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Willim, Robert

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PO Box 117
221 00 Lund
+46 46-222 00 00

Floating Points of Reference

Trust, Enchantment and The Shifting Visibilities of Digital Infrastructures

Robert Willim | www.robertwillim.com |

Lecturer, Artist and Associate Professor of European Ethnology
Department of Arts and Cultural Sciences
Lund University, Sweden

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Abstract

In 2012 Google started a campaign to make parts of its infrastructure visible. Up until that year the company's data centers had been highly secret facilities hidden from the public eye. The visualization campaign was mainly based on stories and images distributed via the Internet. The images were often suggestive, invoking both enchantment and trust.

The text starts by pointing out and discussing how digital infrastructures have been surprisingly invisible since the 1990's. It then positions Google's campaign in a longer history of infrastructure visualizations. It relates the images of data centers and technology to David E. Nye's concept technological and industrial sublime, as well as to the author's earlier studies of Industrial Cool and aestheticizations of manufacturing industries. At the end of the text notions of trust are discussed in relation to Google's campaign as well as to some related endeavors to visualize corporate digital infrastructures.

Most of the time infrastructure is located in the backdrop of everyday life. It can be defined as "the basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise." Nicole Starosielski, who has studied negotiations between visibility and invisibility of critical infrastructures, propose that: "Whether infrastructure is materiality hidden or simply ignored, invisibility has been naturalized as its dominant mode of visibility"(2012:39f). Through its integration in routinized behavior infrastructure is seldom visible, and to a large extent everyday life for most people takes place where infrastructure is designed to be outside the center of attention.

"When infrastructure becomes visible in the public sphere, it tends to be either because it is invested with broader cultural significance or because it breaks down (and fails to maintain transparency in use)."(ibid:40) Recently, aging infrastructures have been discussed as a serious problem in several Western countries. Poorly maintained railways, sewage systems, water and electricity grids has been brought up in the political debates and as part of public concerns

about the future of societies. At the same time, new kinds of infrastructural development and investment are advocated as part of visions for the future. The building of broadband and mobile communication grids has been promoted as infrastructural endeavors to create the backbone for digital futures.

In this text I will examine the movement between visibility and invisibility of digital infrastructures in the public debate and in the rhetoric by IT-companies. How is visibility and invisibility related to broader cultural significance and to the ways feelings of enchantment and trust are provoked?

The text is structured as a story, or as one amongst many trajectories through time. It can be seen as a short, provisional and selective cultural history of shifting visibilities of digital infrastructures. The story stretches over 12 years, and three points in time are used as entrances to present three tendencies when it comes to visibility, cultural significance and aesthetic conceptualization. The points in time are referred to as specific years (2000, 2006, 2012) even if the years are to be seen more as floating points of reference than exact limited timeframes. Every point refers to a certain aspect of visibility.



The outline of the story could be summarized in one sentence: *At the two first points in time digital infrastructures were invisible, then to appear in enchanting guises at the third point.* I will mostly concentrate my discussion to the third point. What do these different visualities tell us about the cultural significance of digital infrastructures, and how they are related to notions of trust and enchantment?

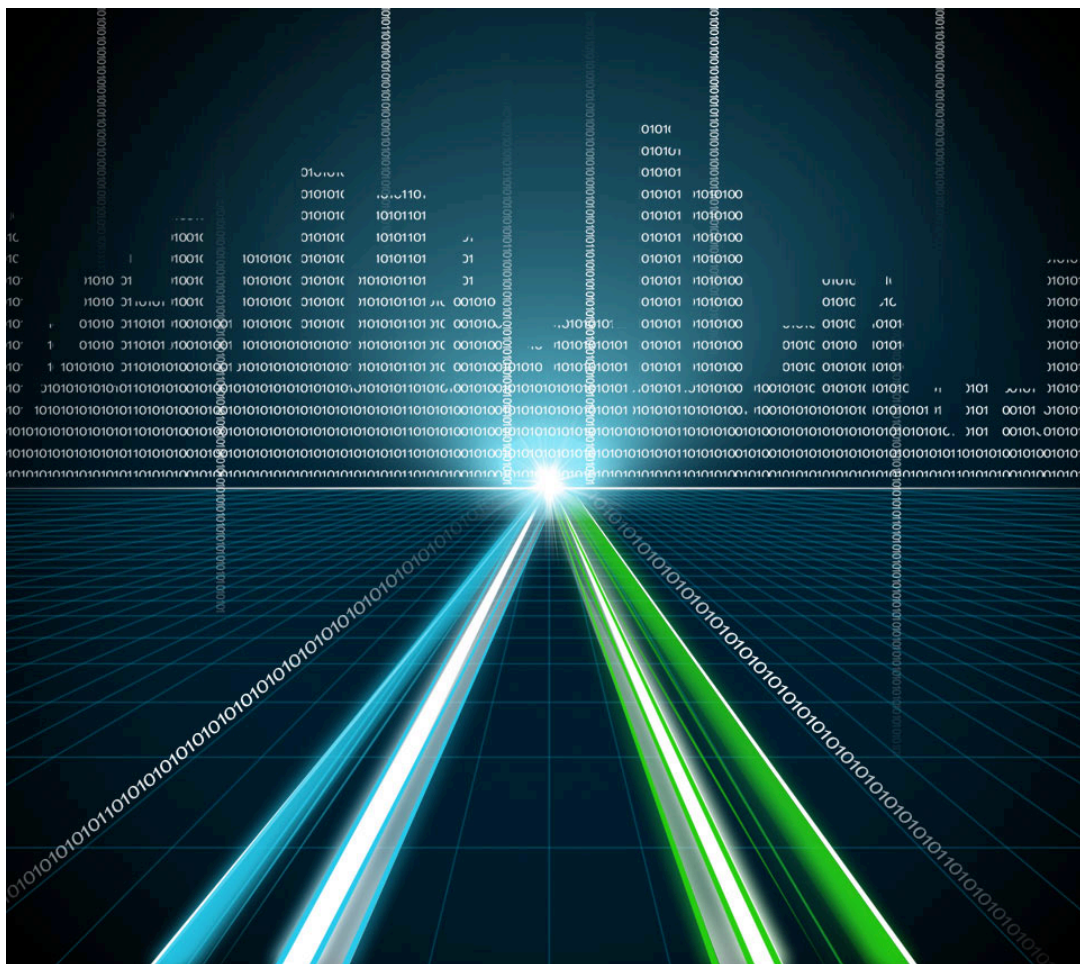
To a large extent I will look at how visualizations have been used in business rhetoric and branding efforts by companies and stakeholders dealing with digital technology. I will use a bricolage-like method to combine empirical findings from some of my own ethnographic studies, my artistic practice as well as material derived from news reports and PR-campaigns from companies (cf. Ehn & Löfgren 2010:217; O'Dell & Willim 2011). Most of the examples in the text will be related to the company Google. At the end of the text I will conclude by making some provisional assertions and raise some further questions.

