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Mediacity Seoul 2012

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On Seeing like a Machine

Orit Halpern

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First shot. 1960 the earth as seen from the TIROS I spacecraft. Taken by an unmanned satellite, this image stands as distinct in offering the first picture of the earth from space. This image from the heavens inaugurated a new territory, one entirely visualized by satellites, heralding the moment, perhaps, when as a group we came to see ourselves as a species by way of a non-human sight. What had once been the province of gods or angels, and later of scientists, is now the vision of machines.

Today, surrounded by data, constantly navigating space through our GIS and GPS systems linked to hand held devices, we almost never think of our forms of perception and cognition as historical or non-natural. We have learned to empathize, in fact to naturalize, seeing like a machine. We live surrounded by interfaces, assuming data to always be available. This magic of non-human vision holds us in its thrall.

As a historian of science not art, I have been asked to situate new media practice within a broader socio-technological history. Unfortunately, due to my training, this history will be American and European in focus, but perhaps it will prompt some engagement and discussion for I want to contemplate the fate of art practice by thinking about our contemporary forms of visualization, particularly data visualization. In that this is a biennial dedicated to spells and magic, I also want to contemplate the mythic nature of our time where we are regularly integrated in new

relationships with machines and information.

Nature



Charles Darwin's initial sketches for Evolution

"To mid-July 1837 Darwin sketched his "B" notebook on Transmutation of species, and on page 36 wrote "I think above his first evolutionary tree"

Excerpted from http://en.wikipedia.org/wiki/Charles_Darwin

"There is grandeur in this view of life ... whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved," articulating a value for discovery and excavation of this bountiful resource which is in nature. Charles Darwin wrote these words in 1859.¹ Darwin found beauty in these forms of nature from which laws might be derived and extracted. Ogluing the abundance of nature as a source of wealth, he marks a 19th century approach to nature, change, and beauty.

Such attitudes were the infrastructures for 19th century urbanization and economy. For industrialists, as for Darwin, nature was material and visible to the human

Measuring the births, deaths, marriages, and other actions of individuals would, in Quetelet's view, offer a way to predict future social behavior and plan accordingly. If statistics and probabilistic thinking would provide the numbers to regulate populations, and anticipate evolutionary change; then photography would produce a standard for imaging individual bodies.

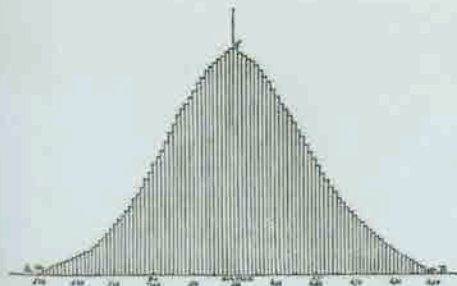
eye and intellect. But nature would only be available if its laws of life, growth, and change could be found and controlled and if its artifacts and objects could be stored, catalogued, and defined by science and technology.

I open with Darwin, therefore because he makes evident a broader 19th century transformation in ideas of science and of observation. Increasingly, scientists sought mastery over nature by overcoming their human fallibility through the use of new instruments, experimental practices, and mathematics—most prominently statistics and mechanically reproduced images. What defines natural history is evolution and it was the desire to control and anticipate evolutionary change while producing stable social orders that structured 19th century science and Capitalism.

Adolphe Quetelet, a Belgian astronomer is paradigmatic of this shift towards what has been labeled "mechanical objectivity"². He began by looking at the errors of instruments when taking measurements of heavenly bodies. He quickly realized that instruments deviate around a common point, or "norm". He proceeded to apply this thinking to societies; measuring the body sizes of soldiers, for example, to create the "homme type"; the ideal or "normal" individual. Discovering these patterns and regularities he dreamed of a new science, like natural history, of society. Measuring the births, deaths, marriages, and other actions of individuals would, in Quetelet's view, offer a way to predict future social behavior and plan accordingly.

The view of the heavens had been brought to earth. Humanity had become the object of our own study.

Quetelet Binomial Distribution (1846)



Francis Galton Composites—Criminal and Jew (1870's)
Supposedly showing the normal or typical face through agglomerating data.

