

# The Digital Invisibility of Broadband and its Representation in the Modern City

Paper presented at the session "The Invisible City"  
97th AAG Annual Meeting  
February 27 - March 3, 2001 in New York, USA

Peter Dobers (peter.dobers@lector.kth.se)  
Royal Institute of Technology  
Industrial Economics and Management  
SE - 100 44 Stockholm  
Sweden

Available as an interactive version to see several ads and movies live:  
<http://130.237.51.103/dobers/index.html>

## Abstract

City managers in several cities have tried to market their city related to information technology; i.e. Osaka as a *city of intelligence*, Barcelona as a *city of telematics*, Amsterdam as a *city of information*, Manchester as a *wired city* (Hepworth, 1990:550ff), and more recently, Stockholm as the *mobile valley* or *internet bay*. These attempts mirror the emergence of a space of flows which replaces the notion of the space of places. It poses a challenge for cities to construct new productive infrastructures, thereby turning cities and regions into critical agents of economic development by introducing informational city concepts like the *technopoles* or *technoburbs*. This paper takes a close look at the human and non-human hubs of the digital network for broadband access to the Internet. It shows how an abstract and material notion of a digital broadband net is represented in concrete and socially infused, indeed personalized, ways. The aim is to discuss the dialectics between abstract invisibility and concrete visibility and how each is represented.

## Invisible Materiality of the digital city

Spurred out of a general interest in how big cities are run (not planned or how they should be constructed or how cities actually are used) the research programme “Managing Big Cities” was formed at Gothenburg Research Institute, Gothenburg University. There has been projects of how city managers market Stockholm as a city of culture (Porsander, 2000; Porsander and Pipan, 2000) or as a most advanced environmental city (Adolfsson, 1999), and how the everyday management of big cities actually takes place in different contexts as Stockholm and Warsaw (Czarniawska, 1998; Czarniawska, 1999; Czarniawska, 2000). My own project, sharing the general disciplinary background of management and organization studies of the previous studies, has dealt with the construction of the fiber optical based broadband net in Stockholm focusing on actors and actions in that process. Such an IT net is literally rolled out into the streets of a city, the only time you actually can observe and see parts of the net, which eventually becomes invisible when covered with sidewalks and regular streets.

“Invisibility” is a concept that has been used in many ways. It has been used in novels to describe social phenomena of individuals that merge completely with their physical and social background whenever suitable in *The Invisible Man* by H G Wells or because of lacking identity in *Invisible Man* (Ellison, 1989). Another book of prose has used the concept to dwell further into abstract images of cities (Calvino, 1997), a book which also serves as an illustration in discussing that technology is representation of the invisible (Kallinikos, 1996:15-47). Invisibility is further experienced when homosexuality is a non-issue in the military and in conservative churches or when homeless people are neglected by politicians and their fellow-beings. Also, the School of Design at the University of Brighton (Faculty of Art, Design & Humanities at the University of Brighton) has an online exposé of commercial ads of the 1950s, where invisibility is represented in many different ways.<sup>1</sup>

These are a few examples of how the concept of invisibility is given sense from many different perspectives. Thus, a workshop named “The Invisible City” caught my eye and made me reflect upon my own research of the IT

---

<sup>1</sup> <http://www.adh.bton.ac.uk/schoolofdesign/MA.COURSE/LPR02.html>

infrasystem of modern cities out of the perspective of invisibility. What I found is invisibility of different layers. On one level, the technological infrasystem of the broadband net is invisible to the observer, since dug into the ground. On another level, the information transported on these nets is also invisible. We have become used to sending and accepting e-mail, some of us have also become familiar with up- and downloading information from the internet. However, we never give it a second reflection how this takes place in terms of the transfer of digits through-out the internet.

Digitally constructed, stored and transferred information most often than not makes sense when it has arrived after a long travel, starting from our own desk top or lap top computer, passing servers and routers and switches before it arrives at another computer. A digitalization of information, I might add, that kills distance as a factor of communication costs (Cairncross, 1997). Depending on the way we access the internet, up- and downloading of information takes more or less time. Thus, a fast and permanent access to the internet has become a “necessary something” to many demanding customers of business and private households. But how is a slow access to the internet, a rather intangible and invisible circumstance, depicted? What role does the invisible materiality of this broadband infrasystem take in everyday life? This paper presents illustrations of how broadband and digits are represented in concrete and socially infused, indeed personalized, ways. It does so by tracing normally unheard voices and pictures when digits are speaking up.

