path First". The network is built on top of the *data link* and *physical layers*, a series of protocols and physical infrastructures responsible for transferring data in sequences of binary digits through transmission substrates such as optical fibers or radio frequencies, sending physical signals to electronic circuits. The message then makes its way up the layers to the recipient's interface.

As a paradigm for conceptualizing and designing systems, the stack metaphor is deeply influenced by the philosophical principles of computer science, such as *modularity, abstraction* and *interoperability*, as well as the professional habits of programming. As software quickly becomes highly complex, abstraction allows lower-level elements to be modularized into components of a larger system. Indeed, most software developers will never interact with the lower levels of the software stack, just as most chemists don't need an advanced knowledge of physics in order to practice their science. Where metaphors like "the cloud" enable complex and indistinct system to be easily (if amorphously) acknowledged, the stack enables a computer system to be abstracted and simplified in such a way that it can be efficiently understood and engineered, often by large teams of people working simultaneously, through the simplification and obfuscation of other aspects of its reality. As one programming textbook puts it, "properly modularized code reduces the 'cognitive load' on the programmer by minimizing the amount of information required

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[43] "Osi-model-jb.svg" by Gorivero, licensed under Creative Commons Share-Alike 3.0. Available from: Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Osi-model-jb.svg

to understand any portion of the system. In a well-designed program the interfaces between modules are 'narrow' (ie simple) as possible, and any design decision that is likely to change is hidden inside a single module."[44] With the rapid rise of the software industry in the past decade,[45] it is perhaps unsurprising that the stack has become an increasingly commonplace metaphor within other domains, particularly those within the subcultural milieux of software developers. In a 2017 article in the *New York Times Magazine*, John Herrman describes the online use of terms like "supplement stacks" by bodybuilders and "nootropics stacks" for those seeking recreational cognitive enhancement, noting that "users compare and critique stacks like developers arguing about server software."[46]

The conceptual and linguistic abstractions performed by the stack identifies an quality inherent to software in general, whereby it hides the very thing it purports to execute: the code. It is for this sleight of hand that Wendy Chun and Alexander Galloway argue that software bears a "formal similarity" with ideology[47], insofar as the latter is defined by Althusser as a "representation of the imaginary relation of individuals to their real conditions of existence."[48] As a Galloway writes,

> Software operates through a technological model that places a great premium on meticulous symbolic declarations and descriptions, yet at the same time requires concealment, encapsulation and obfuscation of large portions of code. Formulated as an assertion, software requires both reflection and obsfuscation.

Like "software" itself, the stack is a practical metaphor, an epistemic structure which allows the underlying mechanisms of a given system to be understood as a coherent series of interdependent abstractions. In this sense, it represents precisely the opposite of what Friedrich Kittler claims when he insists that "There is

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[44] Scott, Michael Lee. *Programming Language Pragmatics.* Fourth edition. (Waltham, MA: Morgan Kaufmann, 2016), 122. Quoted in Alexander R. Galloway, "Language Wants To Be Overlooked: On Software and Ideology," *Journal of Visual Culture* 5, no. 3 (December 1, 2006): 315–31, https://doi.org/10.1177/1470412906070519.

[45] Enrollment in computer science undergraduate majors in the US rose by 74% between 2009 - 2005. — Engineering National Academies of Sciences, *Assessing and Responding to the Growth of Computer Science Undergraduate Enrollments*, 2017, https://doi.org/10.17226/24926.

[46] John Herrman, "New Technology Is Built on a 'Stack.' Is That the Best Way to Understand Everything Else, Too?," *The New York Times*, January 20, 2018, sec. Magazine, https://www.nytimes.com/2017/04/11/magazine/new-technology-is-built-on-a-stack-is-that-the-best-way-to-understand-everything-else-too.html.

[47] Alexander R. Galloway, "Language Wants To Be Overlooked: On Software and Ideology," *Journal of Visual Culture* 5, no. 3 (December 1, 2006): 315–31, https://doi.org/10.1177/1470412906070519.

[48] Louis Althusser, "Ideology and Ideological State Apparatuses"," in *Lenin and Philosophy, and Other Essays* (New York: Monthly Review Press, 2001), 172.

No Software", in which everything comes down to the material transmission of "voltage differences as signifiers".[49] Rather, within the stack metaphor, there is only "software", only interfaces between further abstractions. For example, the popular fitness website Bodybuilding.com offers a dizzying array of "supplement stacks", referring to the simultaneous use of multiple nutritional supplement "on top of one another", in order to maximize their "synergistic" effects[50]. The body is here imagined as a complex program, upon which more programs of physiochemical activity can be optimally arranged. Similarly, within the cognitive enhancement and biohacking community, a "stack" like "Bulletproof Coffee with Collagen Peptides and Protandim Nrf2 Synergizer[51]" is used to give the mind and body a "whole system upgrade[52]". Whether as modules supplements or software, the stack metaphor organizes a given system into a programmatic framework whose organizational structure itself is always defined by users at a higher level. Native to managerial design disciplines such as software development or industrial design, a stack is oriented towards standardization and optimization of production within a larger organizational structure, rendering a system as an inventory of functions and affordances, themselves positioned within larger workflows and supply chains. A model of governance as well as a technical division of labor, the stack fetishistically shows and hides the relations of production, making systems more legible, programmable and interoperable towards some higher-order purpose while hiding the actual social and material relations by which the system is produced.

In *The Stack: On Software and Sovereignty*, design theorist Benjamin Bratton proposes an eponymous speculative construct as "a specific model for the design of political geography tuned to his era if planetary-scale computation."[53] He writes,

As we link infrastructure at the continental scale, pervasive computing at the urban scale, and

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[49] Friedrich Kittler, "There Is No Software," *CTheory*, October 18, 1995, www.ctheory.net/articles.aspx?id=74.

[50] "Stacks For The 21st Century Bodybuilder!," Bodybuilding.com, May 3, 2000, https://www.bodybuilding.com/fun/johnstack.htm.

[51] Ryan Goodwin, "My Personal Biohack Stack for Optimized Brain Performance," *Medium* (blog), January 25, 2018, https://medium.com/@mrryangoodwin/my-personal-biohack-stack-for-optimized-brain-performance-a44ed06bfe57.

[52] "The Science of Nootropic Stacks: Achieving a Whole System Upgrade," Neurohacker Collective, accessed May 10, 2019, https://neurohacker.com/the-science-of-nootropic-stacks-achieving-a-whole-system-upgrade.

[53] Benjamin H. Bratton, *The Stack: On Software and Sovereignty*, Software Studies (Cambridge, Massachusetts: MIT Press, 2015), 3.

ambient interfaces at the perceptual scale, we will explore how these interweave and how we might build, dwell within, communicate between, and govern our worlds. To do this, [the book] draws on the multilayered structure of software, hardware, and network "stacks" that arrange different technologies vertically within a modular, interdependent order. From this and from other non-computational structures, the model abstracts a general logic of platforms, now a fundamental principles for the design and co-ordination of complex systems.

Bratton adopts the stack as a totalizing model that abstracts and encapsulates a suite of emerging network technologies, turning the contemporary digital landscape into a chaotic coherence in order to "inform and support further design of these systems"[54]. Organized into six interdependent layers of Earth, Cloud, City, Address, Interface, and User, Bratton proposes the stack as a cognitive map[55] of the techno-geopolitical landscape, in order to argue that this vertical structure represents an emergent form of sovereignty that has fundamentally disrupted the Westphalian political order. Taking a "strong" computationalist position, he proposes that this condition constitutes a world which can itself be understood as a holistic computational "state", centering not on the computer as a thing in the world, but the world as a thing that computes. As he notes, "Google's mission statement, 'to organize the world's information' [...] changes meaning when the world itself is seen as *being* information, such that to organize all the information is to organize all the world."[56]

It is to this end that Bratton claims the stack to be "design brief"[57]: it imagines planetary computation as an aggregated technical program whose effects are always too vast to understand. The unencroachable otherness of this vast machine is a intriguing thought experiment, though it operates in a permanently speculative mode which disarms all attempts to claim it in the realm of politics or history. Nonetheless, it offers insights into the ways in which computational environments trouble the terms of social and political interaction. Things and concepts turn into processual interfaces: for instance, "the essential function of the city is proximity — to people, markets, goods, transport, information[58]". Within

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[54] Bratton, *The Stack*, 4.

[55] For Fredric Jameson, "cognitive mapping" intimates what an otherwise "(unrepresentable, imaginary) social totality" might look like. — Fredric Jameson, "Cognitive Mapping," in *Marxism and the Interpretation of Culture*, ed. Cary Nelson and Lawrence Grossberg (Urbana: University of Illinois Press, 1988).

[56] Bratton, *The Stack*, 88.

[57] Bratton, *The Stack*, xix.

[58] Bratton, *The Stack*, 168.

this overwhelming aesthetic enterprise, the city is an agent-based model, a set of interactions between "users", human and non-human alike, while citizenship is understood as the addressability of the individual to the sovereign protocol: "The real nightmare, worse than the one in which the Big Machine wants to kill you, is the one in which it sees you as irrelevant, or not even a discrete thing to know[59]." Taking a strongly accelerationist line, Bratton argues that technology as "the armature of the social itself" and understanding "computation *as* governance".[60] (For instance, Halpern takes the opposite view, regarding algorithms as a "displacement" of governance.)[61] For him, however, "politics" is a question of technological design within the totalizing framework of planetary computation: "it is far less important how the machine represents a politics than how "politics" physically *is* that machinic system[62]." Bratton is perhaps an aesthetic extremist, but his overarching deployment of the stack metaphor demonstrates the ways in which society can be broken down and rendered operable to the technical forms that undergird it, as well as the functional and rhetorical power of those forms, in turn, to supplant the social imaginary.

Platforms as Operational Environments

"The new orgman", Keller Easterling wrote in 1999, "sells logistics. He sells management styles and networking protocols. Organization is content. Procedure is product.[63]" Easterling was referencing William Whyte's "The Organization Man", a 1956 bestseller in which the urbanist lamented that the contemporaneous American ethic tended towards a belief in bureaucracy and organizational decision-making rather than the innovative individual. For Easterling's orgman, it is not the bureaucratic organization that prevails over the individual, but the organizational *protocol* that has replaced the *design* of the built environment itself as the agent of architectural practice. As both hardware and software, architecture is subsumed into the networked spatial program of the global city, packaged into "real estate

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[59] Bratton, *The Stack*, 364.

[60] Bratton, *The Stack*, xviii.

[61] Orit Halpern, *Beautiful Data: A History of Vision and Reason since 1945*, Experimental Futures (Durham: Duke University Press, 2014), 25.

[62] Bratton, *The Stack*, 44.

[63] Keller Easterling, "The New Orgman," accessed May 10, 2019, http://kellereasterling.com/wildcards/text/Orgman.html.

products", cut-and-paste cities, shaped by logistical flows and the speculative mechanisms of finance capital. The property portfolio of the new orgman features "offices, malls, global franchises, transportation hubs" — homogenous architectures which can be executed like computer programs. Following Gregory Bateson, Easterling imagines a post-cybernetic vision of urban space as information system,[64] in which "concrete" phenomena such as architecture merely manifest the organizational vectors of information and capital across the spatial domain. In some ways, the formulation of "procedure as product" affords a degree of ideological clarity by revealing things in the world as the result as socio-technical relations, albeit a condition which turns full circle back into the fetishistic mode as those relations are themselves increasingly captured as commodities. As Paul Virilio once argued, "defining a unity of time and place for activities now enters into open conflict with the structural capacities of mass communication."[65]

The contemporary extension of the orgman's wares is the ubiquitous contemporary typology of the *platform*, which harnesses network effects to tender services and operations within a particular technical and economic space. They are spatial constructs, capable of generating their own geographies by offering interfaces between networked software operations and real-world activities. Echoing the orgman's style, Bratton defines the platform as a "third institutional form, along with states and markets"[66], that "simultaneously distributes interfaces through their remote coordination and centralizes their integrated control through that same coordination.[67]" The economist Nick Srnicek, meanwhile, defines platforms more simply as "digital infrastructures that enable two or more groups to interact", positing that they position themselves "(1) between users, and (2) as the ground upon which activities occur, which thus gives it privileged access to record them.[68]" In each case, a platform constitutes a software system which *encloses*, *mediates*, *coordinates* and *captures* a terrain of digital interaction. They are spatial constructs, capable of generating their own geographies by producing sovereign spheres of activity

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[64] "Keller Easterling on Hacking the Operating System of Our Cities," *Metropolis* (blog), April 6, 2015, https://www.metropolismag.com/cities/keller-easterling-hacking-operating-system-our-cities/.

[65] Paul Virilio, *The Lost Dimension*, trans. Daniel Moshenberg (New York: Semiotext(e), 1991), 22.

[66] Bratton, *The Stack*, 44.

[67] Bratton, *The Stack*, 374.

[68] Nick Srnicek and Laurent De Sutter, *Platform Capitalism*, Theory Redux (Cambridge, UK ; Malden, MA: Polity, 2017), 43-44.

across software and real-world domains, from search and index to cloud computing to transport and housing. Amazon offers an instructive example: beginning as an online marketplace for books, it developed into an e-commerce giant facilitated by an expansive logistical infrastructure, as well as a powerful back-end software for in-house management. This proprietary software system became a business-to-business product known as Amazon Web Services, which now accounts for a third of global cloud computing provisions, in turn producing a powerful database for developing artificial intelligence technologies. Meanwhile, its logistical capabilities rival traditional industry giants such as Fedex. As a capitalist monolith in both software services and real-world logistics, it has more recently been able to expand aggressively into brick-and-mortar groceries (WholeFoods) as well as media (Prime Video, Amazon Studios). As a contemporary consumer, it seems possible to live most of one's life only within Amazon's logistical, leisurely and digital environments.

Following Bratton, the emergence of platforms as an "institutional form" over the past two decades has accompanied the physical decentralization of computing from desktops onto billions of mobile devices, which allow platforms to collect aggregate geospatial and behavioral information of as many users on the urban scale. Meanwhile, everything from software packages to clothing are increasingly sold as a subscription service,[69] turning discrete economic transactions into a relationship between producer and consumer that remains forever active and "online" — a part of one's lifestyle "stack". In our inhabitation of the networked world, lived experience within private and political realms is contingent on negotiating a variety of platforms, each with their own operational and cultural logics, enabling and foreclosing further styles of interaction while recursively shaping those environments through algorithmic feedback. With quiet ambition, things mutate into processes. Uber, for instance, brands itself not as a cab service, but an enterprise in the "safe, efficient movement of people and things at a giant scale", "serving people" through the marriage of "bits and atoms".[70] Today, almost all dominant commercial platforms appropriate the language of participation and common good while thriving on surveillance capitalism, trading in back-end behavioral "insights" whilst freely offering front-end services.