If statistics and probabilistic thinking would provide the numbers to regulate populations, and anticipate evolutionary change, then photography would produce a standard for imaging individual bodies. Charles Darwin's cousin, Francis Galton, starting in the 1870's, influenced by ideas of normality, evolution, and probability sought to create a statistical photography; to compile many images in one place thus making visible types of "man"—racial, gendered, and criminal. He wanted it to be possible to find racial and biological features of groups in the faces of individuals.

This link between new forms of numeracy and measurement—statistics—and optical apparatus also transformed the very image of the city. In 1854 the most famous image of an urban space ever made was created by the founder of modern epidemiology John Snow. Showing London during an attack of cholera, Snow used this brilliant visualization to notice that people were getting sick if they drank from certain water pumps. He then could create a new type of intervention—closing the pumps—and a new technology that mapped statistics onto the urban plan. No longer picturing disease as the result of mystical or cosmological forces, instead individual sickness became a group phenomena related to particular behaviors, and available to be administratively dealt with through public health controls.

"This structural visibility of the archive, but the censorship of its contents, can be said to underpin the very ideal of democratic government and commercial transactions even today."

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John Snow, *Cholera Map*, London (1854)

What linked all these practices was a desire to make the invisible visible through new technologies that merged quantitative and statistical thinking with images to envision a new model of humanity and of nature. Instead of the confusion and disorganization of cabinets of wonder from the 16th century, the 19th century was an archive of order linked to stable identities and nations.

These archives where information about populations, statistics, art objects, and images would all be stored were the sites where power and knowledge met. Many Western nations invested heavily in ornamental and highly-visible structures such as the Library and the Museum to signify the might, wealth, and authority of their empires, industry, and science. The inverse of these visible archives were shadow archives; far less open to the public eye where records are kept about criminals, national security, or demography. What links both in the 19th century was an obsession with collection, curation, and organization of data.



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Harvard Museum of Natural History, Collection of Glass Flowers for teaching botany (late 19th/early 20th century)



17th Century naturalist Olaus Worm's Wunderkammer

This structural visibility of the archive, but the censorship of its contents, can be said to underpin the very ideal of democratic government and commercial transactions even today. Transparency and Secrecy. These are most often the two poles of politics or capital. We continue to believe that if we could see more and know more, we would also be more free. Government, for example, is parasitic if it is not transparent. But the pressing question is whether the mythological ideal of objectivity and dominion over information imagined into being in the 19th and earlier 20th century still holds in an age of massive networks and excessive data flows.

"the "responsive" city, the city as a live and sentient organism. The future, it appears, is already here. Past data will stimulate future actions. This space is the place of prediction and simulation, a fantastical realm of anticipatory infrastructures that drives the production of an entire physical geography of sensors, data centers, clouds, and analytic tools."

Big Data

Just as natural history and the emerging biological and human sciences gained prominence in the 19th century, producing an infrastructure of knowledge and technology that underpinned the nascent industrial economies and cities; today venues like the *Wall Street Journal* proclaim a new type of future science—the "Data Sciences", with a figure the "data scientist", whose purview is no single field, but mining data, like European colonialists once mined natural resources. As the COO of a prominent data storage and analytics corporation, EMC, argues, "Big Data is very much still a buzz word ... it [refers] to this idea that companies can extract value from collecting, processing and analyzing vast quantities of data. The ability to make sense of the tsunami of data will require new and different skills ... We do think there is this new skill set—data scientist [whom we must train]. This will be the cool new place to be." This "Big Data" is overwhelming, it is a "tsunami", implying a natural phenomena to be tamed, but also disaster from which to be protected. Big data it appears is a capacity and a threshold not an object. We hear terms like analytics bandied about as the flagships of the next economy that will produce the material to extract in a world increasingly understood as resource constrained.