## **Frontstage. Broadband in Stockholm**

It was first in 1999 when *broadband* became a well-known term in the public life in Sweden, after Jonas Birgersson, then CEO of the internet consultancy Framfab and chairperson of B2 (Bredbandsbolaget), had propagated for a national broadband strategy. According to the internet entrepreneur, Sweden should be turned into the world's greatest lab for digital infrasystems and internetrelated services. The question of who is responsible for the construction of the nationwide broadband network in Sweden became national politics and the IT bill in spring of 2000 formulated the principal strategy of the Swedish government (SOU1999:85, 1999). But what stands behind the word of broadband?

The word broadband is actually a hybrid of two words: *broad* and *bandwidth*. The latter is borrowed from the radio world where bandwidth describes the frequency of a radiostation. In the digital world, bandwidth describes how many digits, or bits of information, can be transmitted per second. A broad bandwidth means that many digits and bits can be transmitted per second. To sum up, broadband is understood as a very fast and permanent connection to the internet. Some say “fast access” starts at 1.5 megabit per second (Wolf and Zee, 2001:21) but in Sweden the official standard of broadband is set to 2.0 megabit per second (SOU1999:85, 1999).

There are different technologies for broadband, of which the most known are ADSL, cable modems, electrical power lines, wireless radio access, and optofibers. All broadband solutions base on the digitalization of previously analogous information – a prerequisite to utilize capacity of existing infrasystems – and a an extensive prerequisite in the way we today access television, telephone services or the internet (Cairncross, 1997). Thereby, fiber optics is often said to be one of todays most promising broadband technology (Maxwell, 1999; Wolf and Zee, 2001). Optocables are thin cables of glass with unforeseen transmission capacities, however expensive to utilize today, since a completely new infrasystem on optofibers has to be built to arrive at the fullest transmission potential.

Hence, it seems as if fiber optics has become the backbone of a digital network that attracts a lot of attention. Many big organizations like AOL - American Online and Time Warner, or large cities around the globe, back up the development and utilization of broadband-based informational networks. One starting date for such endeavors in Stockholm may be 1993, when the tele monopoly in Sweden had been abolished and Stockholm became a test market for international telecom actors. In the same year Stokab was founded. Owned to 91 per cent by the City of Stockholm and to 9 per cent by the Stockholm County Council, Stokab in 1994 inherited infrastructure from the county council, including 450 kilometers of channels to be filled up with fibre optics reaching more than 2 000 kilometres today. Stokab is a little known municipal company that has ever since rolled out optofiber cables under the streets of Stockholm, open for anybody interested to lease capacity. Most of it has been

constructed for supplying certain company clusters with IT infrasystem, but some of it has also been used for the administration of the municipality.

One idea for founding Stokab was to establish an alternative information infrastructure to Telia's dominant infrastructure. This would lead to rate-lowering competition and attracting new IT companies to the region including clean, high paid, information based businesses. The aim was also to stimulate investments in diverse and innovative new telecom in the Stockholm region. Also, lessons were learned from the early liberalization of the telecom markets in the United Kingdom, when the streets of London were dug up several times of different telecom companies. Through the means of Stokab, Stockholm and the Stockholm County Council has access to the first full-scale alternative to Telias infrasystem for tele- och datacommunication. But the -competition thickens. Today there are companies such as B2, Utfors, UPC and the Telia-owned com.hem competing about the last mile of broadband access to the internet for households in the Stockholm area.

## **Backstage. Digits and Their Invisibility**

The dilemma here is not only that the broadband net in some ways is invisible, since dug into the ground, and still quite tangible, since we know that real cables are in the ground after we have dug up the ground. The notion of invisibility goes beyond this situation, where the information being transported on the digital broadband net, the digits and bits themselves, are rather incomprehensible and therefore invisible to users. Nicholas Negroponte, known for his columns in *Wired* magazines, describes a bit this way:

“A bit has no color, size, or weight, and it can travel at the speed of light. It is the smallest atomic element in the DNA of information. It is a state of being: on or off, true or false, up or down, in or out, black or white.” (Negroponte, 1995:14)

A bit is the abbreviation of “binary digit” often used when describing storing and transmitting information with an appropriate modem. The most general meaning of bit concerns a binary character that can take the value of “0” or “1”. It is used to describe storing (memory capacity) and transmission of data or datachunks (speed). A string of 8 bits is called a byte (probably an alteration of bit) and stores information. Sorted in particular ways (for instance 00000000 or 11111111 or any combination of “1” and “0”) they bear specific meanings coded and decoded by computers, and transferred over networks such as the internet.