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[69] One notable example is LOT2046, a monthly subscription service, founded by a former AirBnB employee, which sends monthly deliveries of lifestyle products from underwear to hair trimmers, all styled within a monochromatic technical aesthetic. — "LOT." Accessed May 8, 2019. https://www.lot2046.com/.

[70] Uber. *Bits and Atoms I Uber.* Accessed May 8, 2019. https://www.youtube.com/watch?v=bx1-im6i8uk.

While platforms offer their users convenient and connected forms of action in the world, they also restructure the very environments in which action takes place, casting its subjects as data-generating users and as participatory agents within a model of sociality which is never fully realized. As Orit Halpern writes in "Demoing to Death", the contemporary culture of digital entrepreneurship and neoliberal techno-optimism forms "a global demo ethos" in which one prototype is always replaced by another, seeking instead "to manage futurity without ever needing to know the endpoint".[71] Furthermore, their sleekly personalized digital interfaces obscure a deeply uneven system of production which, while projecting an aesthetic of seamlessly automated services, demands vast amounts of human physical and affective labor for their operation and maintenance. This interface obscures Amazon's warehouses full of algorithmically-monitored logistical workers, Facebook's armies of low-paid content moderators, and Uber's uninsured workforce of "self-employed" drivers, themselves a convenient stopgap for the company's development of self-driving cars. Perhaps the most brazen example of this form of exploitation and enclosure under the guise of generosity was Facebook's internet.org, also known as Free Basics, which attempted to sell internet provisions to underserved populations in India not as an open infrastructure but as a closed platform limited to internet services sanctioned by Facebook. The community eventually rejected Facebook's proposals, but as Mark Zuckerberg noted grimly his own Facebook page at that time, "some connectivity is better than none at all".[72]

Developing on Srnicek and Bratton's definitions, I suggest that the typology of the platform might be considered more broadly as an "operative environment", an ambient network infrastructure that establishes a synthetic "ground" of social production. I make this distinction in order to foreground the ways in which these technical environments can be organized according to collective agendas which are not predicated on centralization and accumulation. More simply put, platforms don't need to generate surplus value, and behavioral data could remain in the hands of those who generate it. For example, it is not so difficult to imagine a version of Uber which co-ordinates between drivers and passengers through a

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[71] "FCJ-215 Demoing unto Death: Smart Cities, Environment, and Preemptive Hope | The Fibreculture Journal : 29." Accessed May 8, 2019. http://twentynine.fibreculturejournal.org/fcj-215-demoing-unto-death-smart-cities-environment-and-preemptive-hope/.

[72] Mark Zuckerberg, "Over the Past Week in India, There Has Been a...," Facebook post, 17 April 2017. Accessed May 10, 2019, https://www.facebook.com/zuck/posts/10102033678947881?reply_comment_id=10102037376443071&total_comments=32&comment_tracking=%257B%2522tn%2522%253A%2522R9%2522%257D&pnref=story.

publicly regulated protocol which did not take a cut of the transaction, except for maintenance costs. While the *environmental* nature of these technologies is increasingly apparent, the terms and accountability of their *operation* are not. As Bratton notes, "we are severely lacking in a robust and practical theory of the political design logic of platforms, even as they remake geopolitics in their image."[73] At stake within the centralized corporate platforms is the colonization and privatization of public fora and increasing the illegibility and unaccountability of fundamental social infrastructure. The pioneers of the first cyberculture, such as Ted Nelson, spoke bitterly of early mainframe computing as controlled by the "IBM priesthood",[74] a cabal of gatekeepers who, alongside the government, would "suppress the free interconnections we hoped to create".[75] This was, to a great extent, the attitude which produced the "Jeffersonian democracy" of "self-sufficient … free-booting individualism" that Barbrook and Cameron describe in their acerbic 1995 critique of Silicon Valley, "The Californian Ideology".[76] As the direct inheritor of this libertarian, market-driven legacy, contemporary platform capitalism has nonetheless created a centralized priesthood of its own, a cultic space whose power derives from its protocological co-ordination of distributed production. As such, the monopolized landscape of contemporary platform capitalism centralizes social power whilst being accountable only to its shareholders, leaving few avenues of hope for the kinds of network utopianism that inspired the early web, be it the libertarian advocates of digital self-sovereignty, or the more commons-oriented networks of the peer-to-peer community.

Tim Berners-Lee recently reminisced to a reporter, "The spirit [of the early web] was very decentralized. The individual was incredibly empowered. It was all based on there being no central authority that you had to go to to ask permission … That feeling of individual control, that empowerment, is something we've lost."[77] Amidst the claustrophobic force of platform enclosure, the image of

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[73] Bratton, *The Stack*, 44.

[74] da009999. *Interview with Ted Nelson, 1990*. Accessed May 9, 2019. https://www.youtube.com/watch?v=ZqqKajwm-Qs.

[75] Richard Stallman. *Stallman's Great Work Came from Xanadu Secrecy!*, 2002. http://archive.org/details/StallmanSurpriseColor.

[76] "THE CALIFORNIAN IDEOLOGY by Richard Barbrook and Andy Cameron I Imaginary Futures." Accessed May 9, 2019. http://www.imaginaryfutures.net/2007/04/17/the-californian-ideology-2/.

[77] Katrina Brooker. "'I Was Devastated': The Man Who Created the World Wide Web Has Some Regrets." The Hive. Accessed May 9, 2019. https://www.vanityfair.com/news/2018/07/the-man-who-created-the-world-wide-web-has-some-regrets.

decentralization re-emerges powerfully across the ideological spectrum as a panacea for the reclamation of the web. If the web is an operative environment constituted by programs and protocols, it is a landscape that can be reconfigured and "taken back" into a state of openness and possibility, or so the thought goes. As will be explored in detail in the next chapter, the terms of legibility and ownership are its key sites of contestation. By rupturing its ideological narrative of free and equal participation, the decentralized web destabilizes the network's ambient technological "neutrality, evincing the web as an operative environment through which the sociality of the digital world are determined.

Chapter 2: The Decentralized Web

> "What if we used all those phones to build a massive network?... We use my compression algorithm to make everything small and efficient, to move things around.... If we could do it, we could build a completely decentralized version of our current Internet with no firewalls, no tolls, no government regulation, no spying. Information would be totally free in every sense of the word."

> Richard Hendricks, a character in HBO's *Silicon Valley*.[78]

The decentralized web (hereafter abbreviated as dweb) refers to a loose collection of web technologies which seek to build a peer-to-peer version of the World Wide Web and related internet technologies. The present wave of decentralization discourse in the 2010s emerged primarily after the popularization of blockchain, the peer-to-peer cryptographic exchange system behind bitcoin, which was released pseudonymously by Satoshi Nakamoto in 2009.[79] For digital civil liberties advocates, bitcoin represented the realization of a hope long-held dream for a decentralized exchange system which would enable secure and anonymous economic transactions across computer networks beyond the purview of nation states, or mediated by a centralized institutions like banks. As Nakamoto stated in the original Bitcoin paper, "What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party[80]."

While bitcoin's efficacy as an electronic cash system remains both largely untested and heavily clouded by hype, the emergence of blockchain as a medium of decentralized, peer-to-peer information exchange sparked considerable interest around decentralized networks as a means to create social infrastructures that directed connected individuals without a trusted third party. As Nakamoto expressed in his original paper, at the heart of blockchain's appeal was its claim to replace "trust" with cryptographic mathematics. Within the rhetoric of its techno-economic imaginary, "trust" is "disintermediated" from

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[78] Klint Finley, "Pied Piper's New Internet Isn't Just Possible—It's Almost Here," *Wired*, June 1, 2017, https://www.wired.com/2017/06/pied-pipers-new-internet-isnt-just-possible-almost/.

[79] Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," accessed May 9th, 2019. https://bitcoin.org/bitcoin.pdf

[80] Nakamoto, "Bitcoin".

legal institutions and constructed in a decentralized manner by the protocol itself, between transacting

individuals, enforced by cryptographic algorithms that render untrustworthy behavior computationally

impossible. For its advocates, this immunity to third parties represented a "step towards censorship

resistant digital currency[81]"; blockchain has been branded both "trustless[82]" and a "trust machine".[83] With

the development of Ethereum, the second major blockchain system after bitcoin, designed to facilitate

decentralized software applications and "smart contracts" rather than simply financial transactions,

blockchain systems have been imagined to "displace the apparatus of contract law", and to supplant the

traditional Hobbesian understanding of a social contract bound by law[84].

Blockchain catalyzed a resurgence of interest around decentralization, with the majority of new

dweb technologies emerging around 2015, when the media interest and financial value of bitcoin was

approaching its peak. While there are evident overlaps within their social and infrastructural ambitions,

dweb technologies are not only economic or legal in nature, focusing more broadly around questions of

access, communication and archive with regards to the vast network of information and services that we

call the web. In August 2015, Brewster Kahle, an influential Bay Area technologist and the founder of the

Internet Archive,[85] launched a call for a decentralized web under the title, "Locking the Web Open"[86].

Citing legal scholar Lawrence Lessig's notion that "code is law", Kahle wrote,

> The way we code the web will determine the way we live online. So we need to bake our values
> into our code. Freedom of expression needs to be baked into our code. Privacy should be baked
> into our code. Universal access to all knowledge. But right now, those values are not embedded in
> the Web[87].

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81 Rainey Reitman, "Bitcoin - a Step Toward Censorship-Resistant Digital Currency," Electronic Frontier Foundation, January 20, 2011, https://www.eff.org/deeplinks/2011/01/bitcoin-step-toward-censorship-resistant.

82 Reid Hoffman, "Reid Hoffman: Why the Blockchain Matters," *Wired UK*, May 15, 2015, https://www.wired.co.uk/article/bitcoin-reid-hoffman.

83 "The Trust Machine," *The Economist*, October 31, 2015, https://www.economist.com/leaders/2015/10/31/the-trust-machine.

84 Kevin Werbach and Nicolas Cornell, "Contracts Ex Machina," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, March 18, 2017), https://papers.ssrn.com/abstract=2936294.

85 In 2016, the Internet Archive, a San Francisco non-profit organization which periodically scrapes all public websites on the web to form the world's largest digital library, organized an event called the "Decentralized Web Summit".

86 "Locking the Web Open: A Call for a Decentralized Web | Brewster Kahle's Blog," accessed May 10, 2019, http://brewster.kahle.org/2015/08/11/locking-the-web-open-a-call-for-a-distributed-web-2/.

87 "Locking the Web Open: A Call for a Decentralized Web | Brewster Kahle's Blog," accessed May 10, 2019, http://brewster.kahle.org/2015/08/11/locking-the-web-open-a-call-for-a-distributed-web-2/.

The following year, the Internet Archive organized the first "Decentralized Web Summit", which brought together a number of the web's original inventors and pioneers[88] along with technologists, researchers and advocacy groups in an attempt to galvanize a movement under Kahle's "bold goal" to "lock the Web open", to "make openness irrevocable" and to "bake the first amendment into the code itself, for the benefit of all[89]." Kahle's techno-utopian call-to-arms at the Summit could be seen as the first major gathering of a community around the idea of the dweb as a social and technological project, legitimized by the Internet Archive, one of the web's few well-respected and longstanding public institutions[90]. While a number of other threads remain absent from the dweb narrative, its discourse readily invokes the notion of "code" as an enforcer and guarantor of rights within the online world, and takes up task of building this code-based structure as the basis of a utopian social project.

To be clear, the dweb — a decentralized alternative to the World Wide Web — *does not actually exist*. At best, the dweb could be said to exist as a collection of prototypes, but even functional implementations with a few million users cannot be justifiably compared to the actually existing web that they seek to replace. Nonetheless, the dweb exists as dream, articulating a desire for a socio-technical vision whose history goes back as far as the invention of the web itself. By connecting a technical diagram with a corresponding social fiction, the emerging technologies that comprise the decentralized web operate both as functional programs and performative metaphors for engineering and enacting this utopian vision. Meanwhile, in believing a different web to be groundwork for a different environment of social practice, the discourses of the dweb engage with cultural and systems aesthetics that makes these utopias imaginable, as a radical alternative to the present conditions of the web.

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[88] In attendance were a number of the web and internet's "founding fathers", including Tim Berners-Lee (WWW), Vint Cerf (TCP/IP), Ted Nelson (Hypertext) and Whit Diffie (Diffie-Helman key exchange).

[89] "Locking the Web Open: A Call for a Decentralized Web | Brewster Kahle's Blog," accessed May 10, 2019, http://brewster.kahle.org/2015/08/11/locking-the-web-open-a-call-for-a-distributed-web-2/.

[90] The Internet Archive was founded by Kahle in 1996 as a non-profit organization. Kahle was previously a computer engineer and entrepreneur, previously known as the co-founder of web traffic analysis company Alexa.com (also based on "web crawling", like the IA), which he sold to Amazon in the late 1990s. Both Alexa.com and the Internet Archive use the image of a neoclassical "library" as their logo.

IPFS and the Peer-to-Peer Production of Space

The principal technological proposition of the dweb is that of distributed and peer-to-peer production, a notion that has significant ramifications for the organizational structure of the web as a technical and spatial system. Peer-to-peer systems are not new in the web: Tim Berners-Lee's original proposal for the web described it as a "distributed hypertext system", and while it ran on a single computer[91], it was imagined as a "universal linked information system" in which users would both add links to the network as well as access its content. In the more recent history of the web, the best-known peer-to-peer systems are file-sharing protocols such as Napster and BitTorrent, which appeared in the early 1990s and gained notoriety for their infringement of copyright laws. In a traditional server-client relationship, the "owner" of the content hosts it on a server, a computer which manages access to this content, while "visitors" download the content by requesting it through a domain name, linked to the IP address of the requested server. In a peer-to-peer arrangement like BitTorrent, users are both servers and clients, acting as "peers" who store and serve the data for other peers across the network. For example, when a user torrents an .mp3, the file is downloaded from the network in a many-to-many exchange between peers who already possess the file. As the user downloads the .mp3, they simultaneously serve (or "seed") the partial file they have to new peers. As such, the basic techniques of information exchange across the web (the activities of downloading, storing and serving) are distributed across the network, rather than being dependent on a single server or its owner. Together, in the vernacular of BitTorrent, "seeders" and "peers" sharing a torrent form a "swarm", alluding to the contingent, collective, bottom-up organization of the system's function. Without peers, the network ceases to exist.