Towards Virtual Realities (2000)

During the years around 2000 ideas about the rise of a new society related to digital technology was widely promoted. Several commentators advocated that we were entering “a new economy” (Kelly 1999; Tapscott 1999). The Industrial Society had been declared obsolete already in the 1970s by several commentators and scholars (Bell 1973; Touraine 1974). Now, at the brink of a new Millennium, the Western world was supposed to fully enter the Information

or Network Society, the era of The Internet and networked digital infrastructures (Castells 2000). This was a world in need of new infrastructures.

Proponents of newer IT-businesses, especially in young companies called Dotcoms, referred to older industry as “dinosaurs” or “respirators”. They also promoted societal investments in new infrastructure. Jonas Birgerson, the CEO of the Swedish Internet consultancy Framfab that I studied for some years, was called “Broadband Jesus” because of his visions and rhetoric about the coming of a new world of the Internet (see Willim 2002, 2003). The networked future was envisioned as virgin land that was up for grabs. A pioneer rhetoric characterized by frontier myths resembling discourses from “The Wild West” of the 19th and early 20th Century was used as reference and as a metaphor now applied in the world of digital technology. The boldest ones, the most innovative and the fastest companies and persons were imagined as the ones who should conquer The Internet. Imaginary lands of the future were often referred to as *Cyberspace* or *The Virtual Reality* (cf. Hakken 1999). Around 2000 we were told that we could see fragments of the coming world if we just looked in the right direction. The path to the future pointed out by “Internet-gurus”, digital evangelists and visionaries of the IT-business was streaked by bold social visions and technology similar to that known from science fiction.



The notions of Cyberspace and Virtual Reality had been either derived from or strengthened by the imaginations of popular culture, art and science fiction. Author William Gibson's use of the concept Cyberspace in his novel *Neuromancer* was one strong reference (1984). Several other popular cultural products were invoked as inspiring visions. In 2000 the movie *The Matrix* by the Wachowski brothers was released (followed by two more parts in the sequel), influencing the visual expressions of virtual worlds and technology driven futures. The glowing green terminal signs that characterized the graphics of the title and end credits sequences of the film became inspiration for mainstay elements in several visualizations of digital futures. Monochrome glowing signs on black screens had been some of the first visual elements of personal computers. With the retro-futurism of *The Matrix* these elements were now remediated into cyberspatial visions.

Parts of IT-business were pictured as science fictional, as mind-bogglingly futuristic and very different from earlier human societies. According to this rhetoric the world was about to reach escape velocity from earlier societal structures, and it was entering a fluid virtual space of bits and bytes. But most of these things were envisioned to take place in the future. Cyberspace was built of vaporware (Willim 2003).

What was astounding at this time was how stakeholders were continuously referring to new large-scale systems in becoming, to complex arrays of technology and widespread infrastructures, without showing almost any imagery of this infrastructure, and not even the products being sold. In my studies of Framfab and Internet consultancies I saw how the businesses mostly pictured themselves by promoting images from various company events and from the offices. Office spaces with mostly young people behind screens, often surrounded by things associated with playfulness appeared in the media coverage. Creativity and quirky "geekyness" were in focus. When politicians visited the main office in Lund, LEGO-toys, bold visions on whiteboards and a relaxed but supposedly creative atmosphere was showcased. Different accessories, science fiction-merchandise, LEGO, cryptic scribbles on whiteboards, colorful collages of post-it notes and tasty café-like parts with free soda and coffee produced the material context. Images of what happened on computer screens, of websites and actual products of the company were not invoked that often if it wasn't for actual clients (Willim 2003).