These discourses of data as wealth have, however, a curious omission, they lack content or specificity. If data has an ontology it is certainly never spoken of. What they do not lack is a fantasy of sensorial information, as the article recounts is not only numeric data but also audio, video, and photography; "unstructured", data that comprises this wealth.³ It is a multi-sensory data set fantasized as comprising of virtually everything. This sudden collapse of sensory differentiation is worthy of note, as is the curious absence of any need for archival order or taxonomy. If in another age collecting was a concern, it would appear that now analysis is the valued task. However, this lack of specificity, "Big Data" is a "buzz" word even for those propagating new academic programs and demanding labor in its name, must therefore be also recognized for what it is—a wish image—an imaginary; a whispered desire, a spell, a myth. This infrastructure is shadowy, mobile, and invisible to human senses; in fact our own sensorium is assimilated into it. It is not the visibility

of the data space, but its effects that now concern us.

This Big Data is not merely a matter of better marketing, but an entire shadow space, carefully concealed—bridging the nerves in our bodies, the programs in the computer, and structures of urban architecture. As major corporations like Cisco and IBM proclaim, the planet will be made "smart", by way of leveraging data to "analyze the future" of urban space. Particularly important is to monitor sense and environmental data to create, in their words, the "responsive" city, the city as a live and sentient organism.⁴ The future, it appears, is already here. Past data will stimulate future actions. This space is the place of prediction and simulation, a fantastical realm of anticipatory infrastructures that drives the production of an entire physical geography of sensors, data centers, clouds, and analytic tools. Urban space is considered sentient and cognitive; comprised of a network of nerves that manifests itself in a territory demarcated by the cost of data transmission and bandwidth, creating new inequalities between the cheap data centers of social networks and popular searches located in realms of cheap energy and labor, and boutique collocation hotels constructed in the most expensive architecture produced for nano-second transactions in markets. This is a different space, where real-time data and infinite data storage will modulate the future of our lived environments.

Algorithm / Probability

To make clear how what we see is no longer the same, if once we sought to identify individuals and normals we now have a world of "clouds" defined by a new concept personalization. Measurement and image are now linked as perhaps never before. Let's take one obvious example—"Page Rank", the page ranking algorithms of the Google search engine. A search is also the image of a world. Since Google bases its ad placement and search result in part by mapping how many links are attached to each site, it is also an image of part of the network at a particular moment. As users we have learned to utilize this image, and to familiarize ourselves with its logic even as what we are presented with is partial. We can never see the

"This personalization exemplifies itself in social networks, where instead of being part of groups, nations, or races, we have "friends". These friends, of course, all come by a form, and everyone has them, but we feel we choose them. Along with these friends comes marketing, branding, and analytics."

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entire network in its complexity nor are we privy to the actual algorithms and computations formulating these results. This is a partial view, not the view from the heavens, but one from inside the network.

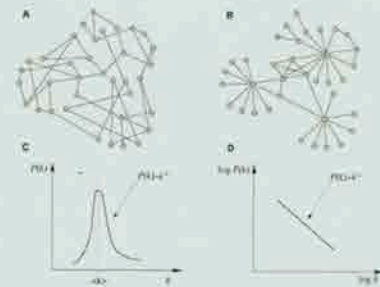
What is titled "personalization" is actually an image of links and other user's utilization patterns. This map appears to each of us as the results of individual request. The probabilistic and algorithmic nature of the media concealed behind the seeming friendliness of the interface. If once there were normal curves with a clear center, the logic of the internet is the power function, where those sites with many links will have exponential dominion over the network rather than privileging the center.

In politics as in the network, it is this law of powers and concentrations that is now dominant over the logic of a democratic or standard middle. We have replaced the "homme type" with the cyborg cloud and the fantasy of a personalized interface that is actually never about the isolated person, but about the networked subject. When we access our networks the only territory we see refracted is not a nation but the self. This personalization exemplifies itself in social networks, where instead of being part of groups, nations, or races, we have "friends". These friends, of course, all come by a form, and everyone has them, but we feel we choose them. Along with these friends comes marketing, branding, and analytics. Who you are is now available to corporations as data to sell with precision products no longer geared at mass markets but to individuals, even if it is personal for everyone in the same way. We all feel special, but we all do so through the same algorithms, interfaces, and analytic tools. But when we look at the interface of Facebook, or any other social network, what we believe we see is only our own face; a world of one. The networks that support it invisible beneath the mythology of choice at the interface. Society with norms, rules, and institutions has disappeared from consciousness and sight.