Where BitTorrent is designed for exchanging individual files across the internet, emergent manifestations of the dweb use similar forms of peer-to-peer organization to organize the web itself, through the peer-to-peer production of the entire information space. A analogy for torrents and the dweb might be made between the technology of a postal system and that of a city: one is for sending and receiving files while the other concerns urban logistics in general. In what follows, I will focus on the Interplanetary File System (IPFS), one of a handful of existing dweb implementations, describing itself

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[91] Famously labelled with a sticky note, "This machine is a server, DO NOT POWER DOWN!"

ambitiously as "a peer-to-peer distributed file system that seeks to connect all computing devices with the same system of files. The Dat project is currently the only comparable implementation, with a similar goal albeit working at a higher level of the stack. Both projects begin with technical ambitions to improve scientific data management, drawing on related work such as BitTorrent and Git. Like BitTorrent, IPFS is a system which stores and exchanges files across a network of computers, while also introducing Git's version-control methods for keeping track of changes in the file over time. However, rather than each specific file being exchanged by a dedicated swarm of peers, all the data on the network is collectively stored by the entire network. As founder Juan Benet writes,

> IPFS is an ambitious vision of new decentralized Internet infrastructure, upon which many different kinds of applications can be built. At the bare minimum, it can be used as a global, mounted, versioned filesystem and namespace, or as the next generation file sharing system. At its best, it could push the web to new horizons, where publishing valuable information does not impose hosting it on the publisher but upon those interested, where users can trust the content they receive without trusting the peers they receive it from, and where old but important files do not go missing. IPFS looks forward to bringing us toward the Permanent Web.[92]

IPFS presents an early example of how the dweb's low-level infrastructure might function, built on top of the internet but replacing the existing many-to-one paradigm of the World Wide Web with a distributed, peer-to-peer exchange. Like Kahle's call for values to be "baked" into the code of the web, Benet's ambitions for IPFS articulate a desire familiar to dweb discourse — perhaps a characteristic of systems engineers in particular — to produce higher-level effects such as "value" and "trust" through the low-level and totalizing design of infrastructure and protocol.[93] Benet's basic claim, however, is that IPFS represents a more stable and temporally structured peer-to-peer network, echoing Kahle's call for a more resilient and less lossy web, while also foregrounding the idea of the web as a unified, versioned file system built on top of the internet, rather than a system of links connecting millions of individual servers. Its documentation describes this system as one of "possession and participation" in contrast to the World

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[92] Juan Benet, "IPFS - Content Addressed, Versioned, P2P File System," accessed May 10th 2019. https://ipfs.io/ipfs/QmV9tSDx9UiPeWExXEeH6aoDvmihvx6jD5eLb4jbTaKGps

[93] The stated mission Kahle's Internet Archive, which has lately been integrating its system into IPFS, is "Universal Access to All Knowledge".

Wide Web's model "ownership and access[94]", a shift from the language of privatization to that of a commons-oriented and collectively-constituted spatial arrangement. For IPFS, this involves two primary techniques: peer-to-peer architecture and a content-addressable file system. Together, they decentralize the conventional spatial and territorial relations of the web by inverting the relations of ownership and the location. Currently, the World Wide Web's hypertext system is essentially a vast network of interlinked addresses, known as universal resource locators (URLS) which, like place names on a map, denote storage locations for online content — a method known as *location-addressed* storage. Storage on IPFS, on the other hand, is *content-addressed*: the file's storage is arbitrarily distributed across the network of peers, while its "address" is a hash digest,[95] a cryptographic abbreviation of the data itself, an onomatopoeic elision of sign and referent[96].

If a territory is defined as "an area of land under the jurisdiction of a ruler or state[97]", the World Wide Web "bakes in" the norms of territorial space by assigning web addresses to individuals via the Domain Name System (DNS), which gives individuals ownership rights to a web domain, typically subject to the renewal of an annual lease[98]. The web domain points to an IP address which is in turn is linked to a hosting service, often rented as part of a shared server in a large data center operated by one of a few major companies, such as Bluehost, GoDaddy and Amazon Web Services. Within the territorial idiom, web hosts (storage space) and DNS (address space) have administrative jurisdiction over the "namespace" of the World Wide Web, according legal ownership rights to individuals and organizations through registration and leasing. Meanwhile, over in actual (geopolitical) territory, the centralized administration of ownership structures on the web are also deeply vulnerable to the power of nation states. For example, DNS was administered by United States until 2016. Menawhile Verisign, the Internet backbone company which manages the dominant .com domain name, remains a U.S. company. As a result,

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[94] "IPFS Documentation," accessed May 10, 2019, https://docs.ipfs.io/introduction/overview/.

[95] A hash algorithm takes any data as an input and produces a hash digest (a short string of data) as its output. Its cryptographic virtue lies in the fact that any slight variation in the input produces an entirely different output. Therefore it can be used for indexing a file, or checking whether two files are identical without actually seeing their contents.

[96] To create links to the latest version of a page, IPFS also uses a hash-based namespace called Interplanetary Naming System (IPNS).

[97] "Territory " Oxford Dictionaries English, accessed May 10, 2019, https://en.oxforddictionaries.com/definition/territory.

[98] Hence why "domain parking", the practice of buying domains which others are likely to want, is controversial and lucrative.

U.S. authorities retain the power to shut down "top-level" domains even when they are registered with non-U.S. organizations.[99] In a peer-to-peer system like IPFS, no individual claims exclusive control of the address or storage of a piece of content: there is no "origin server". In practice, this means that a webpage will never go down so long as there are users who continue to possess/serve it[100] (hence a "Permanent Web"). As such, the dweb would be considerably more resistant to state censorship than the conventional web,[101] while also being susceptible all the problems that come with ungoverned and unaccountable networked activity.

In Henri Lefebvre's conception of "social space", "space" is without substance *a priori* of the legal, social and material relations that give it form, presenting itself to those relations as a further "means of production" as well as a "product to be used", an "object" to be occupied, possessed, or consumed[102]: "it is once a precondition and a result of social infrastructures[103]". Lefebvre's formulation of social space links its existence as a "social relationship" to the legal forms that govern it, and in turn to the underlying productive relations inherent to land. Analogously, the space of the World Wide Web is constituted by the physical hardware that "produces" it (e.g. servers) as a space to be used, the legal administration that names and orders it (e.g. DNS) as a territory to be owned, and the networks of exchange between people and things that produce it a "social space" as such. By contrast, the dweb binds social and spatial relations together through a dynamic structure that co-ordinates these activities: networked content is constituted by the "swarm" that coalesces around it, rather than being anchored to the individual who initially hosts it. An analogy could be made to Deleuze and Guattari's notion of "nomadology", in which they develop the distinction between arboreal hierarchy and rhizomatic organization through the games of Chess and Go. The former is "structural … institutionalized, coded, regulated", while:

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[99] David Kravets, "Uncle Sam: If It Ends in .Com, It's .Seizable." *Wired*, March 6, 2012, accessed May 10th 2019. https://www.wired.com/2012/03/feds-seize-foreign-sites/.

[100] In a sense, this is similar current condition of viral content, which becomes informally distributed across many sites. A peer-to-peer web also alleviates the World Wide Web's perennial issues with "linkrot".

[101] Several news outlets have reported that IPFS was used in by the Catalan activists to manage election data after the Spanish government blocked over 140 websites in an attempt to quash the independence movement in 2017. See: Armstrong, Stephen. "Catalonia Plots Digital Government in Exile in Bid for Independence." *Wired UK*, October 9, 2017, accessed May 10th 2019. https://www.wired.co.uk/article/catalan-government-independence-internet-spain.

[102] Henri Lefebvre, "Social Space" in *The Production of Space*, trans. Donald Nicholson-Smith (Malden, Mass.: Blackwell, 2011), 85.

[103] Lefebvre, "Social Space", 85.

In Go, it is a question of arraying oneself in an open space, of holding space, of maintaining the possibility of springing up at any point: the movement is not from one point to another, but becomes perpetual, without aim or destination, with out departure or arrival. The "smooth" space of Go, as against the "striated" space of chess. The Nomos of Go against the State of Chess, *nomos* against *polis*.[104]

By eliminating of the power of centralized storage and address in favor of distributed production and exchange, dweb systems like IPFS deterritorialize the "grounding" structures of the web, unlinking it from the codifying powers of naming and location, producing it instead as a self-organizing space of swarming peers. Such an organizational form goes some way to redress the complex power imbalance that exists on the web between users and platforms by rendering the infrastructural production of the web (storage, service) as a *collective activity* rather than a binary relationship between producers and consumers. Users are engaged in the act of making-swarm, while content "infects" each user it interacts with, turning them into a seeder, resulting in an informational space which is fundamentally socially determined: that is, shaped by the collective activity of those who inhabit it. Moreover, because social participation is distributed across the network rather than on a platform's proprietary servers, the dweb presents a significant challenge to platform monopolies which claim ownership of the behavioral data generated by users of their services. For example, Facebook on the decentralized web might resemble a decentralized publishing and chat protocol with an identical interface but run from users' personal servers. This would effectively upend the business model of the majority of advertising-driven platforms operating today, particularly Facebook, which generates over 98% of its revenue from user data.

Coding, Public and Private

Within a network, the boundaries between private and public space are defined by bureaucratic and operational structures of permission, storage and address. To visit a webpage is to make a request to download data from *there* to *here*, from the global network to be rendered by a browser on the local

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[104] Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis: University of Minnesota Press, 1987), 353.

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machine. Where the notion of DNS as HTTP's "global phonebook" invokes an index of location-based addresses that users request and visit, IPFS's description as a "global filesystem" collapses the spatial distance between local user and global network, as the object is queried from the network as a whole: *there* is also *here*. Furthermore, dweb systems like IPFS erode the threshold of the browser window and the local file system, since the global file system is always already being served by many "local" computers, and its "interplanetary namespace" (the naming system for a file structure, e.g. a file path) overlaps with that of the the "personal" computer. Peer-to-peer storage reiterates the fact that at the most technical level, this boundary between local and global is hardly there, and that "personal computers" are never entirely personal. The network interface card (NIC) on any computer connected to a network is always already receiving all the data packets on that network, retroactively deleting the packets which are not addressed to the user. In "promiscuous mode", made visible by packet sniffer programs such as Wireshark,[105] users can see all the traffic going through their machine, though others' packets need to be decrypted to be made truly visible, to be "possessed". As Wendy Chun and Sarah Friedlander write,

> Your network card is, technically speaking, initially "slutty": dirty, open to all traffic, indiscriminate (to clean is to delete). Crucially, though, without this necessary vulnerability/openness, there would be no Internet, no communications; our network cards only appear "promiscuous" if we envision our machines as personal[106].

This contradictory nature of the bounded individuality of the networked personal computer — that informational objects are possessed only insofar as they are properly addressed and decrypted, that the computer is only retroactively personal (through deleted traffic) — reminds us that the networked object's conditions of existence are not object-like at all, but fundamentally processual and entropic. Thus, to combat packet loss, the Transmission Control Protocol (TCP) simply repeatedly sends packets down a leaky pipe until it can verify that the whole message has been properly received. Within the operations of the conventional web, the pseudo-legal parameters established by transmission and encryption protocols define the boundary between the private user and the public network, between what is passed up to the

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[105] An open source packet-sniffing software.

[106] Wendy Hui Kyong Chun and Sarah Friedland, "Habits of Leaking: Of Sluts and Network Cards," *Differences* 26, no. 2 (September 1, 2015): 5, https://doi.org/10.1215/10407391-3145937.

user's operating system as an object to be "possessed", and what is merely "passing through" the machine as part of the network's traffic flow — traffic which could nonetheless be intercepted and captured by an enterprising hacker. (Whether packet-sniffing on unencrypted networks amounts to illegal "wiretapping" remains subject to legal debate).[107] In practice, what one can "possess" in the networked world could be understood as which signal one is able to receive, typically determined by the web's legal-technical codes of address, query and response, such as the HTTP GET request[108], which authorizes legitimate access to data. Viewed in this light, decentralized web systems like IPFS embrace the non-personal and decentralized nature of the networked computer (and internet itself), inverting the dynamics of storage and service to render participation in the open and leaky conditions of the network's infrastructure as a peer-to-peer production, wherein participating computers don't only listen for their own transmissions, but also actively serve requests to the rest of the network.

Through content-addressability and automatic versioning, IPFS claims that "users can trust the content they receive without trusting the peers they receive it from," while also maintaining that "old but important files do not go missing.[109]" This structure speaks to two ideals held by dweb advocates seeking to "fix" the current web: a "baked in" protocol for "trust" between users, and a "permanent web". Since the World Wide Web has no archival function, archivists and engineers like Kahle and Benet advocate for resilience against the network's entropic tendencies, imagining an information space which "no longer [exists] in the land of the perpetual present".[110] The nature of infrastructural "trust" and collective maintenance is aligned what communications scholar Lana Swartz, writing about blockchain, has termed "infrastructural mutualism": "a shared utility produced and maintained by all participants … free from the

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[107] See Joffe v. Google, Inc. FEDERAL STATUTES — "WIRETAP ACT — NINTH CIRCUIT HOLDS THAT INTERCEPTING UNENCRYPTED WI-FI BROADCASTS VIO- LATES THE WIRETAP ACT", *Harvard Law Review*, April 14th, Vol. 127, No. 6, 2013.

[108] At this most basic level, this is an HTTP GET Request, through which a user (client) sends a GET query to a host IP (server), which returns the requested data or otherwise sends a denial message such as the familiar "HTTP 404 Not Found"

[109] Juan Benet, "IPFS - Content Addressed, Versioned, P2P File System," accessed May 10th 2019. https://ipfs.io/ipfs/ QmV9tSDx9UiPeWExXEeH6aoDvmihvx6jD5eLb4jbTaKGps

[110] "Locking the Web Open: A Call for a Decentralized Web I Brewster Kahle's Blog," accessed May 10, 2019, http:// brewster.kahle.org/2015/08/11/locking-the-web-open-a-call-for-a-distributed-web-2/.

prying eyes and inference of corporate intermediaries."[111] In this socio-technical idiom, "trust" refers to the network's ability to safeguard the veracity of a transmission between sender and receiver through protocols of encryption and verification, a meaning specifically opposed to a more conventional definition of trust, such as the "acceptance of the truth of a statement without evidence or investigation."[112] Rather than trust in the given statements of another human subject, the trust desired by dweb advocates is trust in the protocol, the legal-technical structure that facilitates the online relationship in the first place. It is a trust in terms of technology which enables relationships that are conversely "trustless" in terms of people. Recalling Satoshi Nakamoto's ambition to replace trust with cryptographic proof, "trustless trust" represents a desire in decentralization discourse to supplant—or rather, perform technically—the social contract. If one is to follow Lawrence Lessig's assertion that "code is law", then it is trust in a different kind of "law", not the law of the sovereign state but the law of executable programmes. As Wendy Chun argues, this self-executing law at the "level of everyday practice" fulfills the logic of neoliberalism beyond its economic theorists' wildest dreams: "code as self-enforcing law "privatizes" this function [of state-backed law], further reducing the needs for government to enforce the rules by which we play."[113]

Protocols for Publics

Such is an image of totalitarianism -- non-kin society organized by bureaucracy and law.