These digits of “0” or “1”, as the quotation above shows, is a world of discrete values, by which computers process data. The digital world would be rather meaningless to most of us, had there not been a graphical interface that approximates and makes the digital world look-alike the world we experience, the analogue world. Analogue comes from the greek *ana logos* which means corresponding, symmetrical or conformity and describes change as continuous rather than discrete. Analogue is therefore often used as the opposite of digital.

## **Bringing Digits on Stage. Digital Invisibility and Its Representation**

Digits are, as we have seen, an abstract and in many aspects an invisible form of information, that, put together in certain patterns, are transformed into meaningful information. Examples by which these digits are transformed into visible items and give meaning in a represented way to the digital world, are radio spots, internet ads, or TV commercial run by the Swedish tele provider Telia during 2000.

Several radio spots describe an ongoing strike regarding the bad working conditions of digits suffering under slow connections to the internet. Journalists from news room describe the situation in different ways, interviewing individual digits who remain in work or those who already have dropped out. One example is the 62 second radio ad further below (my translation from Swedish):

When listening to *how* the “news” is brought to the radio listener, the sound and seriousness of the matter is just as if the content would have been true news of our own world. Instead we hear about the obviously worsening working conditions of “digits” and how they take action and demonstrate. A very human thing to do when the situation calls for it. Striking people are giving voice to something that cannot speak up by itself. Digits are represented by people and makes a technical matter social; a digital matter analogue; and invisible matter more visible since we can imagine the situation while listening to the radio.

**Illustration 1: “Strike on the Internet” (Swedish radio commercial, my translation).**

Female news reader in standard Swedish:  
“The crisis on the internet is worsening. An additional 3 million gigabytes have now joined the full-scale strike on the internet and feelings are very upset. Over to our internet reporter.”

(Background shouts: “Far too slow connections – we need broadband actions”)

Reporter with highpitched voice to overcome the shouts, with Stockholm accent  
“Yes, here are mp3 files, long mails and game demos side by side, all of them sharing the bad working conditions they no longer want to accept. Dragging downloads and slow connections.”  
“– I see a binary digit! Excuse me! Excuse me! Why are you here?”

Binary digit with Gothenburg accent and slang:  
“Because something has to be done!”

Reporter: “What do you mean?”

Binary digit: “We digits are no slaves. Being close to burning out we have to fight the slow connections of people. That is tormenting!”

Jingle in the background:  
“Do you also want fast internet connection?”  
“Check out telia.se/broadband”

Another example describes the entry of digits into the analogue and material world in which we live. In a series of some 30 short movie clips on their internet site, Telia describe how five “personalized” digits arrive into the analogue world on several places in Stockholm, maybe after being “zapped” from their *City of Bits* (Michell, 1995): after a long and seemingly risky connection to the internet, Kicki (“1”) arrives on the lap of the mobile internet surfer sitting in a café, waiting for connection; Jorgen (“0”) arrives in a computer room of a school; and Kurt (“0”), Tracy (“0”) and Arash (“1”) arrive at yet different places around Stockholm. Some of them rent a car and pick up the other digits to start their roadmovie throughout Sweden to mission about broadband and its potentials (delivered by Telia). They travel around to illustrate broadband in many different ways, to distribute leaflets about broadband in Swedish cities, complaining about the analogue development of film when you can take digital pictures and print them immediately, realizing future problems with video stores when you can stream videos in real time on the internet, and eventually party with other digits from Denmark at the Oresunds bridge before leaving the analogue world to “zip” back to the world they belong to, the digital world of broadband.

The last arena for the digits to enter the analogue world is in 6 TV commercials that have been aired since summer 2000. All of them concern the working

conditions of digits in general and certain digits in particular. First out to hit the TV viewers was a science fiction like setting of a 45 second little film called “The JPEG”.