Gone is the vision of "man" offered by statistics and photography, or the vision of place offered by maps. Our laws and functions are still about computing, statistics, and probability but now immersed in images that no longer represent the world, but rather serve to integrate us into the network.

If for one moment we examine the image of a normal curve compared to a power law this difference becomes immediately visible. Rather than points arrayed around

a center, as one might imagine a nation around its capital, or the normal body in the midst of a range of differences, in the power functions we have a world of unevenness and radical differentiation. An unevenness that exemplifies itself in the overwhelming force of certain entities—Amazon, Google, Facebook—vacillating against a myth of openness and democratic potentials in the network. In our financial markets, the future tense of probability reigns, built into algorithms and financial instruments. This same mathematical reasoning results in crashes when computers all mime each other and over concentrate risk in single locations (such as sub-prime mortgages). It is also an infrastructure explaining the massive dispersal of labor and supply chains and the simultaneous concentration of capital and power in a few spaces. But whether nomadic or controlling, in our networks statistical functions and images are so closely married as to be indifferntiable, and analysis has become a process without end.



Exponential Networks (grouping around a center with equal links between nodes and high levels of homogeneity) versus scale-free networks (power functions) where many links are around a few nodes, insuring connectivity but through differentiation and inhomogeneity.

Black Box

Archiving and memory, however, are the supplements to personalization, clouds,

"We are a society that increasingly spends all its energy storing data, but even as icons or myths they have no representation. They are like vampires in a mirror."

and speculation. Above all, it appears, our future is always about the past. Here our data appears ghostly, haunted, and monstrous. Housed in indecipherable blocks or hidden in older telecom exchanges, behind a world of networks lies an infrastructure of storage. But the data centers of the present are camouflaged and vampiric. Labeled farms and containing "clouds" these structures are the inverse of the 19th century archives of museums and governments. If once there was a static space and a desire for territory and maps, now we dream of data sets that "move" as though they could be de-linked from the physical sites where they are stored. To maintain these clouds is a massive undertaking. Either located near financial exchanges to insure the fastest speeds of response time even at the speeds of light, or flung into the far zones of the earth where energy is cheap and available, these black boxes dot the landscape usually out of notice. They feed on the older infrastructures of information, sometimes occupying old telephone exchanges replacing the electrical copper infrastructure with fiber optics or cannibalizing older energy sources, as they consume more energy and power than small (and soon large) cities. Strangely, these massive sites where our entire image of the world is stored are themselves virtually invisible as an aesthetic choice. We are a society that increasingly spends all its energy storing data, but even as icons or myths they have no representation. They are like vampires in a mirror. A figure we know is there but do not care to see. In an age of redundancy and networking these sites are disposable and modular. We may wish to compare these algorithmic architectures of servers to the space of 19th century London; each exemplifies a different territory. And we may ask what society camouflages its archives, and rarely cares where its data is hidden?

Even our science today is invested in "analytics": the analysis of data from a world we assume to be fully sensed, recorded, and stored ... somewhere. This analysis bases itself in the fantasy of an invisible and ever growing archive of infinite data. In turn, versioning has replaced the assertion of absolute and objective truths over an outside, and clearly visible, world. The mining of nature continues but is veiled in the mining of data to produce new types of global networks.

Beautiful Data

As though to affirm the seductions of this fantasized garden of data there is an aesthetic to this discourse. This ubiquitous data so valuable, even without a set referent, is also often labeled "beautiful". Prominent textbooks in computer science and blogs by computer research groups tell stories about "elegant data solutions" and have titles like "Beautiful Data" and "Beautiful Evidence". Opening with the premise that the web today is above all about the collection of personal data, they urge the designers, engineers, and programmers of our future, to address the important aesthetic component of making this data useful, which is to say, "beautiful". But data is not always beautiful. It must be crafted, mined, so to speak to make it valuable and beautiful.⁵ This infrastructure is thus empathetic, we have learned to desire our machine vision, we want the network perspective.