Michael Warner, "Publics and Counterpublics"[114]

Behind this neoliberal and libertarian tendency, blockchain and the dweb share a lineage to the cyber-utopian culture of the early web, such John Perry Barlow's "Declaration of the Independence of Cyberspace" and Timothy C. May's "Crypto-anarchist Manifesto" (1988), which imagined a near-future in which the anonymity afforded by strong cryptography would incur an unstoppable "revolution" that

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[111] Lana Swartz, "Blockchain Dreams: Imagining Techno-Economic Alternatives After Bitcoin," in *Another Economy Is Possible: Culture and Economy in a Time of Crisis*, ed. eds. Manuel Castells et al. (Malden, MA: Polity, 2017), 85, http://llaannaa.com/papers/Swartz_Blockchain_Dreams.pdf.

[112] "Trust" Oxford Dictionaries, accessed May 10, 2019, https://en.oxforddictionaries.com/definition/trust.

[113] Chun, *Programmed Visions*, 27.

[114] Michael Warner, *Publics and Counterpublics*. (New York, NY: Zone Books, 2010 [2002]), 69.

would dismantle the social, economic and legal infrastructures of the modern world.[115] For May, encryption is the networked society's de facto frontier of sovereignty, for the private individual as well as the nation state[116]. One could argue that both blockchain and the dweb draw their energies from the very failure of this project, seeking to revise new structures upon the broken promises of a utopian cyberspace. However, contemporary dweb initiatives such as those of the Internet Archive, IPFS, Mastodon, Dat Project and Beaker Browser embrace a far "softer", more socially conscientious notion of the decentralized network, as a space of social practice rather than a trustless armature of raw sovereign individualism.[117] Emerging in the post-Snowden and post-Facebook techno-politics of the early 2010s, the negative valence of *de*-centralization in the contemporary dweb "movement" seeks to challenge the the distribution of power in the social and technological world of the web itself, seeing the web as a public infrastructure that has been colonized by corporate platforms. As Beaker Browser states, "The Web's value flows from the people who use it, yet our online experiences are dictated by corporations whose incentives rarely align with our own."[118] However, within the immature discourses of the dweb, these competing agendas, are as much cultural as they are technical, perhaps more imaginary than actual. Still, protocol and architecture help to anchor their claims in speculative diagrams of function (i.e. software). As Nathan Schneider writes, decentralization serves as a "floating signifier" which "whispers the occult caveat that the true meanings of our words may be revealed some time in the future, if we continue putting words to use."[119] Michael Warner writes of "publics" as amorphous structures of kinship and affinity which "necessarily [remain] invisible to consciousness and reflective agency",[120] not necessarily bound by traditional social

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[115] Timothy C May, "The Crypto Anarchist Manifesto," accessed May 10, 2019, https://www.activism.net/cypherpunk/crypto-anarchy.html.

[116] In the U.S., strong encryption software was regulated as a munitions export until 1996, while the Bureau of Commerce and Security still needs to be notified about the release of open-source encryption tools. — "Executive Order 13026 of November 15, 1996: Administration of Export Controls on Encryption Products" (White House, November 19, 1996), https://www.govinfo.gov/content/pkg/FR-1996-11-19/pdf/96-29692.pdf.

[117] Dat Project, for example, is funded by community-focused non-profit Code for Science and Society, as well as the Knight Foundation.

[118] "About - Beaker Browser," accessed May 10, 2019, https://beakerbrowser.com/about/.

[119] Schneider, Nathan. "Decentralization: An Incomplete Ambition." *Journal of Cultural Economy* (forthcoming) (April 17, 2019): 1–21. https://doi.org/10.1080/17530350.2019.1589553.

[120] Warner, *Publics and Counter Publics*, 14.

identities, such as nationality. Instead, a public emerges through the internalized but collective "we", as an "imaginary being [that] must be projected from an already circulating discourse".[121] The rhetorics of decentralization draw out new publics within the contested imaginary of the web, bringing into question the metaphors and techniques that construct it as a space of social practice. Like populist political platforms, dweb platforms promise to return control of digital information to *the people*", and to build a "*person-to-person*" web, sounding a call for a body to populate its aspirational politics. These dweb projects could be seen as an effort to "denaturalize" the web, to destabilize and re-politicize it as a contested social infrastructure by retooling its protocols towards a more commons-oriented network. Where blockchain ventures typically seek to build game-theoretic incentive structures as a way to ensure the financial and legal sovereignty of individuals within a network, the dweb projects I focus on here are predominantly concerned with reclaiming social agency and civil liberties within the web as a common space.

As a proliferation of socio-technical diagrams, dweb projects not only emerge from diverse publics but at every turn imagines new ones. That is to say, each "white paper" produced by a dweb project or blockchain startup supposes a new and more ideal protocol for a given social domain. For example, Mastodon is a decentralized social network which shares many of the same functions as Twitter, but consisting of federated servers (independent but interlinked Twitter-like communities) which can set their own rules and codes of conduct. As such, while Twitter became fraught with criticism over its handling of abuse and harassment, Mastodon labelled itself as a "safer and more humane place"[122] for social media, in which one could "find your perfect community"[123]. While the egalitarian rhetoric of the dweb seeks to bake principles into protocols, the publics that emerge are not always the same as those imagined. As it turned out, Mastodon's technical model for decentralized, self-governed communities was a success, but its rapid growth was ultimately driven by Japanese lolicon ("Lolita complex" — erotic animations and drawings of children) communities, which had recently been banned from Twitter. As social network "refugees", the lolicon community migrated to Mastodon, and soon became the largest Mastodon server

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[121] Warner, *Publics and Counter Publics*, 107.

[122] "Learning from Twitter's Mistakes: Privacy and Abuse-Handling Tools in Mastodon," accessed May 10, 2019, http://blog.joinmastodon.org/2017/03/learning-from-twitters-mistakes/.

[123] "Mastodon," accessed May 10, 2019, https://joinmastodon.org/.

in the world.[124] The episode demonstrates that while communities can bring about technologies (after all, the dweb exists as part of a long history of open source software building), technologies also call forth new publics. Meanwhile, the propositional techno-publics of the dweb's designs exist as a conflation between network agents and human subjects, whose behaviors are apparently determined by the protocol's regime of control. Even "concrete" implementations of the decentralized web are projective aspirations towards the generalized public that will one day enter into its domain of governance. As one blockchain CEO claims, "Today, we are in the first time in history that we can actually try out new governance models without the need of people getting killed"[125]. Insofar as they exist and function, these inchoate systems resemble social experiments that sit somewhere between a role-playing game and an agent-based model, drawing from a pre-existing public to grow its community through their enthusiastic evangelism. After all, a network without peers is no network at all.

A Softer Web

Nonetheless, within the totalizing political, economic and technological forms of platform capitalism, the dweb has given rise to a cultural counter-imaginary that carves out utopian spaces of social practice. In particular, designers and artists drawn to the dweb emphasize its potential as a tool for thinking about the web as a more communal, intimate and thoughtful social space. With many echoes of the communalist movements of the 1960s, these communities see the dweb as a means of performative disalienation from a web whose corporate interfaces and surveillance economy have become a source of political frustration and personal anxiety. Through creative and experimental engagements, the decentralized web takes on a positive definition, as a way of claiming agency in day-to-day operational environments, and in turn to inhabit new forms of sociality and digital identity enabled by a web in which these terms are subject to contestation. In a way, these artists, many of whom (like myself) grew up in the late stages of an earlier, pre-platform web, harbor a nostalgia for the sense of freedom granted by an online

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124 "Mastodon Is Big in Japan. The Reason Why Is… Uncomfortable I … My Heart's in Accra," accessed May 10, 2019, http://www.ethanzuckerman.com/blog/2017/08/18/mastodon-is-big-in-japan-the-reason-why-is-uncomfortable/.

125 Aragon, *Aragon - The Fight for Freedom*, accessed May 10, 2019, https://www.youtube.com/watch?v=AqjIWmiAidw.

environment which felt both more anonymous and more personal, an exploratory space of fluidities and affinities (and dangers) for our own inchoate identities. Homepages were more private than professional; strangers would pop up on chatrooms to ask for your "asl"—age, sex, location—because you could be anyone, anywhere—a different kind of "trust" and performative vulnerability that has since disappeared into other spaces. In her essay "My website is a shifting house next to a river of knowledge. What could yours be?", web designer and educator Laurel Schwulst considers a plethora of metaphors for what a website could be, amongst them a room, a garden, or a puddle. Her metaphors invoke websites as a "living, temporal spaces"[126] which their makers and visitors relate to on the level of practical, social, emotional life: that is to say, they are at once objects of utility and grounds of everyday practice, both text and context. Just as peer-to-peer infrastructures like Dat and IPFS argue for a web which is more like a shared file system than a publishing system, thus broadening the notion of what a network of digital objects could be, Schwulst suggests that the website as a site of internal contemplation as well as outward expression, not only through its contents but also its architecture: "when you put energy into a website, in turn the website helps form your own identity."[127] While the web is increasingly commercialized, with even personal websites typically serving professional purposes, Schwulst reminds us that "a surprising, memorable, monumental, soothing, shocking, unpredictable, radically boring, bizarre, mind-blowing, very quiet and subtle, and/or amazing website could work." Furthermore, she writes, personal websites are "individual [acts] of collective ambition"[128] for the web as a whole.

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[126] Laurel Schwulst, "My Website Is a Shifting House next to a River of Knowledge. What Could Yours Be?" *The Creative Independent*. Accessed April 19, 2019. https://thecreativeindependent.com/people/laurel-schwulst-my-website-is-a-shifting-house-next-to-a-river-of-knowledge-what-could-yours-be/.

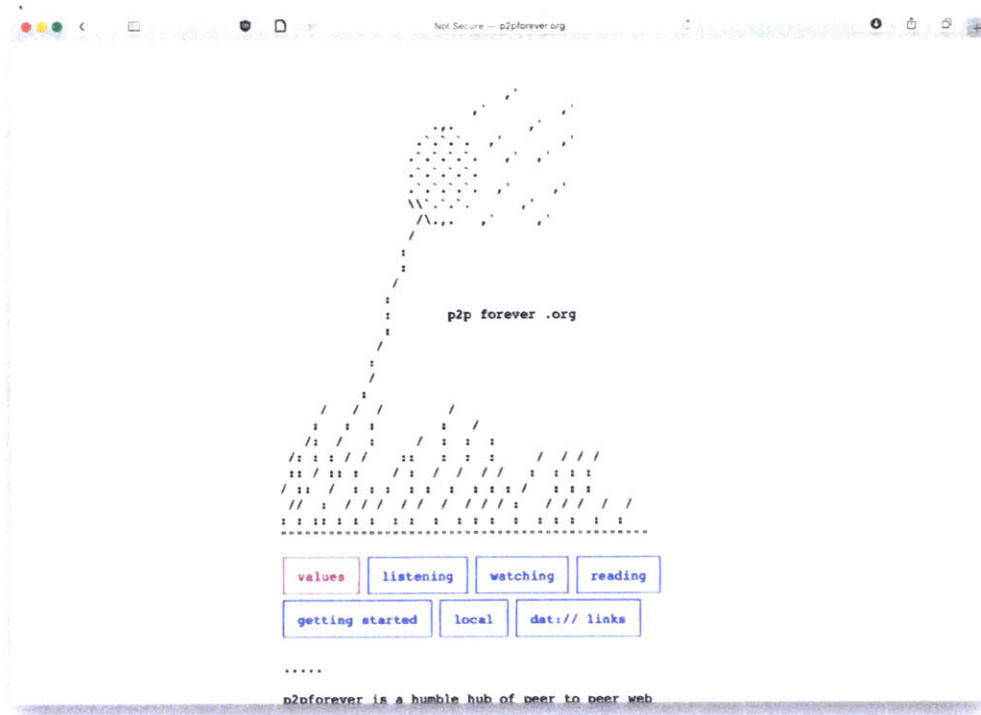[127] Ibid. Schwulst

[128] Ibid. Schwulst

Figure 3. Homepage of Laurel Schwulst's p2pforever.org[129]

Where the decentralized web falls short as an actual socio-technical system, it thrives as a subculture, understood as an assertion of values of a subordinate group against a dominant ideology, further expressed through *style*.[130] One of Schwulst's many websites is p2pforever.org, a "humble hub of peer to peer web resources".[131] A single page with a list of links on a white background, it begins with an ASCII drawing of dandelion broadcasting its seeds. Its combination of bare-bones HTML and CSS code and bucolic net.art imagery exemplifies the DIY aesthetics of dweb subculture. The language of protocol—itself a slippery metaphor for the lines of code which execute the terms of network interactions—is folded into a living metaphor of growth, ecology and care. This subcultural aesthetic shifts the focus of decentralization away from ideological diagrams of freedom and governance, instead aligning the dweb with the more interpersonal domains of communalism, kinship and craft, in opposition to the commercial platforms perceived to preclude these meaningful forms of sociality. For example, artist, technologist and

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[129] Laurel Schwulst, "P2pforever.Org." Accessed May 9, 2019. http://p2pforever.org/.

[130] Dick Hebdige, *Subculture: The Meaning of Style* (New Accents. London ; New York: Routledge, 1991).

[131] Laurel Schwulst, "P2pforever.Org." Accessed May 9, 2019. http://p2pforever.org/.

educator Taeyoon Choi runs "Distributed Web of Care", described as an initiative to "*code to care* and *code carefully*"[132]. At the School for Poetic Computation, a New York-based artist-run school Choi founded, he teaches a class on the dweb which examines peer-to-peer technologies such as Dat and Scuttlebutt before taking on "performative exercises to explore the feeling of being in a network. We will learn to move around in physical space with strings in order to care, not control, each other."[133] For Choi and others, the dweb represents not a coercive infrastructure of "trustless trust" but an opportunity to break apart the narratives, norms and practices that have congealed around the World Wide Web. Like the other aforementioned protagonists of the dweb, Choi embraces computer networks as a site of potentiality, but rather than seeking to "bake" values into code, his pedagogy takes peer-to-peer protocols as a model through which to consider the affects and ethics of networked participation. In this framing, the network is not a technology as such but a cultural technique which understands networked sociality as reified by, but not inherent to, the computing technologies that brought it about. (In the twofold genesis of cultural techniques described by Geoffrey Winthrop-Young, the emergence of media technologies initially considered "inimical to culture" are subjected to the "culturalization of technology",[134] which reveals such technologies as mediatory techniques, acculturated ways and aptitudes of being in the world which are inscribed by our technologies but do not necessarily belong to them.) As such, in Choi's participatory performance, the distributed network needs no routers, instead asking participants engage with the practice of peer-to-peer exchange as an intimate form of negotiation between people. Here, the dweb is not a particular technological demo or protocol, but instead constitutes a tool for speculation, a (literally) performative metaphor for enacting and unfolding the social fiction(s) of "the web we want".

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[132] "Distributed Web of Care," Distributed Web of Care, accessed May 10, 2019, http://distributedweb.care/.

[133] "Code Societies Winter 2019," Code Societies Winter 2019, accessed May 10, 2019, http://sfpc.io/codesocieties-winter-19/.