During the 1990s the concept "Information Superhighway", often associated with American senator and vice-president Al Gore, was promoted. This was a way to frame the future needs of infrastructural development. The information superhighway, or *The Infobahn*, was to some extent "The Road Ahead" which Bill Gates wrote about (1995). But *the highway* was a metaphorical one. It was surely built of concrete matter, of cables, chips and circuits. But what was mainly envisioned, and visualized at this time was the glowing and hazy virtual spaces, matrixes, cyberspaces and a kind of imaginary extrapolation of elements that people could experience on computer screens, in computer games and in fiction of the time. Cyberspace, and the Information Superhighway were envisioned as stretching beyond the confines of material space and life. What was visualized was a new enchanting non-material world located in the realm of the digital. The real infrastructures, being the backbone to the digital and to Internet was mainly invisible for the public eye. Large parts of the real infrastructure probably wasn't seen as "cool enough" or as enchanting enough to represent new promising digital futures. Instead the fluid and somewhat blurry images of coming cyberspaces were there to enchant.

Small Moving Dots (2006)

The year 2000 was the climax of visionary cyber-rhetorics. In the spring that year the dotcom-bubble burst. Stock values plunged and a huge restructuring of IT-business took place. When the bubble burst and when the eschatological vision of The Millennium Shift wore away, some of the hazy and blurry notions of Cyberspace weren't seen that often. I can't say that they have disappeared. We still see similar visual evocations of ephemeral digital worlds today. Instead, new kinds of digital visibilities have appeared alongside, competing to gain cultural significance. Half a decade after the bubble, digital worlds were often presented as enchanting by uses of visualities that focused on new amalgams of the digital and the physical.

During the first years after the Millennium shift a new colorful stakeholder appeared from the rubble of the dotcom bubble. The Californian company Google had avoided the worst economical disaster 2000, probably because it was still too small and not part of the volatile stock market at that time. But during the coming years Google became a giant in the search engine business, and by acquiring a number of smaller companies it quickly grew into other parts of digital business. At the middle of the first decade of the new millennium it became a central player in a growing field of digital technology, now associated with concrete geography and spatial practices. The virtual was about to "get a place", to become mobile and locative.

In 2004 Google acquired the smaller company Keyhole, which soon became the foundation for the venture Google Earth. A virtual globe, with maps and locative services were released as Google Earth in 2005. In the coming years it converged with a number of augmented reality and locative media services. Now digital visualizations could be connected to physical space, instead of floating around in a more ephemeral cyberspace. At this time much of the public attention of IT was about the ways that networked digital technologies became local, and enmeshed with physical things and places. Adam Greenfield introduced the concept *Everyware* as a way to explain ubiquitous computing (2006), and *Alternate Reality Games* (networked transmedia games) had been around for some years (McGonigal 2011). Bruce Sterling published his book *Shaping Things*, which boldly described a future of physical products enmeshed with digital information (2005). The markets for mobile technologies were also growing, bringing the digital to new places. The cell or mobile phone became a basic personal gadget that soon should become much more than a phone.

During this time I made some fieldworks studying the practices of Geocaching, which is a treasure hunt, using GPS-technology. I also created some locative media artworks. One of these works was called *Surreal Scania* (2006), and was realized together with video artist Anders Weberg. We combined mobile media players, GPS-receivers and Google Earth. The idea was to make a number of surreal short films associated with specific points in Skåne. (Scania). We then published the films on a website together with GPS-coordinates and KML-files (which would show the exact location in Google Earth). The idea was that a person could download the films to a mobile media player, use the coordinates in a GPS-receiver to go to the actual location in Skåne. At these locations the films could be viewed and compared to the sensory experiences of the physical place at the specific time. Also Google Earth visualizations could be parts of a meditation process, convolving experiences and representations of places, aura

and site-specificity. We got some attention for the project, with a number of screenings and shows around the world. Several commentators pointed at the visual potential when combining these technologies in relation to place and site-specificity. In the online journal *Rhizome* focusing on art and technology it was described like this:

Following the trajectory established by photography, film and video have become our most relied upon methods for documenting the visible world, from TV news to home videos. Of course, the reliance on photographic truth--which is really just an index of visible light on a reactive surface--is now being displaced by more abstract and mathematical forms of depicting 'reality,' like global positioning systems. And just as photographic reality was toyed with from the early days of the medium--see Hippolyte Bayard's 1840 photo of his own 'death,' for example--contemporary artists are challenging the new truth tools. 'Surreal Scania,' a new work by the Swedish team of Anders Weberg and Robert Willim, fuses a series of lush and seductive video montages with geocoded data to examine 'how aura and attraction are connected to different places.' All of the videos are available for download, as are corresponding sets of data that can be used to 'locate' the video's geography in 'real' space and on Google Earth. For those with portable video players, you can take a clip with you and compare it to the 'real' N 55 37.501/E 013 02.215."(Griffis, 2006)

Surreal Scania was a way to examine how visual representations of space could be combined with being in and moving through physical space. The question is if this mode of “virtual-meets-real-visibility” could be experienced as enchanting?

In my participatory observation and interviews with geo-cachers, the digital visualities in relation to physical space and place were in fact often highlighted as something enchanting (Willim 2007). What were described as enchanting were some quite inconspicuous visual examples. One of the stories told by an informant who called himself Scrapman was about the small but enchanting practice of walking with a GPS-receiver through the landscape. On the screen of the receiver a map with a small moving dot or arrow was shown. The dot represented the user's location. Scrapman told me how walking with the screen intrigued him. As an example, he told me about walking while seeing the small dot on the screen approaching a blue line. After a while he could hear the splashing sound of water of a small brook ahead. Then just as the small moving dot was approaching the blue meandering line on the screen he could look up from the GPS-receiver and see the actual brook floating through the landscape. The virtual map on the screen of the device with its small and animated cursor augmented the experience of the landscape.