**Illustration 2: “The JPEG” (45 second TV commercial in English).**

Setting:	<i>A man stands elevated on a pedestal and has just overviewed a departure of some digits. He is in a huge industrial plant that is clean and white and overlooks a large space in the building. Let’s call him the manager of digital distribution.</i>
Manager:	<i>“Goodbye!” “Next.” (A door slides open with a swishing sound and a group of digits arrive into the building) “And you are?”</i>
Digit:	<i>“We’re a JPEG, sir. We’re going to IP address 195.149.129.195.”</i>
Manager:	<i>“Alright. That will be gate 42 then.”</i>
Digit:	<i>“Right. Brilliant, cheers.” (The group of digits start waling towards gate 42.)</i>
Manager:	<i>“Wait! Hold it there! It looks like you’ve got a slow connection. An old 28.8 modem.”</i>
Digit:	<i>“Jesus Christ. Not again! All last night we were downloading for a personal computer of an old lad.” (Many digits shout out loud).</i>
Manager:	<i>“Yes, I am sorry.”</i>
Female digit:	<i>“Do you know how it is, do you know how hard it is to work on slow modems?”</i>
Manager:	<i>“Sorry lads. You know the drill.” (Major gate opens and digits leave port in which lights are flickering and they are walking by foot.)</i>
Digit in gate:	<i>“Twenty-first century? Ha! More like the Eighteenth century!”</i>
<i>(text appears on the screen: Telia broadband: <a href="http://telia.se/bredband">telia.se/bredband</a>)</i>	

The episode gives us an overview of a personalized group of digits. We have not only heard the second hand news about the strike on internet, but here we are gaining a first hand understanding of how terrible the working conditions for digits can be and how fed up they are. When receiving the new destination, the digit sounds quite annoyed already (“Right. Brilliant, cheers”). However, when hearing about the slow connection, we witness how upset the group gets, although accepting the situation as is. But it is first in the next two illustration we meet individual digits as they are speaking up at the psychologist in monologue-like manners. It seems that individual digits from the JPEG-episode are given voice and emotions here.



**Illustration 3: “At the Psychologist” (30 second TV commerical, in English).**

Setting: One digit lies down on a sofa (patient), and another digit stands up (doctor).

“Mostly we do e-mails, text files, that sort of stuff. You know, I feel I got potential you know. I mean, I should be flying airopplanes, racing cars, chasing my mates down the corridor for big machine guns, stuff like that, you know! (Sigh) –What do they give me? (Huh) Business mail from an insurance company. (Big sigh. Turns around and looks into the camera and a text appears on the screen: Download games in a minute: [www.telia.se/broadband](http://www.telia.se/broadband)). The patient speaks up: “It’s a fucking joke man!”

**Illustration 4: “Chris” (45 second TV commerical, in English).**

Setting: A female digit gives a monolog. The room is white, lit up with two lights on the roof.

“Ehm... well, it’s just... you know. Someone was telling that we’ve... we’ve got kids to take care of | to look after as well. Ehm, huh, you know, but huh... How can we when we are stuck in a crappy slow connection, an old line. I got kids in the home. He’s like all alone, he’s sitting there, you know. I know he is crying out, you know: ‘Where is my mom?, Where is my mom?’. How am I supposed to explain, huh, a slow modem, to a three-year-old? Can you tell me? Can you? Can you explain | Can you explain | You tell me and I tell a three-year-old what a slow modem is. You can’t, can you?” (Text appears in Swedish on the screen: “[telia.se/bredband](http://telia.se/bredband)) “No, I don’t think so.”

Here we are meeting individual digits in their very personal ways. They are dejected and see no way out of the situation. In typical ways, each digit is given gender-specific characteristics as how society look upon men and women. We have the male digit who rather would like to be involved in computer games than working for a regular insurance company. We have the female digit who rather would like to be with her son, at least spend more time with him.

## Discussion

All these illustrations show how digits are infused with anthropomorphous qualities to enhance our understanding and attachment to digital technology. An invisible and incomprehensible world of the digits in broadband nets is given meaning in sense-making episodes (Weick, 1995). Just like saying: “After all, these digits have the same bad working conditions as anyone else in this society. Let’s help them out by getting broadband connections to our homes.” These illustrations describe waiting time caused by slow connections to the internet like modems (put together from the words *modulator-demodulator*).

The personified digits are tired of waiting and this becomes a problem. Those digits are translations of a situation to which there are no actor that can speak up by themselves (Latour, 1993; Latour, 1996). Instead, the commercial company Telia takes on an intermediary task to give voice to the otherwise silent digits (just as Heather Chappells describes the unheard voices of reservoir managers and meter readers in her abstract to this session: *Tracing unseen flows. Tales of water storage, transformation and monitoring in the city*). Regardless of their commercial interest in this issue, Telia gives voice and meaning to an invisible part of the modern city, to a situation otherwise incomprehensible.