[134] Geoffrey Winthrop-Young. "Cultural Techniques: Preliminary Remarks." *Theory, Culture & Society* 30, no. 6 (November 1, 2013): 6. https://doi.org/10.1177/0263276413500828.
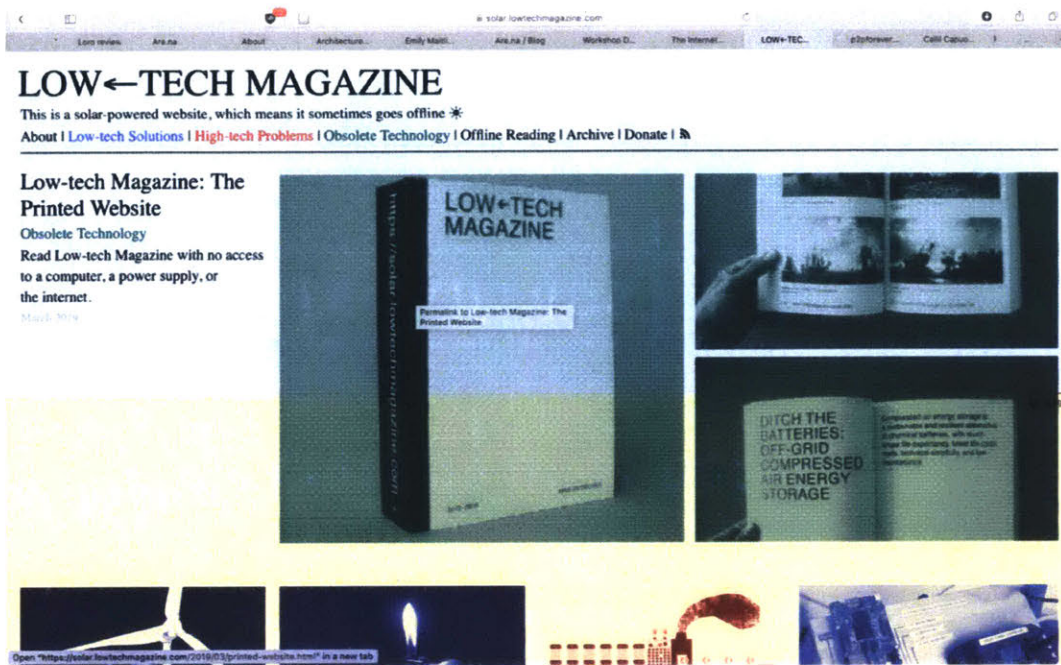
Figure 4. A screen grab of the solar-powered website of *Low-tech Magazine*.

I suggest that dweb subculture be understood as a "back to the LAN"[135] movement, an emerging cyberculture which, at times paradoxically, sees new network technologies as a way to eschew the dominant narratives of high technology, embracing ideals of localism, communalism, and a DIY utopian ethic built around self-sufficiency. One sustainability-focused technology publication, *Low-Tech Magazine*, runs its website on a solar-powered server which occasionally goes offline in overcast weather. Similarly, on her website, Laurel Schwulst likes to mention not only the time but the location of each update, reminding users that her webpage is not a finished product, but is "always under construction" contingent on the piecemeal and personal efforts of an individual in the world[136]. To reconstruct the dweb's communalist aesthetics, it is necessary to return to the first cyberculture of the 1970s, which responded to the hierarchical "priesthood" of IBM with a countercultural conviction that computers would empower individuals and connect communities under the banner of the "whole earth", against the centralized

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[135] LAN = Local Area Network.

[136] Laurel Schwulst, "P2pforever.Org." Accessed May 9, 2019. http://p2pforever.org/.

regimes of power belonging to "government, big business, formal education, church".[137] Like the subcultural aesthetics of the dweb, the '70s cyberculture was explicitly connected to ecology. As the computer visionary Ted Nelson wrote in the opening pages of *Dream Machines*, the reverse side of his classic double-publication *Computer Lib/Dream Machines*, the rise of the "computer underground" was akin to the "Greening of Computerdom."[138] (He also compares the computer's empowering potential to the civilian protest against "atmospheric pollution" and the feminist health publication *Our Bodies, Ourselves*.)[139] Nelson was prescient in understanding computers as an "ecological" medium: not only a device to be used but a powerful social and environmental substrate, "not everything, but an aspect of everything."[140] Influenced by the spirit of the *Whole Earth Catalog* (whose outsized physical dimensions it shares), *Computer Lib/Dream Machines* championed the personalization of computers in protest against the stiff culture of computer corporations, aligning these new technologies instead with the communalist ambitions and ecological concerns of the era. The dweb doubles back on this dream, responding not to the frigid atmosphere of cold war America but the corporate enclosure of everyday life by coercive and extractive digital platforms. While the present-day takeover of the web by corporations echoes the power-hoarding "computer priesthood" characterized by Nelson, the contemporary culture of Silicon Valley can also be traced directly to the utopian, libertarian counterculture Nelson helped to create.[141] Indeed, the shift from Silicon Valley's dependency on federal funding in the 1970s to the Wild West of venture capitalist startup culture in the 1980s mirrors the narrative entrepreneurial, rugged individualism to which Nelson personally aspired[142]. The ecologically-inclined subculture of the dweb recapitulates the aspirations

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137 *Whole Earth Catalog*, ed. Stewart Brand, (Menlo Park, CA: Portola Institute, 1968), 2.

138 Theodor H. Nelson, *Computer Lib ; Dream Machines*, Rev. ed (Redmond, Wash: Tempus Books of Microsoft Press, 1987), 126D

139 Theodor H. Nelson, *Computer Lib ; Dream Machines*, Rev. ed (Redmond, Wash: Tempus Books of Microsoft Press, 1987), 2.

140 Theodor H. Nelson, *Computer Lib ; Dream Machines*, Rev. ed (Redmond, Wash: Tempus Books of Microsoft Press, 1987), 2.

141 Nelson was an associate of Stewart Brand, Timothy Leary, and other luminaries of the counterculture, as well as computer pioneers like Douglas Engelbart. Like Brand, Nelson has lived for many decades on a houseboat moored in Sausalito, California.

142 Fred Turner, "Don't Be Evil: Fred Turner on Utopias, Frontiers, and Brogrammers", *Logic Magazine*, Issue 3. https://logicmag.io/03-dont-be-evil/

See also, Barbrook and Taylor, "This retro-utopia echoed the predictions of Isaac Asimov, Robert Heinlein and other macho sci-fi novelists whose future worlds were always filled with space traders, superslick salesmen, genius scientists, pirate captains and other rugged individualists.[17] The path of technological progress didn't always lead to ecotopia – it could instead lead back to the America of the Founding Fathers." http://www.imaginaryfutures.net/2007/04/17/the-californian-ideology-2/

of Nelson and Brand's era, in many ways echoing their frontierist imaginary, while seeking instead to imagine new communal forms that are native to the networked world. For example, the second Decentralized Web Summit in 2018 featured an ambitious creative commission called "Distributed Gardens", a participatory work comprising what the artists called a "peer-to-peer knowledge eco-system": a series of kiosks for guests to submit documents and debris collected from the summit as it took place, with the resulting "data seeds" scanned into a "living" digital visualization of links, conversations and objects. In a blogpost titled "New Gardens", Callil Capuozzo, a member of the Distributed Gardens team writes,

> When considering the concept of the distributed web, we might look towards both the metaphor and practice of gardening and farming. I hope that we can show how building for digital spaces requires respect, patience, and a real awareness of the environment around you.
>
> Maybe we can write some new folk talks together.[143]

Against the "flattened" universality and always-connected lifeworld projected by digital platforms, the formation of diasporas and localities appear as radical possibilities, as do offline forms of networking, such as gossip, folk tales and oral traditions. For example, the popular dweb social network Secure Scuttlebutt[144] uses a peer-to-peer "gossip protocol" that emphasizes a local-first approach: as long as a user can form a local connection with another peer, they need not be connected to the global network to be kept up to date. In keeping with the horticultural imagery, Scuttlebutt states of its moderation process, "*Tending and pruning* are not a stranger's duty … infrastructure is a voluntary act."[145] In the communalist rhetoric of dweb subculture, the notion of ecology takes on its scientific meaning of organic, (techno-)environmental systems as well as its etymological evocations of homemaking (*oikos*: family, home, house)[146]. For Capuozzo, Schwulst, Choi and others, the dweb offers an opportunity to cultivate new forms of domesticity, locality and pedagogical practices in gentler archipelagos far adrift from the

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[143] "New Gardens," Distributed Web of Care, June 27, 2018, http://distributedweb.care/posts/callil/.

[144] So named for the "watercooler" on a ship where seamen chatter.

[145] My emphasis. "Principles · GitBook," accessed May 10, 2019, https://www.scuttlebutt.nz/principles/.

[146] οἶκος in Liddell & Scott, *A Greek–English Lexicon* (Oxford: Clarendon Press, 1940), accessed May 10th 2019 http://www.perseus.tufts.edu/hopper/text?doc=Perseus:text:1999.04.0057:entry=oi)%3Dkos1

advancing empires of platform capitalism. The peer-to-peer technologies that enable these alternative realms of practice are ultimately a projection—though a powerfully affirmative one—of kinships built upon existing social and technological desires.

Are.na: Tool Aesthetics

While the nomadic imaginaries of dweb subculture are a far cry from the promethean machismo of the *Whole Earth Catalog*, they shares with that earlier communalism a valorization of tool-making. Famously subtitled "access to tools", the *Catalog* began, "We are as gods and we might as well get good at it"[147], and proposed to develop the "power of the individual to conduct his own education, find his own inspiration, shape his own environment, and share his adventure with whoever is interested.[148]" In its propositions for new protocols and practices, the technologies and cultures of the decentralized web contest the meanings of concepts such as identity, ownership, architecture, inhabitance, and community within the contemporary digital sphere. Its technologies are frequently referred to as "tools", a phrase favored in tech parlance for its connotations of empowerment, as well as its transferral of responsibility from the hands of the maker to those of the user. (Mark Zuckerberg allegedly used the word eleven times in his statement to congress.[149]) At the same time, tools also suggest dismantlement and disalienation from the means of production, an increasingly salient prospect amidst the interpellation of networked subjects by expansive platforms environments. Like the New Communalists half a century ago, the dweb also seeks to make claims to individual and collective empowerment. In a list of values for the peer-to-peer community, Paul Frazee, a co-founder of Beaker Browser (who was also involved in Secure Scuttlebutt), writes,

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[147] *Whole Earth Catalog,* ed. Stewart Brand, (Menlo Park, CA: Portola Institute, 1968), 2.

[148] *Whole Earth Catalog,* ed. Stewart Brand, (Menlo Park, CA: Portola Institute, 1968), 2.

[149] Weigel, Moira. "Silicon Valley's Sixty-Year Love Affair with the Word 'Tool,'" April 12, 2018. https://www.newyorker.com/tech/annals-of-technology/silicon-valleys-sixty-year-love-affair-with-the-word-tool.

3. "View source" is critical to an open Web. The more code that users can read, the more code they can review and learn from.

4. "Modify source" is the p2p Web's great power. A Web that can be made and remade by its people can better serve their needs and produce a more diverse & exciting world. The Web should be a truly "live" society.

By viewing and modifying a page's source (standard browser capabilities known as "developer tools"), visitors to a website can examine and intervene in the underlying code elements—a reminder that a webpage, while downloaded from a distant server, is rendered in the local space the browser. While changes made to a page are not hosted on the web for anyone else, the browser nonetheless becomes a contested interface through which users can reclaim some of the agency to shape online environments for themselves. This could be understood as a strategy of decentralizing in the private space of the individual, if not in the common space of infrastructure, just as Foucault contends, "the architect has no power over me. If I want to tear down or change a house he built for me, put up new partitions, add a chimney, the architect has no control."[150] For example, web developer Omayeli Arenyeka describes browser extensions as an "easy and accessible way for people to express their vision of the internet they want",[151] while critical browser tools like Kalli Retzepi's *clickhere* break down the interface to reveal the ideological conditions of a website as a technical medium, rendering pages as a minimalist, abstract canvases that highlight their most interaction-hungry elements.[152]

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[150] Michel Foucault, "Space, Knowledge and Power," in *The Foucault Reader*, ed. Paul Rabinow, (New York: Pantheon, 1984), 247.

[151] "Decentralized Web Summit 2018: Global Visions / Working Code," accessed May 10, 2019, https://www.decentralizedweb.net/prototyping-the-decentralized-web-with-browser-extensions/.

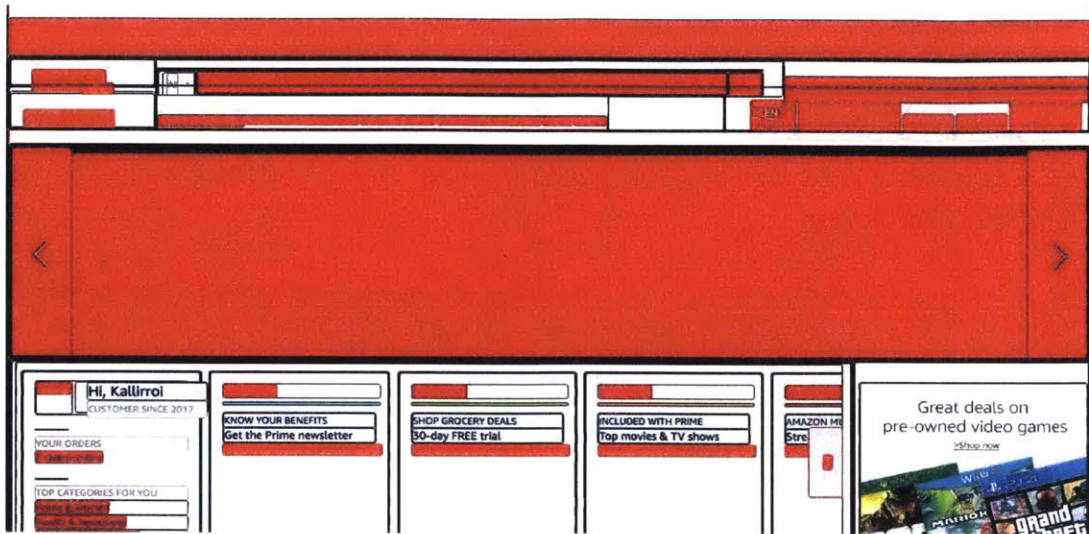[152] Both Arenyeka and Retzepi were participants in the Decentralized Web Summit in 2018.