Like all digital or fairly advanced technologies, a complex infrastructure was underlying this experience of “small moving dots”. It was the awareness of this opaque complexity that was part of the enchantment. It was probably even the awareness about the complexity together with the very invisibility of infrastructure that made it enchanting. In order to engender the small moving dot on the screen, an enormously complex (military)-industrial assemblage of technologies and organizations had to be developed and maintained. Around 30 satellites orbiting the earth would have to synchronize its signals with the GPS-receiver. The absence of this complex and opaque workings standing there by a bubbling brook with the GPS-receiver in hand surrounded by woods and singing birds was probably part of the enchantment.

Since 2006, mobile technologies had become more wide spread, and the smart phones of some years later incorporated much of the locative and communicative technologies that were introduced around 2006. Surreal Scania wouldn't get as much attention just a couple of years later as it got 2006. With an iPhone, an Android or Windows phone users could soon use locative services and augmented reality applications that merged the physical surroundings with digital visual layers in complex ways. An example of this is the flight tracking service Flight radar 24, based on a network of ADS-B receivers. The service was opened for the public 2009, and was soon to be enhanced with apps for mobile devices like iPhones and Android phones (www.flightradar24.com). With the app installed the user could point the phone to the sky, aim at a plane flying by, and get real time data on the screen about the flight, its route, altitude, speed etc. It was soon even possible to get a virtual perspective from inside the cockpit, as the plane flew by overhead.

These kinds of apps, as well as a number of earlier examples, have seldom been marketed with a presentation of the complex infrastructural workings beyond the user interface. The enchantment is enhanced by the experience that “it just works” without the visibility of any of the complex systems supporting the application. It's like when the magician presents illusions for an audience without showing the real workings behind tricks. The audience is enchanted by what takes place under the spotlight, suspecting but also ignoring that something is happening beyond their attention. Digital applications were promoted as enchanting almost magical

endeavors supported by an invisible infrastructure... “look no hands” (cf. Löfgren & Willim 2005).

Beneath The Clouds (2012)

During the last years, several new cloud based services have appeared. The cloud (it has not been called Cyberspace in the rhetoric for a while) is a concept used to describe services that are provided through a converged infrastructure based on a number of networked computers connected through scalable and dynamic structures. Services from companies like Facebook, Amazon and Google are based on cloud architecture, and has been introduced and scaled up during the last decade. Also companies like Microsoft and Apple, as well as a large number of business to business-cloud providers have built up vast infrastructures to keep up their own clouds. For some time the infrastructure that was supporting cloud services was not made visible by the providers of the services. Like the augmented reality applications discussed above, several social media services should be enchanting and alluring in themselves without any presentations of the machinery “beneath the clouds” being necessary.

It's easy to think of the Internet as an ethereal, otherworldly place. Even the way we talk about it speaks to its inherent everywhere-ness and nothingness — it's all “wireless” this, “in the cloud” that. We used to reach the Web by sitting down at a large, slow-moving machine and waiting while screeching noises let us know our phone lines were being put to work. Now we carry the Internet around in our pockets, we have Wi-Fi on planes, and we can Instagram photos from the middle of nowhere (Berman 2012).

These are the first sentences of a *Washington Post* review of the book *Tubes – A Journey to The Center of The Internet* (2012) by Andrew Blum. The book is a trip to a number of places showing the materialities of The Internet. Datacenters, Network hubs, Internet exchanges, landing points of transoceanic cables and a number of other locations are critical points in the infrastructure of The Internet. Blum takes the reader to some of these places, writing about the extreme tangibility of Internet. When visiting Google he is let into one of the company's datacenters, almost at least. He is allowed to visit the facility, and the lunchroom, but not the server halls. Some Google-parts were still closed and secret, even if the company has started to display some transparency.

The same year as Blum published his book, Google decided to launch its own visualization and information campaign. This was the first time that Google's production environments beyond their office complex in Mountain View were highlighted and pointed out as part of the company's public image. Now the “nuts and bolts” of the Google verse should be displayed. On the company's website onlookers were “welcomed inside”. The gallery section of the site was structured in three different categories, “tech”, “people” and “places”.

*Showing what we're made of—inside and out
For the first time, we're giving everyone a glimpse into where we run our products. Now you can take a virtual tour of one of our data centers in Street View. Or browse a photo gallery of the technology, people, and places that keep Google's products running. Come inside.
(<http://www.google.com/about/datacenters/>)*