Beauden Martin-Anderson, "Shoreline Path Tree of Seattle", June 2, 2012. <http://beautifuldata.tumblr.com/post/249585061/data-is-the-21st-century-of-data-visualization>
If compared to Derrida's tree the fascinating feature of this graph is that it is impossible to tell what it signifies (both paths and walking paths), it could be any networked environment.

"We should note the tense, but repressed, productivity in our systems between the desire for probability and change and the necessary constraints of programming and algorithms and between our wild embrace of the future and real-time and our pathological insistence on data storage and archiving."

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But what form of "beauty" is this? For these digital infrastructures are also not spectacular or specular. There is no outside world to mine and explore as for Darwin. No discoveries to be made or beauty of "nature" to behold.

Instead, digital infrastructure increasingly enables a feedback driven experience of reality in which users have access to information and in turn, information has access to users. A sentient but psychotic network whose entire structure is invisible to the human eye, even as everywhere there are screens.

This opens us to the question of what is it we "see" when we look into our many interfaces? And what is the work of imagination, perhaps art, in a world where it is simulation, prediction, and storage that are the main concerns?

Despite the naturalness of data and its virtues there is nothing automatic, obvious, or pre-determined about our embrace of data as wealth and space as sentient. Like the evolutionary biology of a previous era, digital networks unify new physical structures with transformations in how we see and what we know. In the 19th century at least in the West, science took on what has been called the "god-trick"⁸ attempting to study human beings through technologies of statistics and mechanical reproduction that would give some people (usually white, male, straight) authority over other people—racial, gendered, colonial. Today we face a strange moment with our machines and each other. We still want to show "media". In artistic practice we are often almost Romantics; valorizing programming and demonstrations of technical mastery as though these would make us human again, and capable of seeing from the heavens and understanding our machinic networks.

But we forget that the view from above is now that of the machine, and that we can never know our networks. They are too fast, too complex, and often unpredictable. We should note the tense, but repressed, productivity in our systems between the desire for probability and change and the necessary constraints of programming and algorithms and between our wild embrace of the future and real-time and our pathological insistence on data storage and archiving.

The question then is what practice can produce forms of beauty that compliment our data filled world but do not pretend to make it objective, knowable, and static? If aesthetics is the organization of sense then to art lies the project of recognizing that

our networks are historical and predictive, archival and speculative all at once. We are enveloped in a new sensing territory—a sentimental, beautiful, statistical space—that is empathetic, shadowy, predictive, sentient, and wildly violent and unfair. Integrated in networks, we are left to ask what remains of chance and imagination in a world of algorithms, automated speculation, and power functions? How can we transform seeing like a machine to reveal new forms of life? Perhaps this is a function of returning to myth and storytelling, of using the recombinant and data driven nature of our machines in a manner that re-enchants our technology. Perhaps, it is about producing meaning, space, and time in a world where such perspectives seem so impossible as to appear as magic, at least from the viewpoint of machines.

"Integrated in networks, we are left to ask what remains of chance and imagination in a world of algorithms, automated speculation, and power functions? How can we transform seeing like a machine to reveal new forms of life? Perhaps this is a function of returning to myth and storytelling, of using the recombinant and data driven nature of our machines in a manner that re-enchants our technology."

¹ Darwin C. (1859) *Origins of the Species*. New York: The Modern Library, Random House Inc.

² Galison P and Upton L. (2007) *Objectivity*. New York: Zone Books.

³ Rooney B. (2012) *Big Data Demands New Skills*. Available at: http://blogs.wsj.com/tech-europe/2012/02/10/big-data-demands-new-skills/?mod=google_news_blog, February 10, 2012.

⁴ http://www.fox.com/america/places/us/en/america_cities/overview/index.html?res=sp

⁵ Seeagan T and Hammerbacher J. (2009) *Beautiful Data: The Stories Behind Elegant Data Solutions*. Sebastopol, CA: O'Reilly. Seege E and Heer J. (2012) *beautiful data: how to tell stories with data*. Available at: <http://beautifuldata.nytimes.com/>, Tufte E. (2006) *Beautiful Evidence*. New Haven: Graphics Press.

⁶ Haraway D. (1991) *A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century*. In: Haraway D (ed) *Simians, Cyborgs and Women: The Reinvention of Nature*. New York: Routledge. 149-181.

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