Figure 5. A screenshot of Kalli Retzepi's project *clickhere*.[153]

Recalling Lefebvre, these practices of browser-based tool-making identify the space of the browser as an ongoing production, rather than a product to be served and used. By engaging the browsing subject with its underlying technicities, they also serve to make online experience more legible as a complex of socio-technical relations. These approaches to the dweb could be understood as a means of "re-tooling" the online environment in much the same way as skaters or flaneurs re-tool the spaces of the city, making it less hostile, more legible, or more pleasurable. One such tool which has lately evolved into a significant social node for the dweb community is Are.na, a social platform which bills itself as a "more visual organization tool designed to help you think and create ... a more mindful community".[154] In practice, are.na is an online hypertext system, an interface for linking objects ("blocks") to one another into arbitrary categories ("channels"), which has become highly popular amongst developers, designers and artists to organize collections of links, images, PDFs and other things collected from the web into individualized or collaborative conceptual archives. Its founder, artist-cum-CEO Cab Broskoski, suggests that the platform seeks to promote the "soft skills" around the decentralized web, not at the level of protocol, but in building alternative interfaces and environments for the experience of inhabiting and

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[153] "Clickhere | Kalli Retzepi." Accessed May 8, 2019. https://kalli-retzepi.com/clickhere/.

[154] "Are.Na / About," accessed May 10, 2019, https://www.are.na/about.

thinking in online space.[155] Broskoski refers to a desire to re-organize the fractured and distracting experience of online space into personally coherent associative and conceptual structures, and to conduct "work in public"[156], turning private acts of browsing into collective forms of cognitive and discursive activity. Describing his decision to leave his art practice and form the company, Broskoski writes,

> ... it's actually about tools. It's actually removing myself entirely and making things for other people to do stuff. I decided making tools is the nicest thing you can do as an artist. So Are.na still feels like a natural extension of where I was going as an artist.[157]

In an attempt to cultivate these "soft skills" through tool-making, are.na is explicitly modeled on historic imaginaries of the "web" that preceded the World Wide Web itself. In particular, it harks back to Project Xanadu, an interlinked "docuverse" proposed by Ted Nelson in the late 1960s. Presciently imagining the computer (and in many ways, the web) as a "new form of literature", Nelson was responsible for coining the term "hypertext" to denote interlinked digital documents made possible by the new digital computers. Project Xanadu grew to be a complex, multi-decade project for a system of decentralized digital publishing, in which documents were inherently interconnected through link structures and annotative mechanisms such as "xanalinks" and "transclusion". For Nelson, the core concept of Xanadu (and precisely what remains missing from the World Wide Web) is "visible connections", or the two-way informational link between textual objects which makes the web/hypertext's meshwork of connection legible. The World Wide Web as proposed by Tim Berners-Lee arguably sacrificed this structural legibility for a more simple, if ultimately illegible form of networking: the web's uni-directional hyperlinks transport users from A to B, while saying nothing of the way that B is connected back to A.

In are.na, one finds a bare-bones realization of such a system, in which users cohere their many-tabbed, multi-attentive browsing behaviors into meaningful structures by linking digital objects together, as well as

[155] Author's conversation with Charles "Cab" Broskoski, Are.na CEO.

[156] "Charles Broskoski on Self-Discovery That Happens Upon Revisiting Things You've Accumulated Over Time," accessed May 10, 2019, https://thecreativeindependent.com/people/charles-broskoski-on-self-discovery-upon-revisiting-things-youve-accumulated-over-time/.

[157] "Charles Broskoski on Self-Discovery That Happens Upon Revisiting Things You've Accumulated Over Time," accessed May 10, 2019, https://thecreativeindependent.com/people/charles-broskoski-on-self-discovery-upon-revisiting-things-youve-accumulated-over-time/.

keeping rarer finds from the depths of the web at hand. While browsing data is collected en masse by companies, who use cookies and other tracking methods to understand users' behavioral patterns, the layout of the browser interface means that web users themselves have relatively little access to temporal trajectory of their activity. Indeed, there has been a lack of critical attention to the mundane yet significant cultural technique of browsing as an activity of research, exploration and play in the affective and phenomenological plane (or "information space")[158] of the web—a space which constantly elides into other forms of production, such as writing. (Asked if he disconnects in order to write, the author William Gibson responded "No, I've got Word open on top of Firefox."[159]) The question of "embodied" behaviors of navigating information spaces were central to the lineage of ideas inherited by the web. In "As We May Think", a seminal essay published just after the Second World War, the American engineer and national science administrator Vannevar Bush sketches an image of hypertext systems and information networks to come. Observing contemporaneous techniques for information management, (index cards, microfilm, computed by "a whole roomful of girls armed with simple key board punches"),[160] Bush noted that human thought does not work by indexing, but by association, a process of readerly connection that "may yet be mechanized". Bush imagines a device called a Memex, a kind of desktop microfilm browser which gives its user access to all the world's knowledge at their fingertips. More than a mechanical archive, however, the Memex has the functionality for "associative indexing", a proto-hypertext in which texts can be connected to one another to build an associative "trail" of information. Individual trails can be passed to other users, so that they may join them to their own trails, making possible "wholly new forms of encyclopedias" comprising "[meshes] of associative trails.[161]" Indeed, a similar concept was outlined by Jorge Luis Borges a few years before in his short story, "The Garden of Forking Paths"; Bush describes the user of the Memex "branching off" here and there, "[building] a trail of his interest through the maze of

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[158] As defined by MIT CSAIL: "An information space is a type of information design in which representations of information objects are situated in a principled space. In a principled space location and direction have meaning, so that mapping and navigation become possible." http://www.ai.mit.edu/projects/infoarch/jair/jair-space.html

[159] James Bridle, "The Ebook That Forces the Reader to Pay Attention." *The Guardian*, March 11, 2012, accessed May 10th 2019. https://www.theguardian.com/books/2012/mar/11/marc-saporta-composition-no-1.

[160] Bush, Vannevar. "As We May Think." The Atlantic, July 1, 1945. https://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/.

[161] As We May Think

material."[162] As suggested by the title of his essay, Bush's own rhetorical thread aligns the processes of browsing (that is, reading and navigating a system of documents) and thinking, linking the researcher's annotative process with the "association of thoughts ... in accordance with some intricate web of trails carried by the cells of the brain."[163] Emerging around the same time as the birth of cybernetics, this vision of information systems for collective learning was partially borne out in the World Wide Web, but lacking is Bush's emphasis on a more reflexive form of browsing through hypertextual connections that produce legible patio-temporal structures of knowledge production, a conviction shared by Nelson and Broskoski. Like Xanadu, are.na takes up these "associative trails" by providing tools that give users a more direct access to the meshwork of technical and cognitive processes that browsing entails—bringing the web a little closer to a less alienated relation between networked individuals and the information spaces they navigate, drawing from an alternative history that has yet to emerge.

[162] Vannevar Bush, 'As We May Think', *The Atlantic*, 1945

[163] Ibid. Bush

Interlude: Caretaking

My friend, M, is a computer programmer. I don't know what she does in her day job, exactly —
some kind of back-end, database work. But for the past 35 years, she has been keeping a detailed diary in a
piece of personal software she calls the mx. The program itself is a brutalist relic, a DOS command-line-
style interface with rows of pixilated, monospace text on a black screen, the kind of thing you see when
you switch on a PC, just before the actual operating system graphics kick in. She wrote it back in the
summer of 1984 as a poetry experiment, and has kept it largely for personal use. As we chat, M scribbles
down odd phrases and references in our conversation with pen and paper. Every notable encounter or
musing, every thought that interests her in a book or a lecture, she notes and types them up in the mx,
which now contains several million entries.

The mx is a hyperlist, a "list of lists" comprising millions of entries which form an ever-accreting
database of M's knowledge and experience, subjectively mapped across time. Some entries are
recognizable as notions and things, while others are more like captured moments, utterances and turns of
phrase, tokens of a subjective encounter. A recently logged meeting M had contained phrases such as 'the
philosophy of biology', 'assuming it either explicitly or implicitly', 'the other hidden place', 'proper
function'. Most entries are accompanied by a number in the margin, indicating how many times this term
has come up before. For instance, 'somewhat stable' is mentioned eleven times, 'as outsiders' for the first
time ever, while 'reciprocity' has forty.

Sometimes, mx stands for "memory experiment" (it seems to have stood for other names in the
past). M hits enter on an item, opening up another list of all its other instances over the years, each
instance linking, in turn, to their own contextual flow. M tells me that these entries are not intended to be
sensible to others, but offers them as an empirical inventory of her knowledge and phenomena, a private
ecology of thought. She was once approached by a venture capitalist (she lives in San Francisco) about the
mx's purpose. She told him it gave her a 'more intensely felt inner life'. He told her he couldn't sell that.
She wasn't so sure, but they left it at that.

The feminist economists J.K. Gibson-Graham (who write under the pseudonym) ask us to seek
out the contours of 'diverse economies', the globally extensive practices within and without capitalism

which elaborate radically heterogenous economic activities centered upon care, cooperation and co-reliance.[164] As systems gather in scale and complexity, the desire for single-minded, instrumental ends eclipse the vast amount of work required to oil the machine, work which is increasingly outsourced to bodies deemed less valuable, or outsourced altogether. For example, the crisis in care work induced by Brexit in the UK, a society with a rapidly aging population threatening to decimate a predominantly immigrant care sector that is crucial to its future; or the tech industry, in which a crowdsourced global workforce is precariously employed to perform Human Intelligence Tasks (HITs) which cannot yet be performed by machines. Geopolitical injustices aside, these deferrals to the invisible other of technology and the global precariat alienates individuals from the inherent co-dependency of the social, seduced by an illusion of transactional autonomy. Moreover, as Socrates said of writing, 'this invention will produce forgetfulness [...] because they will not practice their memory.'[165]

The creation myths of computing are bound up with the limitations of memory and labor. The first "computers" of the 19th century were human beings, unsung women who compiled vast mathematical tables, sending and receiving packets of calculations by post, not unlike contemporary Mechanical Turk workers. John von Neumann, the Hungarian-American inventor of modern computer architecture, allegedly possessed an eidetic ("photographic") memory with which he could recite the phonebook on demand. A fellow child prodigy was Norbert Wiener, the founder of cybernetics, who kept an obsessively detailed personal archive of his life's work and correspondence which now fills 71 archival boxes in an MIT basement. Today, as our every interaction is captured and stored on a server some place, we are perhaps more anxious about how we remember, and how to be forgotten.

The anthropologist Mary Catherine Bateson, daughter of Gregory Bateson and Margaret Mead, recently lamented that the history of cybernetics advanced headlong down the narrowly technical path of computer science, rather than the epistemological inquiries of systems theory.[166] While the pioneers of computing engaged with the philosophical and architectonic implications of building information

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[164] J.K. Gibson-Graham, (2008) Diverse economies: Performative practices for "other worlds." *Progress in Human Geography* 32, 5: 613–32.

[165] *Plato in Twelve Volumes*, Vol. 9, translated by Harold N. Fowler. (Cambridge, MA: Harvard University Press, 1925).

[166] 'How To Be a Systems Thinker: A Conversation With Mary Catherine Bateson' edge.org, April 17th, 2018, accessed May 10th 2019. https://www.edge.org/memberbio/mary_catherine_bateson

systems, technological memory became largely concerned of calculative efficiency and capacity rather than those of process and organisation. Memory became a resolutely functional technology, rather than an open question about how information and reality. If a mushroom can help us to remember, then perhaps we can cultivate technologies that ask us to think and to care, to engage with the fragile links within and between ourselves and the world.

The mx fascinates me because it has nothing to do with efficiency. It is, if anything, a deeply laborious practice, one that has little to do with aggregation or producing algorithmic optimized performance: *it makes nothing easier*. It serves rather to intensify M's engagement with her own habits of thought: a vast, reflective machine that opens new channels for the nervous circuits of her memory to pass between her thoughts, the mx and the world. Some time before the invention of the internet, the computer visionary Ted Nelson coined "hypertext", pieces of information visibly connected to one another, forming an organismic meshwork of information. Echoing Wiener's assertion that "there are no answers, only cross-references", Nelson called his hypertextual universe "intertwingularity". It never caught on, but it's an typically Nelsonian coinage, evoking not only an entangled system of knowledge and experience, but also the living and lively activity of interconnection, a deeper engagement with systems which form our collective memory. As much as ever, we need caretakers.

Chapter 3: On Worldbuilding

It would seem thus that instead of a situation in which the production of cognitive maps is impossible, we are locked in a situation in which we produce them — or at least approximations of them — all the time, in which the founding gesture of ideology critique is simulated by something that also pleasurably mimics ideology. Software and ideology fit each other perfectly because both try to map the tangible effects of the intangible and to posit the intangible caused through visible cues. Both, in other words, promise a vision of the whole elephant.

<div align="right">Wendy Chun, Programmed Visions[167]</div>

What gives software its power? Wendy Chun suggests that the sense of agency associated with using and designing software arises from its function as a pseudo-cognitive map, an interactive system which approximates, intimates, and makes imaginable the dynamics of a larger totality. In other words, software fulfills a desire for agency because it brings forth a "microworld" (to use Paul Edwards' term) in which our actions matter, a world in which the "direct manipulation"[168] of interfaces produces meaningful and immediate feedback within the system. Chun foregrounds direct manipulation, an influential component in the history of digital interface design, as a technique which reinforces this transmission of the user's power over the system through skeuomorphic visual feedback: if the interface is a metaphor for the instructional source code it executes, then direct manipulation makes this metaphor all the more compelling and accessible to physical experience. For instance, the direct manipulation of moving a file from one folder to another involves the now-familiar spatial gesture of drag-and-drop, rather than the command line instruction "mv from://source_file.txt to://destination/folder" which is more consistent with the technical operation of software. In the agency-giving world of software, the interface is doubly fetishistic. First, it manifests as an illusive relation between virtual objects manipulated by the user which dissimulates the Kittlerian realities of symbolic-electrical operation at the level of hardware. Secondly, it manifests a simulation—or an approximate cognitive map—of the wider totality of social practice by creating a "microworld" in which users have demonstrable agency. The ideological obverse of software's illusions is exhibited in the culture of engineers and programmers, in which "going lower" in the computing stack—interfacing as closely as possible with the machine's physical computation rather than

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[167] Chun, *Programmed Visions*, 71.

[168] Chun, *Programmed Visions*, 63.

more "abstract", human language—has been historically regarded as a demonstration of bareknuckled purity and virtue. "The Story of Mel", an anecdote published by computer scientist Ed Nather on the Usenet messaging network in 1983, is a classic of this genre. It begins:

> A recent article devoted to the *macho* side of programming
> made the bald and unvarnished statement:
>
> Real Programmers write in FORTRAN.
>
> Maybe they do now,
> in this decadent era of
> Lite beer, hand calculators, and "user-friendly" software
> but back in the Good Old Days,
> when the term "software" sounded funny
> and Real Computers were made out of drums and vacuum tubes,
> Real Programmers wrote in machine code.
> Not FORTRAN. Not RATFOR. Not, even, assembly language.
> Machine Code.
> Raw, unadorned, inscrutable hexadecimal numbers.
> Directly.