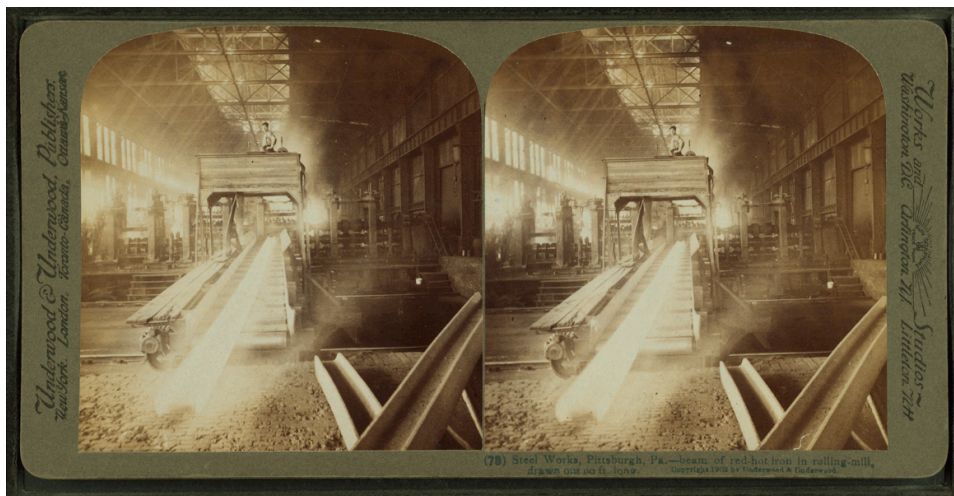
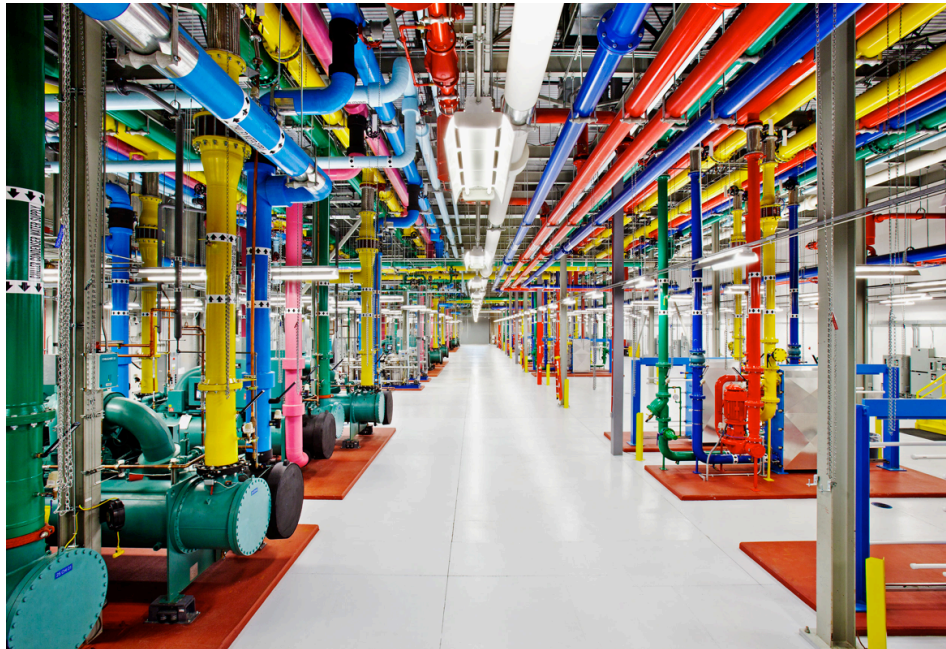
The Industrial and Technological Sublime

The images presented 2012 made parts of the infrastructure of Google visible. Google wasn't the only company displaying its facilities, even if its campaign stood out as especially conspicuous. By this campaign the visibility of Google was also inscribed in a longer visual tradition, spanning back in time to early industrialism. Several of the pictures from datacenters 2012 resemble how early industry and technological structures gained cultural significance and became part of movements of aestheticization and enchantment over 100 years ago.

In *American Technological Sublime*, David E. Nye shows how large technological endeavors like the railway, electrically lightened cityscapes or early industrial facilities became the focus for fascinated attention. Awe-inspiring and fascinating, slightly frightening encounters with places like the Niagara falls or The Grand Canyon had been described as sublime. "...the sublime is a mental state caused by our inability to fathom the power, vastness, magnitude and magnificence of an object witnessed" (Peeples 2011:379) According to Nye, a new kind of sublime grew in strength with the rise of the industrial society. This sublime was fueled by the awe and amazement over the scale and power of human achievements reached through the rationality of engineering and technological advances. What were brought up, as parts of the enchantment were the vastness, the symmetry and the dynamic rationalism that could be witnessed and associated with factories and mills:

Most visitors to early textile mills testified to the powerful impression created by many rows of spinning machinery, each containing uniform lines of spindles that became a visual metaphor for the promised cornucopia of industrial production. (In later years photographers often exploited such repetition in depicting the mills.) In an age when one seldom saw more than one or two machines together at one time, the view of a large factory room humming with incessant activity created astonishment at the ingenuity and apparent perfection of the arrangements (Nye 1994:114f).

Mostly onlookers and visitors not working in the very places experienced the enchantment of factories. For workers, a textile or steel mill of the early 20th Century was part of a routinized (probably arduous) everyday life. For them the factory was a place of labor more than a landscape that could be associated with the sublime. “Outsiders might perceive it as a form embodying certain abstract ideas, but to the laborer the factory was a place of action” (ibid:116).

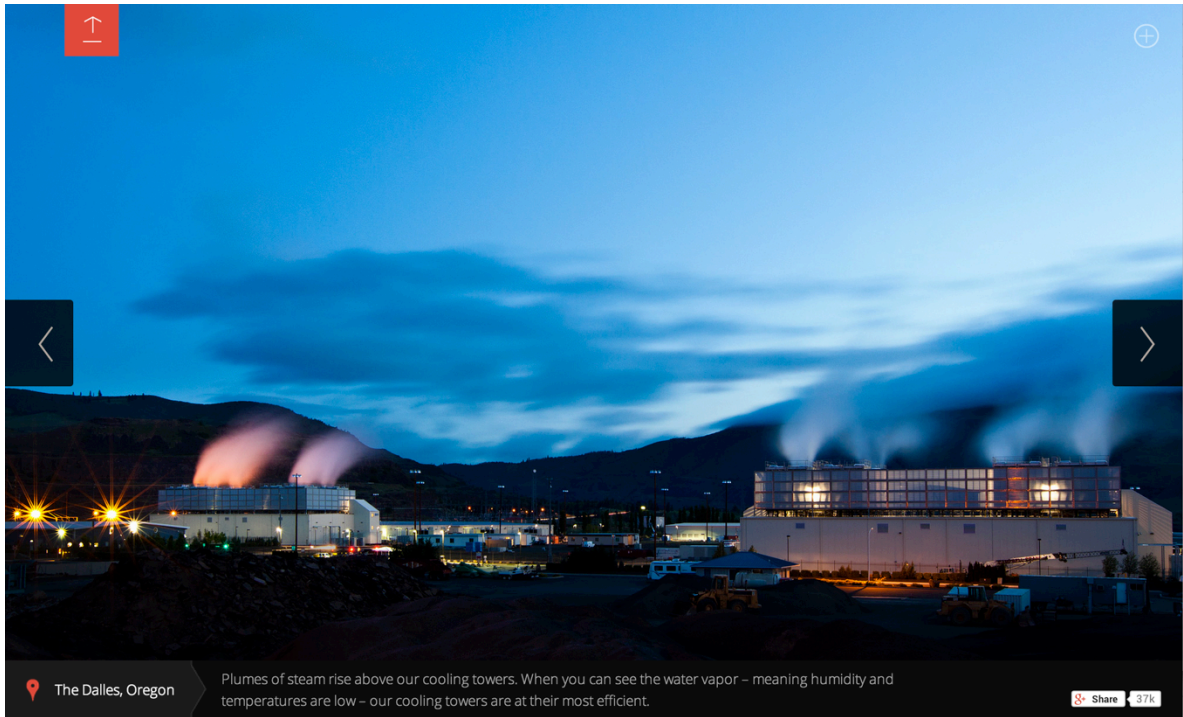


Visiting a factory and experiencing it as a place of sublime experience required some distance to the facility. This distance was made even longer through the photographs and stereoscopic images of industry that became popular in the early 20th Century. The ways factories were pictured in these has a number of visual resemblances with Google's visualizations of their facilities 100 years later. Long lines of machinery or equipment stretch out towards a horizon creating an impression of visual depth and the repetition of elements. The stereoscopic images from the Steel Works in Pittsburg (picture above) show long steel bars, machinery and repeated architectonic elements creating the impression of an almost infinite factory hall. The image just above, showing cooling pipes from one of Google's datacenters have a similar composition. Here the winding colorful pipes also give the impression of vastness and a rationalized complexity. Google has also brought in the bright colors from their logo into the factory, creating a playful and imaginative contrast to the robustness and rigor of industry. In order to communicate ingenious simplicity the company describe how the blue pipes are for cool water on its way to cool down the servers, while the red pipes are for heated water coming back from the server hall.

Despite the difference in colorscale, it is obvious that there is a resemblance between early visualizations of industrial grandeur and Google's way to make facilities visible. These ways to evoke The Industrial Sublime can also be seen in other visual examples, most notably in the photos of Edward Burtynsky. He has used similar compositions as in the early examples of Industrial Sublime to picture large-scale production environments, but also beautiful yet frightening motifs from exploited environments of the extraction and mining industry. A good example is his book *China* (2012) in which he presents images of Chinese manufacturing facilities and industrial environments; see also *Manufactured Landscapes* (Burtynsky & Pauli 2003). The photos by Burtynsky are though provoking acquaintances to the visualizations of Google infrastructures.

The Industrial Cool of The Internet

When Google decided to publish pictures of its datacenters it was part of a visualization strategy through which a selection of the companies' most secretive operations should be shown. On the website you might get the impression that it is all about transparency, that now finally the physical facilities and the very operations of the often enigmatic company should be revealed. In the timeline they present on the website, the year 2012 is also combined with the word "transparency". But the visualizations do still uphold an aura of mystery. Some of them evoke an aura of serene (and cool) stillness.



Google’s presentation of “the physical Internet” is part of a business strategy aligning it with the phenomenon or trend I have called *Industrial Cool* (2008). This is a broader aestheticization of heavy industrial practices and facilities. Part of this phenomenon are *staged factories*. In a study some years ago I pointed out Volkswagen’s showcase-factory Die Gläserne Manufaktur (The Transparent Factory) in Dresden as a prominent example of Industrial Cool and staged factories (2005).



IDEA ASSEMBLY **DISCOVERY** VISITORS' SERVICE CUSTOMER CARE EVENTS PARTNER EN

- PIAZZA & ORANGERY
- INSIGHTS INTO PRODUCTION
- VEHICLE TOWER
- CUSTOMER LOBBY
- VOLKSWAGEN LOUNGE
- THE MANUFACTORY SHOP
- RESTAURANT & BISTRO LESAGE

AT A GLANCE

EXPERIENCE AREA | 05.05.2011

VISITORS AND CUSTOMERS CAN WITNESS THE CREATION OF LUXURY CLASS VOLKSWAGEN AUTOMOBILES FIRSTHAND AT "DIE GLÄSERNE MANUFAKTUR".

The architectural concept for "Die Gläserne Manufaktur" is designed in such a way that the L-shaped assembly area incorporates the entire adjacent experience area, the so-called visitors forum. As a result, the view from the Orangery takes in the entire process, from customer care to final assembly, temporary storage of the vehicles in the vehicle tower and handover in the customer lobby.

The building's unique architecture, together with its outstanding restaurant and a range of cultural events and exhibitions culminate to guarantee an unforgettable experience.