Nather's anecdote was an early piece of viral content, spreading across Usenet and eventually transforming into free verse (it was originally written in prose) befitting its folkloric tone. It recalls Nather's attempt to understand code written by a fellow programmer, Mel, who designed a piece of software which used hexadecimal code[169] to directly manipulate the computer's memory allocations. "When the light went on it nearly blinded me"[170]: the power Nather senses in Mel's code evokes virtuosic programming as an aspiration towards machinic transcendence through perfect physical and symbolic control (for the two are palpably combined at the lowest levels). Mel is able to exert his power over the computer by operating it as a logical and physical mechanism, rather than through a compiler interpreting the programmer's linguistic instruction. "The Story of Mel" exhibits the exhilarating extension of "direct manipulation" at the level of programming, wherein power and agency flows from the ability to perform computation

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[169] Base 16 numerical instruction, which operates in the computing stack one level above binary code.

[170] "The Story of Mel," accessed May 10, 2019, http://www.catb.org/jargon/html/story-of-mel.html.

through the precise manipulation of machine code, a labor which demonstrates not only technical skill but also an expression of logical and literary devotion. Had Mel reached an even higher state of computer transcendence, he would have resembled Neo at the end of *The Matrix*, directly manipulating electrons in order to bend computational reality to his will. At all levels of abstraction, irrespective of Mel's "low-level" fundamentalism, programmers strive for "elegant" code, referring to the legibility, modularity and concision of implementation.[171] On a practical level, the aim of elegance speaks to programming as a collaborative professional practice, in which coders must functionally interpret one another's designs (and impress one another), while reducing the computational load and vectors for attack caused by redundancies in the system. Elegance is a negentropic force, resisting the system's tendency towards disorder as complexity accretes, a state referred to colloquially as "a big ball of mud".[172] At the same time, elegance also evinces programming as a discursive activity which valorizes a kind of poetic formalism, wherein complex rational solutions are expressed with the utmost concision of form and function.

Software produces a sense of power and agency in its *users*, as "mapping subjects" who are empowered to reveal and interact with a greater totality, and in its *makers*, as creative subjects who gain mastery through designing and debugging, manipulating the system to cohere with their bidding, and in turn, influencing the world that software engages. As an aesthetic regime, programming exudes agency by bringing into view a world which is both deeply rational in its systematic nature and powerfully manipulable by individuals through technical mastery and will. This world is both open-ended and formally constrained by its self-consistent logic: as David Golumbia argues, the "computer, despite its claims to fluidity, is largely a proxy for an idealized form of rationality."[173] In this frame, programming resembles a peculiar form of world-building, based on abstract principles, in which the programmer builds a complex architecture with a powerfully internalized sense of order: however sprawling this synthetic domain, as long as it "runs", it remains rationally consistent with its own parameters. The renowned computer scientist Joseph Weizenbaum notes that "the computer programmer is a creator of universes for

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[171] "C Style," accessed May 10, 2019, http://syque.com/cstyle/ch10.1.htm.

[172] "Big Ball of Mud," in *Wikipedia*, April 14, 2019, https://en.wikipedia.org/w/index.php?title=Big_ball_of_mud&oldid=892470940.

[173] David Golumbia, *The Cultural Logic of Computation* (Cambridge, Mass: Harvard University Press, 2009), 14.

which he alone is the lawgiver."[174] While one might attenuate this assertion by adding that the user

nonetheless has to follow the axiomatic limits of his own "laws", or the ones of his chosen language, it is

precisely this quality that allows the synthetic universe to be expansive, complex, and deeply rewarding in

its difficulty. As Paul Edwards writes, "programmers are omnipotent, but not omniscient[175]". Faced with

software as an external system of her own creation, the programming subject finds her sovereignty

confirmed only by her ingenuity; like an object of perverse desire, the greater the difficulty/resistance, the

greater the power/pleasure: its consummation manifests not at an endpoint, but in the successful

perpetuation of the code's uninhibited "cycles". In her ethnography of the Free/Open Source Software (F/

OSS) community, *Coding Freedom*, Gabriella Coleman links this power-knowledge regime to a liberal

impulse amongst programming culture towards individual freedom and enlightenment rationality. She

observes that "hackers", as an archetype, are "self-determined and rational individuals who use their well-

developed faculties of discrimination and perception to understand the "formal" world—technically or not

—around them with such perspicuity that they can intervene virtuously within this logical system."[176] In

Coleman's account, the programmer's acute prowess in constructing and deciphering technical systems

("microworlds") corresponds with an aesthetic regime that reveals the world at large as an object of

technical intervention and rational inquiry. Indeed, the notion of the hacker arises at a crucial bridging

moment in the historical and cultural backdrop of this thesis. The term "hacker" in the computer context

was popularized by Steve Levy's book, *Hackers: Heroes of the Computer Revolution*, which in turn inspired

the closed-doors "Hackers Conference" in 1984, convened by Stewart Brand and attended by many of the

luminaries of the first cyberculture, including Ted Nelson, Richard Stallman and Steve Wozniak. The

conference saw prominent "hackers" grappling consciously with their newfound cultural identity through

heated discussions around the meaning of the "hacker ethic" to establish a coherent countercultural

identity. As Fred Turner notes, by the 1990s, "Their long hair and late-night prowlings were no longer

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[174] Joseph Weizenbaum, *Computer Power and Human Reason: From Judgment to Calculation* (San Francisco: Freeman, 1976), 115.

[175] Paul N. Edwards, "The Army and the Microworld: Computers and the Politics of Gender Identity," *Signs* 16, no. 1 (1990): 109.

[176] E. Gabriella Coleman, *Coding Freedom the Ethics and Aesthetics of Hacking* (Princeton: Princeton University Press, 2013), 7.

depicted as evidence of deviance, but marks of genius."[177]

Today, programmers are increasingly responsible for the systems and interfaces of social, political and urban infrastructure, networked microworlds which exist not only as a relation between the software and the abstract user, but as the programs and protocols of social activity. That is to say, in the platform context, building software is increasingly aligned with the design of social interaction, always already functionally mapped onto the spatial domain. In the previous chapter, I discussed various technical configurations of decentralized web technologies and their role as performative metaphors and techniques. These operationalize social mechanisms such as trust, governance and economic exchange, as well as foregrounding new forms of kinship, peer-production and communalism, all of which are perceived to be lacking in the present conditions of the World Wide Web. As technologies in various states of emergence, I suggest that these programs bear consideration not as socio-technical realities as such, but as social fictions that populate the contemporary cybercultural imaginary. They are utopian designs, knowingly and (sometimes) critically engaging with the histories of techno-utopianism that influenced the development of the "legacy web". By contesting the web as question of social infrastructure (be it through "incentive engineering" or reimagining forms of intimacy and locality), the dweb destabilizes the universality of the network culture and conceives of its socio-technical infrastructure as an political operating system in need of an update.

[177] Fred Turner, "How Digital Technology Found Utopian Culture: Lessons from the First Hackers Conference," in *Critical Cyberculture Studies*, ed. David Silver and Adrienne Massanari (New York: New York University Press, 2006), 258.

Urbit and the Limits of Reactionary Code

> In Urbit, the function *is* the protocol. Which is also the application. On Mars, there is only one application: Urbit. There is one operating system: Urbit. There is one network protocol: Urbit. One ring to bind them all, and in the darkness hold them![178]

> — Curtis Yarvin, "Urbit: functional programming from scratch"

In 2017, a Google engineer named Justine Tunney published a petition on the White House website, calling on a referendum which would "1. Retire all government employees with full pensions. 2. Transfer administrative authority to the tech industry. 3. Appoint [Google Executive Chairman] Eric Schmidt CEO of America."[179] A former "black hat" hacker and one of the founder of the Occupy movement, many commented on her transformation from anarchist activist into corporate shill for the most powerful surveillance mechanism in the world. Questioned on Twitter about her beliefs, she replied: "Read Mencius Moldbug."[180]

Mencius Moldbug is the pseudonym of Curtis Yarvin, a software engineer and political blogger who is also the founder of Urbit, one the most notorious projects in the decentralized web landscape. As Moldbug, Yarvin's writings have made him a darling of the "neo-reactionary" movement, an online political discourse which is arguably the ideological heart of the "alt-right" and the so-called "dark enlightenment". Moldbug's prolific writings are rooted in right-libertarian ideals, underpinned by a critique of 20th century democracy basically rooted in conservative thinkers such as Thomas Carlyle, but also colored by a historically expansive and deeply sympathetic reading of autocracy, shot through with innumerable racist tropes. As a right-libertarian, Moldbug's political theory is founded on what he calls "primary sovereignty" or an inalienable and unmediated property right, which extends itself into feudal landscape in which the ideal ruler seeks only to prevent loss of revenue, with no reason to impose laws

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[178] Yarvin, C. Guy. "Moron Lab: Urbit: Functional Programming from Scratch." *Moron Lab* (blog), January 13, 2010. http://moronlab.blogspot.com/2010/01/urbit-functional-programming-from.html.

[179] Alex Hern, "Occupy Founder Calls on Obama to Appoint Eric Schmidt 'CEO of America,'" *The Guardian*, March 20, 2014, sec. Technology, https://www.theguardian.com/technology/2014/mar/20/occupy-founder-obama-eric-schmidt-ceo-america.

[180] Corey Pein, "Mouthbreathing Machiavellis Dream of a Silicon Reich," The Baffler, May 19, 2014, accessed May 10th 2019. https://thebaffler.com/latest/mouthbreathing-machiavellis.

which fall outside this purpose.[181] His blog, "Unqualified Reservations", contains over a decade of lengthy

screeds with such as "From Mises to Carlyle", "Why I am not a White Nationalist", as well as

"Patchwork", a political theory that proposes to replace the nation state with a geography of corporate city

states[182], ruled by "a national CEO [or] what's called a dictator"[183]. While he is, in many ways, a

contrarian troll, his political influence can hardly be underestimated (Steve Bannon is allegedly a

reader),[184] nor his presence at the nexus of multiple discursive spheres: his interlocutors include economics

professor Robin Hanson[185], best known for promoting governance by prediction markets; noted British

philosopher Nick Land, one of the key theorists of accelerationism; as well as Nick Szabo, a computer

scientist widely thought to be the individual behind "Satoshi Nakamoto". Meanwhile his company, Tlon

Corporation, which builds Urbit, is a San Francisco-based startup funded by high-profile venture

capitalists such as Andreesen Horowitz and Peter Thiel. Of course, Silicon Valley has no shortage of

rightwing libertarians, but Urbit presents a peculiar case in which software and ideology are developed

intensively in parallel. We can say that technology in general, and perhaps software in particular (as a

series of commands), is always political. But to invert the claim, what are the limits of building reactionary

code?

Urbit describes itself as "digital land", or more technically, a "new clean slate system software

stack" and an "operating function" which is designed to work as a personal cloud server built on top of the

existing internet. Within the landscape of decentralized web projects, Urbit is eccentric for the

megalomaniacal depth of its ambition. Yarvin claims the problem with the web is the design of the

internet itself, as a set of networking protocols working on the UNIX operating system.[186] In a gesture

181 "The Magic of Symmetric Sovereignty I Unqualified Reservations by Mencius Moldbug," accessed May 10, 2019, https://www.unqualified-reservations.org/2007/05/magic-of-symmetric-sovereignty/.

182 "Chapter 1: A Positive Vision I Patchwork: A Political System for the 21st Century I Unqualified Reservations by Mencius Moldbug." Accessed May 6, 2019. https://www.unqualified-reservations.org/2008/11/patchwork-positive-vision-part-1/.

183 BILtalks. *BIL2012 - Mencius Moldbug: How to Reboot the US Government*. Accessed May 6, 2019. https://www.youtube.com/watch?v=ZluMysK2B1E.

184 Rosie Gray, "The Anti-Democracy Movement Influencing the Right," The Atlantic, February 10, 2017, https://www.theatlantic.com/politics/archive/2017/02/behind-the-internets-dark-anti-democracy-movement/516243/.

185 xavieramont, *Robin Hanson and "Mencius Moldbug" Debate Futarchy at Foresight 2010*, accessed May 10, 2019, https://www.youtube.com/watch?v=Tb-6ikXdOzE.

186 UNIX is amongst the oldest operating system standards still widely in use, forming the basis of Mac OS and Linux.

towards self-sovereign networked existence as peer-to-peer servers and clients, more or less aligned with the broad goals of decentralized web, Yarvin opines that individuals should ideally run their own servers, but current computing standards mean that administrating a server is a considerable technical challenge. In response, Urbit proposes to build an entirely new software stack, from low-level assembly language to programming language and operating system. Together, this constitutes a *virtual tabula rasa* of the existing web stack, insofar as it builds a virtual machine[187] that works on top of the existing UNIX operating system. In short, rather than building a peer-to-peer protocol for conventional computers to manage data on the internet, Urbit proposes to build a network of virtual computers on top of the internet which doubles as a user's individual network presence and identity. As Yarvin describes it in a presentation: "[once] 20th century software is totaled … you need to completely isolate your system from it and basically you have to design a new stack for an alien planet. So basically, treat the internet and UNIX the way the internet and UNIX treated the phone network, just something to build on top of."[188] In keeping with the aesthetics of "martian software", Urbit's bespoke programming languages are called runic names like "Nock" and "Hoon"; contrary to programming conventions, in Hoon, a true statement returns 0, while false returns 1. Meanwhile, the name of its corporation, Tlon, is aptly borrowed from the name of a fictional world described by Borges, whose inhabitants only believe in subjective reality.[189]

How does Urbit's design square with its founder's political ambitions? Urbit describes itself as a "digital republic" which ironically, begins as a monarchy because young networks cannot help but be centralized: "Everyone in the network is a pioneer, and all pioneers have the same goal: found the republic. Anyone who stops believing in the network just leaves."[190] At a point most closely aligned to Moldbug's "primary sovereignty", it imagines "digital land" in the form of an identity on the network's namespace, an

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[187] A system capable of general purpose computation housed within an existing operating system.

[188] Joseph Boyle. *Urbit - Mencius Moldbug - Personal Cloud Community Gathering Sept 2013*. Accessed May 6, 2019. https://www.youtube.com/watch?v=6S8JFoT6BEM.

[189] Borges, Jorge Luis. "Tlön, Uqbar, Orbis Tertius" in *Labyrinths: Selected Stories & Other Writings* (Cambridge, MA: New Directions, 1986).