This factory is located in the middle of the city Dresden. It is marketed as a city attraction amongst others like The Semper-oper, museums, famous churches and baroque buildings. Visitors are welcome to watch selected parts of the production of the luxury car model Phaeton take place on the other side of glass walls. The cars are slowly transported and assembled by white clad workers under spotlights on wooden floors. The whole factory is a brandscape, a mix of carefully designed and maintained showcase factory and an experience world (Klingmann 2007). A staged factory is not about showing faux practices; instead it is about showing choreographed practices of production and intentionally aestheticized visualizations of facilities. In criticizing these examples of brandscapes there is a clear risk of being trapped in metaphors of surface, shallowness and superficiality in contrast to depth and substance. "...much of what is dismissed as 'cultural icing' – like aesthetics, style and performance – reaches deep into management and production processes" (Löfgren & Willim 2005:13). There's nothing unreal about staged factories, instead it is a new kind of amalgam between branding, public- and customer relations and the production of different

commodities. However, there is definitely a reason for asking what parts of an enterprise are made visible, and for what reason.

Central to the staging of Industrial Cool is a very selective practice of visualization. Facilities are simultaneously characterized by an aura of mysterious secrecy and apparently transparent presentations of suggestive images. This resembles Google's choice to visualize "the physical Internet". The materialities behind digital services are here presented in a way that is presented as transparent, but it is really more about staging and about the formation of the Industrial Cool of The Internet. The virtuality and ephemerality of Internet is now enmeshed with evocative images of the physical and the material structures of the digital.

Can You Trust What You See?

The visualization efforts by Google didn't randomly occur some years ago. Parts of the reason might be a broader interest in the physical and tangible behind digital services and The Internet. Google's promotion started the same year as Blum's book about infrastructures of Internet was published, and about the same period of time the Academic interest to research the social and cultural aspects of materiality of the digital grew (see van den Boomen et.al. 2009; Dourish & Mazmanian 2011; Starosielski 2011, 2012 and in Swedish: Fleischer 2009). In 2012 the book *The Art of the Data Center: A Look Inside the World's Most Innovative and Compelling Computing Environments* by Douglas Alger was also released. The book is marketed with the text:

Today, data centers are the beating hearts of the companies they serve. Data centers process billions of Internet transactions every day. It's therefore critical for companies and IT organizations to understand the state-of-the-art in data center design. Narrow aspects - such as cooling, wiring, or power usage - are often the subject of technical documents. But it's rare to find a holistic view of how a great data center was designed - until now. In The Art of the Data Center, Cisco's Douglas Alger takes you behind the scenes at eighteen of the world's most innovative data centers. Through interviews with their designers, Alger reveals why key decisions were made, and shows how construction and other challenges were overcome. He goes behind the scenes with pioneering companies like Cisco, eBay, Facebook, and Yahoo! presenting design lessons that can be applied in widely diverse environments.

Readers will encounter amazing data centers like these:

- *A data center built into a 1920s chapel*
- *A data center built in an underground military bunker, with artificial daylight, manmade waterfalls, and submarine engines providing standby power*
- *A data center inspired by a chicken coop*
- *The world's first all solar data center*

(Alger 2012)

The design of data centers, and the visuality associated with Internet infrastructures can be related to notions of enchantment, fascination and the creation of aura. Another side of these

examples of visualization can be related to the establishment of trust. In order to get new, and to maintain old, customers and users service providers and producers like Google have to signify trustworthiness. A glance at the three aspects the company has decided to concentrate on in their transparency campaign gives a hint of how they align themselves with hot topics of recent public debates and concerns within the industry.

By pointing out concrete locations of some of their premises they relate themselves to recent debates on the location of data. The question among users, especially within enterprises has been if they can really trust that their data is processed and stored in a secure way by cloud service providers. In Sweden there has been discussion if eg. the use of products like Dropbox, Google Drive or server solutions by eg. Amazon really meets the security requirements by the public sector or enterprises. Issues about national legislation and the awareness about threats of unwanted surveillance (raised by the Snowden affair) has been on the agenda in news media, in the public debate as well as in boardrooms and governments. One way to evoke trust might be through the kind of visuality Google has chosen.

The campaign is also a way to tackle discussions on environmental impact. By highlighting renewable energy, efficiency as well as innovative and sustainable visions and operations, businesses dealing with digital technology might try to look attractive. And several news and industry journalists have subsequently published reports that stress exactly this:

Companies like Google, Apple, and Facebook don't just innovate with products: Just look at their data centers. The designs and operations playbooks of these new centers aim to lower costs, increase reliability and maintainability, and improve agility, while reducing energy use and carbon footprint (Dawson 2014).

As Dawson, like several other journalists has pointed out, it is not just Google who wish to evoke appealing images of their enterprises. In fact Google was quite late to jump on the infrastructure visuality train. Douglas Alger pictured many of the players eager to showcase facilities in his book on datacenter design, one of these was Facebook. This broader visibility movement, as well as the transparency effort from large competitors like Facebook was possibly one reason for Google to launch their transparency campaign.

In several places where datacenters of large corporations has been recognized, like in Alger's book, a relative small but though provoking contrast to the likes of Google and Facebook appeared. It was the Swedish Internet service provider Bahnhof. Founded in Stockholm it has been known for its support of several controversial Internet-based services. In 2014 they are hosting the WikiLeaks-materials on their servers, making them an enterprise relevant far beyond the Swedish context. Bahnhof have some of their facilities in a refurbished civil defense center in the middle of Stockholm.



The data center is located deep under the rocks of Södermalm, and the space was originally built during The Cold War in order to withstand a hydrogen bomb. The refurbished defense center Pionen now has simulated daylight, fountains, greenhouses and a saltwater fish tank. The premises look like a mix between some of the more flashy datacenters of Google and the somewhat quirky office design from dotcoms like Framfab during the 1990s.