[190] urbit, "Design of a Digital Republic," *Urbit* (blog), October 26, 2015, https://medium.com/@urbit/design-of-a-digital-republic-f2b6b3109902.

inalienable computational property with which users "homestead" on a chosen network.[191] The network, meanwhile, is organized in terms of a hierarchical structure of "planets", "stars" and "galaxies" ultimately containing a finite supply of 4 billion identities ("planets") which generate revenue as a system of digital real estate. Urbit's implementation of "digital land" is analogous to the real-life "seasteading" movement, in which wealthy libertarians (led by Milton Friedman's grandson, Patri) hope to build a network sovereign of ocean colonies using yachts and artificial islands to reside permanently in ungoverned international waters.[192] Similarly, by isolating itself from both the conventional computing stack and the web, Urbit envisages a self-governing constellation of digital republics run by the protocol of a corporation-like voting system under which "authority is proportional to property".[193] In the colonialist tradition of American frontierism, the digital homestead belongs to the pioneers. As its documentation notes, "most theories of property agree that anyone who creates or discovers new property starts out by owning it"[194] As such, unlike other dweb platforms, which are typically generalized protocols for networks of interaction whose social prescriptions are implicit, Urbit imagines the moral and technical designations of its intergalactic social network as a self-policing suburban community, while ignoring the economic contingencies and racially charged environment that produces such imaginaries. Indeed, one of Moldbug's examples of "primary sovereignty" is exemplified in a stand-off between "a respectable white person who enunciates properly and is maybe a little portly" living in "Whiteville" and "a bunch of boyz from tha hood":[195]

> Friendliness is a direct consequence of scarce, individually owned identities. We're not changing human nature, just creating the right economic incentives. Shady stars and galaxies that sell blocks of planets to spammers will also develop reputations as "bad neighborhoods," damaging the value

191 urbit, "Design of a Digital Republic," *Urbit* (blog), October 26, 2015, https://medium.com/@urbit/design-of-a-digital-republic-f2b6b3109902.

192 *The Seasteading Institute* (blog), May 24, 2015, https://www.seasteading.org/.

193 "Urbit / Posts," March 14, 2019, http://web.archive.org/web/20190314181458/https://urbit.org/posts/essays/the-urbit-address-space/.

194 "Urbit / Posts," March 14, 2019, http://web.archive.org/web/20190314181458/https://urbit.org/posts/essays/the-urbit-address-space/.

195 "The Magic of Symmetric Sovereignty | Unqualified Reservations by Mencius Moldbug," accessed May 10, 2019, https://www.unqualified-reservations.org/2007/05/magic-of-symmetric-sovereignty/.

of the whole block. Abuse at any level is designed to be counterproductive and economically self-terminating.

In order to get a better read on where Urbit is coming from, it is helpful to understand its genesis. Yarvin was a precocious youth, graduating from Brown in 1992 at the age of 19, after which he became a software engineer focusing on operating systems and wireless protocols.[196] After making some money in the Dotcom boom, he became an "independent scholar" in the early 2000s in order to focus on his political writings and the beginnings of Nock, Urbit's machine language. It was not until 2013 that Urbit incorporated as Tlon, and began officially to hire employees. As an admirer of Carlyle, best known for his "great man theory" (as well as his defense of slavery), it is perhaps not surprising that Urbit's creation myth follows the narrative of a lone inventor working in isolation for almost a decade[197]; the bulk of Yarvin's voluminous political writings developed over the same period. Like many a rightwing populist, Yarvin's rhetoric combines radical political provocations with an appeal to "common sense" rationalism. Of his critique of democracy, he writes: "The key is to look at [society] not as a moral problem, but as an engineering problem."[198] In translating the chaos of the digital landscape literally into the language of cosmic order, the cold futurism of Urbit's intergalactic naming system is surely part of its appeal to the Silicon Valley community. This branding, however, was a recent development, while in older versions a far more romantic vision of "digital feudalism" takes hold. The "ships", "planets", "stars" and "galaxies" that name the hierarchical layers of Urbit's network were originally assigned as "forts", "lord", "earl" and "duke", with the special title of "prince" reserved for Yarvin himself:

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[196] Curtis Yarvin, Richard Bukowski, and Thomas Anderson, "Anonymous RPC: Low-Latency Protection in a 64-Bit Address Space," in *In Proceedings of 1993 Summer USENIX Conference*, n.d., 175–186.

[197] "2blowhards.Com: The Mencius Vision." Accessed May 6, 2019. http://www.2blowhards.com/archives/2007/04/trial_version.html.

[198] "2blowhards.Com: The Mencius Vision." Accessed May 6, 2019. http://www.2blowhards.com/archives/2007/04/trial_version.html.

The rules for signing forts are simple:

> Pawn P is signed by lord (P & 0xffffffff)
> Lord L is signed by earl (L & 0xffff)
> Earl E is signed by duke (E & 0xff)
> Duke D is signed by duke 1 (the first duke)
> Duke 1 is hardcoded in the SFN.

> The master of this public key is the *prince*

> [...]

> More broadly, the prince will distribute duchies as he sees fit
> to benefit both his fellow dukes, and Urbit as a whole. His
> first priority is creating and maintaining a stable polycentric
> order; his second priority is loyalty to the ducal order.

> On the other hand, the prince (because he spent 8 years working
> on this project, without being paid), has reserved 32 duchies for
> his *exclusive* personal benefit.

In this jarring combination of cryptographic operations and feudal nomenclature, it is not difficult to imagine Urbit as an exercise in fantasy. Indeed, like so much of the decentralized web, it could be understood as a roleplaying game of sorts. As Paul Edwards writes, "In the microworld, as in children's make-believe, the power of the programmer is absolute."[199] All the same, Urbit exists as a software platform currently in development by a team of up to 50 employees and millions of dollars in funding.[200] In the promise of a clean slate and a blank screen, software-building projects a powerful sense of agency. Yarvin has the obsessive and arrogant intelligence of an autodidact who has isolated himself in the intoxicating universe of his own invention, claiming to solve social structures with an engineer's precision while playing "prince" in a make-believe kingdom with a "made-up" language. Indeed, within programming, inventing a language is akin to inventing a new metaphysics ("in the beginning was the

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[199] Paul N. Edwards, "The Army and the Microworld: Computers and the Politics of Gender Identity," *Signs* 16, no. 1 (1990): 109.

[200] "Tlon." Crunchbase. Accessed May 6, 2019. https://www.crunchbase.com/organization/tlon.

word…"). In Borges story, the fictional encyclopedia of Tlön and its idealist metaphysics is constructed over centuries by a secret society; eventually, as these encyclopedias are made public, the world is gradually becoming Tlön.[201] If not for its influential racist founder and its rising power in Silicon Valley, Urbit would have made for an interesting speculative fiction. And while many of its principle objectives are uncontroversial to the cause of decentralization, Urbit's background should raise deeply uncomfortable questions. Software struggles to construct ideology (as all the attempts discussed so far have indicated) but it has the power to express it, by galvanizing discourse and engendering publics. More broadly, Urbit exhibits the underlying colonial impulse of technological world-building, towards the call of new frontiers over which to can claim its dominion.

In one freewheeling presentation on Urbit, Yarvin described the early days of the web: "everybody's ports were open, nobody had ever heard of a firewall … it was a general purpose distributed social network. We're basically all trying to recover that state of innocence and what happened was, *eternal September and like, hordes of orcs were unleashed[202].*" This is not the first time that Yarvin has publicly referred to the Usenet era as a golden era for the web, reflecting a nostalgia for a more connected community which many in the dweb space would likely agree with. The Usenet messaging network was used heavily within the academic community, and had developed a distinctive community subculture within its small discussion groups. Each September, an influx of "newbies" would join Usenet upon entering college, and those who stayed would gradually assimilate into the culture and "netiquette" of the Usenet. "Eternal September" refers to the fall of 1993, at which point AOL began to package Usenet subscriptions with their standard internet service. This caused the network to flood with a continuous influx new users, opening access to the wider world while completely overwhelming its cultivated social groups, leading to the decline and eventual demise of the Usenet community. For those who remember it, "eternal September" was the "September that never ended", the moment in which one of the web's first subcultures was wiped out by the immigrant forces of commercial mainstream adoption. Read through "eternal September", Yarvin's deep xenophobia, which suffuses his social thought as well as being

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[201] Borges, Jorge Luis. "Tlön, Uqbar, Orbis Tertius" in *Labyrinths: Selected Stories & Other Writings* (Cambridge, MA: New Directions, 1986).

[202] Joseph Boyle. *Urbit - Mencius Moldbug - Personal Cloud Community Gathering Sept 2013*. Accessed May 6, 2019. https://www.youtube.com/watch?v=6S8JFoT6BEM.

rationalized through his code, ends up on a continuum of desire around sustaining and protecting

particular forms of sociality and discourse shared by others in the dweb landscape. As with Usenet, the

"pioneers" of any successful network then have to contend with the wider population who follow them to

the frontier, but who would never truly know the place as they did. As Wendy Grossman writes of the end

of Usenet, "we were probably the last newcomers to glimpse the net before the boundary disputes between

the cyberspace and the real world began in earnest."[203]

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[203] Grossman, Wendy. *Net.Wars*. New York: New York University Press, 1997. p. 9.

Conclusion: Circuits of Desire

The decentralized web is an aesthetic project in which an image of sociality finds expression through the performative metaphors of software architecture and networking protocol. This expression is a *projection*, both in the future-oriented activity of modeling systems of collectivity, and in the psychoanalytic sense of a projection that manifests the desires and designations of its maker in the "objective" form of software. Therein lies the trick: the production of socio-technical lifeworlds through the operative, executive power of software (the computer programs that mediate our participation within the networked world), a fundamentally ideological medium which always obscures even as it reveals. *Software is ideological, but it is not a mirror of political ideology.* Instead, software stands in asymmetrical relation to the production of political ideology: it is an enunciation of desire which manifests in technical form, an objective-projective microworld at one's fingertips. At times in this thesis, I have also fallen for this sleight, in seeking the lines of desire which see code as an analogue and template for political structure. Wendy Chun reads software as *logos*, a conflation of word and action and a fetish that "turns process in time into process in (text) space".[204] Following Chun's thought, one can say that the systems and protocols of the decentralized web give logical expression (pertaining to the power of *logos* as well as mathematical structure) to a sociotechnical order which is not only represented but also interactively manifested within the space of networked agents. The technical discourses examined in this thesis suggest an altogether less satisfying but more complex alternative: that sociality is not determined by code, but instead *speaks through it*, communicating the contours of social possibility through performative structures of interaction. It is a demo of sorts: a site of practical, experimental sociality. As a discursive operator, code also produces new publics. When dweb advocates host a blog on Beaker Browser, or send a message on Scuttlebutt's gossip protocol, or even activate an Urbit "planet", they are not threatening the power structures of the web at large, but they are assenting to a different kind of community.

The achilles heel of the decentralization dream is that it remains largely ambivalent to the dominant political and economic structure of technocapitalism, instead attempting to project a third space beyond public and private, state and corporation in which technologies untethered from capitalist

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[204] Chun, *Programmed Visions*, 19.

production enable individuals may form free and direct connections with one other. As Michael Warner and others have pointed out, this is the space of "publics and counterpublics", the unregulated and emergent spaces of the voice, affinity and kinship, but it exists only in opposition to more formal structures in society. Warner writes, "although the premise of self-organizing discourse is necessary to the peculiar cultural artifact that we call a public, it is contradicted … by material limits—the means of production and distribution [and] the social conditions of access to them."[205] It is indeed such a free-flowing, bottom-up imaginary that decentralization seeks to realize, but it is always faced with the challenge of constructing its systems *in media res* — the network has never been sovereign, always subject to the social and technical landscape that came before. Given the rule of network effects, if new decentralized systems do not stand in antagonism to existing paradigms, these utopian projects are doomed to fall into the cycle of technocapitalist innovation without any meaningful ways to supplant it.

There is no-one, perhaps, who exemplifies this projective orientation more than Ted Nelson, who first imagined the information networks of hypertext in 1960. For half a century, Nelson has been single-mindedly pursuing the realization of his opus, Project Xanadu, the hypertextual software universe which was beaten to the punch, so to speak, by Tim Berners-Lee's World Wide Web — although Nelson has always maintained that his project is "much more ambitious."[206] While his profound contributions are too complex to account for here, Nelson exhibits a curious irony around theorists of systems, in which an idea so fundamentally concerned with the networked schematics of interconnection is conceived and pursued by a thinker who was singularly individualistic to the point of egotism and solipsism, a quality that Nelson himself notes in the introduction of his Ph.D dissertation (which was in part an autobiography).[207] In the closing comments of this dissertation, Nelson writes, "In our time, data structure has replaced philosophy."[208] This incisive conjecture identifies the proper role of software, not as tools or infrastructures, but as what Nelson calls "universe-filling generative concepts", theoretical, world-building forms that re-order the universe through meaningful and associative operations. Like conceptual metaphors, software

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[205] Warner, Michael. "Publics and Counterpublics." *Public Culture* 14, no. 1 (January 1, 2002): 54.

[206] Theodor H. Nelson, "Philosophy of Hypertext" (Ph.D dissertation, Keio University, 2002), 123.

[207] Theodor H. Nelson, "Philosophy of Hypertext" (Ph.D dissertation, Keio University, 2002), 8.

[208] Nelson, Ibid. p. 123.

summons up a realm of mediatory constructs which give users and programmers a means of articulation between social and technological domains. That is to say, the programs and protocols of the decentralized web allow us to perform new ideological structures, but the work of actual politics—the re-ordering of power—takes place elsewhere.

What, then, to make of the decentralized web, if the efficacy of its underlying mission to "take back control" in order to produce more equitable sociotechnical structures manifests in actuality as something more akin to communalist role-play and fantasy world-building for a disenfranchised technological elite? Fred Turner notes that critiques of digital libertarianism typically fall into two approaches: the observation that new technologies have always been accompanied by an uncritical utopianism, and in turn, a critique of this utopianism as the "self-serving ideology of an emerging "virtual class"".[209] If the decentralized web falls short of its stated objectives, it fulfills the important function of reminding us that it is not enough make the system visible, to redraw the diagram or even to build functional micro-utopias. These are, however, necessary steps towards a denaturalization of the contemporary network environment in order to disclose alternative spaces of possibility. Against the encroaching forces of enclosure, the programs and protocols of the decentralized web remind us that these relations have yet to be determined. Unlike the utopianism of the early web, the decentralized web is not mere hopeful rhetoric: if anything, it can be understood as a siege mentality, responding to an urgency arising from the emergence of a dramatically imbalanced power structure. At the same time, these new network imaginaries also engender the beginnings of a discourse focused on the affirmative technics of care and cultivation rather than the coercive reliance on protocol alone. Within a powerfully homogenized and alienated digital culture, they also intimate the fuzzy and desirous logic of strangeness and drift, rather than a network founded on security alone. If there is any residual hope in the utopian vision of systems aesthetics, it is in this space of indeterminacy, where critical practice throws technical paradigms, cultural imaginaries and social forms into an ongoing state of antagonism.

[209] Fred Turner, "How Digital Technology Found Utopian Culture: Lessons from the First Hackers Conference," in *Critical Cyberculture Studies*, ed. David Silver and Adrienne Massanari (New York: New York University Press, 2006), 258.

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