When journalist Michael Hanlon wrote about the datacenter in *The Daily Mail*, the heading of the article was "Just like out of a Bond film: Inside the astonishing subterranean WikiLeaks bunker" (2010). The reference to the fictive world of James Bond was partly because of the connection to Julian Assange and WikiLeaks, but also because of the very design of the facility, which made the journalist think of the head quarters of a Bond villain. Also the magazine *Wired* made associations to Bond-films and science fiction when visiting Pionen.

[CEO Jon] Karlung's internet service provider, Bahnhof, took the nuclear bunker idea and went all-in. It now looks like a cross between a James Bond lair and the eco-pod-filled spaceships of the 1972 cult sci-fi film Silent Running. Karlung, who worked briefly as a film archivist before getting into the data-center business, says that he immediately thought of putting plants in the underground caves to capture the computers-meet-plants vibe of Silent Running. "It had this mood and it had this atmosphere that I liked. It captures this atmosphere of growing something from outer space."(McMillan 2012)



In this way it is possible to move between notions of transparency and the opaque, evoking cool and aesthetic visualities that make associations travel in imaginative ways. When businesses like Google, or for that matter Bahnhof, uses images of infrastructure with broader cultural significance, we enter just about as imaginative universes as was evoked during the cyberspatial virtual times of the dotcom-bubble. Bond-films and sci-fi-films like *Silent Running* are evoked in similar ways that *The Matrix* or Gibson's *Neuromancer* was 15 years ago, when they fuelled imaginaries and discourses.

The visualizations of digital infrastructures discussed here are characterized by enchanting imaginaries and evocative visuality unfolding in often very different directions. The visibilities of digital infrastructure, and its cultural significance, might also move in unforeseen ways in the future. Some decade into the new Millennium we can witness a number of examples of how the physical and the digital is enmeshed. When this is written there are several reports in the news and in campaigns from companies showing possible infrastructural endeavors. In March 2013 Mark Zuckerberg of Facebook said: "Today, we're sharing some details of the work Facebook's Connectivity Lab is doing to build drones, satellites and lasers to deliver the internet to everyone,"(Oreskovic 2013). Google on their side worked on developing a system of hot air balloons in order to bring Internet access to parts of the world that were out of the company's digital reach: "We believe it's possible to create a ring of balloons that fly around the globe on the stratospheric winds and provide Internet access to the earth below. Balloons present some really hard science problems, but we're excited about the progress so far."(Project Loon 2013). There were also mysterious reports on barges with containers in harbors on the West Coast of the US during 2013. The barges were supposed to be part of a secretive project from Google to create floating data centers. In an announcement in

November 2013 the company claimed that the barges definitely were no data centers, but were to be used as "interactive spaces to learn about technology"(Vincent 2013). But the statement didn't silence all rumors. "Although Google's statement has dampened down some of the speculation regarding the project, the secrecy with which the barges were constructed still raises some eyebrows. Building on water rather than land meant that the company could avoid filing public permits, and US Coast Guard officials who inspected the barges signed non-disclosure agreements."(ibid). Infrastructure is merged with imaginary universes through these stories and through evocative visual representations.

These evocations and the development of new technologies force us to ask the question: where does infrastructure really end? New gadgets like 3D-printers are about to be integrated in new everyday practices, making notions of infrastructure even more complex, and provoking us to rethink what reckons as production and manufacturing (Gibbs 2013). Imperceptible electronics that are integrated with the human body will blur the interfaces to the digital even more (Curtis 2013). Many of the companies we today associate with ephemeral Internet services and products might move in directions that was not expected some years ago. Google has acquired a number of companies and competencies associated with robotics and machine-learning, most notably Boston Dynamics, producer of life-like military robots (see Cadwalladr 2014).

When looking at all these examples linked to issues of digital infrastructures, the assertion by Star and Ruhleder that infrastructure is a relational concept and not just a system of substrates becomes relevant (Star 1999:380). Depending on the viewpoint and relation of various actors, infrastructure can have very different meaning and significance. Infrastructure can be integral to the everyday uses of technology, part of a process, but also part of PR-campaigns and brand building, evoked through various visualities. Through these visualities notions of trust and enchantment are enmeshed in a web of associations stretching out towards such disparate things as Bond-villains and renewable energy towards staged factories and the virtual. When looking at the recent visualizations of the facilities and infrastructure from Google or for that matter Bahnhof, we might benefit from asking ourselves questions like: Why is this shown in this certain way at this time? When looking at the shifting visibilities of digital infrastructure today, there are several processes moving in entangled ways. We realize that even if very concrete places, technologies and materialities are pointed out in the visualizations of infrastructures of digital enterprises, what we actually see are very floating points of reference.

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Still from film by author (Garmin handheld GPS-receiver).

Scen capture from review of Flightradar 24

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Steel Works, Pittsburg

[upload.wikimedia.org/wikipedia/commons/8/87/Steel_works,_Pittsburgh,_Pa.,_beam_of_hot_iron_in_rolling_mill,_drawn_out_\(00%3F\)_feet_long,_from_Robert_N._Dennis_collection_of_stereoscopic_views.png](http://upload.wikimedia.org/wikipedia/commons/8/87/Steel_works,_Pittsburgh,_Pa.,_beam_of_hot_iron_in_rolling_mill,_drawn_out_(00%3F)_feet_long,_from_Robert_N._Dennis_collection_of_stereoscopic_views.png)

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Bahnhof Pionen

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