These illustrations create meaning since they link up with mundane and trivial issues that people can identify with: overloaded jobs resulting in exhaustion and explaining difficult issues to children. Those digits are... Chris for instance, is depressed, and would cheer up if she only could work with fast broadband access. However, those poor digits cannot influence their own situation, but the audience to the radio spots and TV ads can.

To describe something intangible and invisible as digital information and fast broadband access to the internet, we need to make reference to something else. In this case, *something else* of the digits of the digital world becomes represented in our world by human beings. These metaphors of humans give sense to a senseless and invisible digital world.

The graphical interface of today's computers, and the screens with growing resolutions, play an important role in the translation or representation from the analogue world to the digital world. Data by themselves can be based on digital rather than analogue media. However, since we live in an analogue world, full of atoms and not full of bits, eventually we need analogue information to reach our senses. Digitally stored music on compact discs have been around for more than 15 years by now. But to reach our ears and to touch our senses, the digits of the CDs must be converted through amplifiers and loudspeakers into analogue sound waves; digits of DVDs or streaming videos over the (broadband accessed?) internet must be converted on a screen to create images and pictures and waves to reach our eyes and sound waves to reach our ears.

Thus, the graphical interface of computers is a prerequisite for us to make sense of any digitally stored information. A random number of "0" or "1" won't do us any good, but the translation into sound and changing colors of pixels on the

screen, will eventually make sense. Sense making and perception processes remain analogue. A screen, regardless if it's a TV or computer screen, is constructed with many small square dots or pixels (*picture elements*) as the smallest picture element is called. They are used to construct two-dimensional pictures as we see them on screens (voxels, volume elements, are used to construct a three-dimensional digital picture or sound). When close to screens you will recognize each individual pixel, but when the distance is right, your eye will be fooled to recognize many pixels as a car, or a person. Our eyes accept the approximate representation of the analogue world through the digital medium of a screen and we are fooled to "see" a car or a person. People in real life, as represented by digits in the computer and translated into changing pixels on the screen, do not need any analogies from the digital world to be understood, because the digital approximation represent satisfactory the physical or analogue world.

## **Conclusion**

What this paper has tried to explore is a consequence of the nature / culture divide of society and its effects for the visibility of invisible digits. The divide between the real, visible and analogue world ("nature") and the virtual, invisible and digital world in the early stage of the digitalization of information ("culture") has been narrowed. The divide has been narrowed by the graphical representation of information on the screen as Steve Jobs did to the personal computer with the Macintosh and Apple corporation in the mid 1980ies and Marc Andreessen did to the internet with Mosaic and later the Netscape software in the mid 1990ies. A representation of information on the screen that gave "a presence to what novelist William Gibson (1984) termed 'cyberspace' (Gibson, 1984; Everard, 2000:124). Thus, invisible digits become visible by means of representation.

Since digits cannot speak up on their own they need to attract spokespersons who speak for them (Latour, 1996). In this paper we have seen illustrations where a commercial company has exploited digits by manipulating their representation by choosing to present them in very mundance, everyday human situations. It seems that to grasp the invisible, you have to make it visible, and to grasp the abstract, you have to make it tangible and concrete.

## **References**

- Adolfsson, Petra, *Environment as a part of the city*, Gothenburg Research Institute, Göteborg, Paper presented at the conference: *Managing Big Cities*, 26-28 August 1999 in Gothenburg, 1999.
- Cairncross, Frances, *The death of distance. How the communication revolution will change our lives* (Boston: Harvard Business School Press, 1997).
- Calvino, Italo, *Invisible cities* (London: Vintage Classics, 1997).
- Czarniawska, Barbara, *European capitals 2000. On local construction of universal models*, GRI - Gothenburg Research Institute, Göteborg, Keynote address at the conference "Memory and fury in architecture, Alvar Aalto Museo, Jyväskylä, August 1998, 1998.
- Czarniawska, Barbara, *Det var en gång en stad på vatten: Berättelser om organisering och organisering av berättelser i Stockholm* (Stockholm: SNS, 1999).
- Czarniawska, Barbara, *A city reframed. Managing Warsaw in the 1990s* (Reading, UK: Harwood Academic Publishers, 2000).
- Ellison, Ralph, *The invisible man* (Twentieth Century Classics), (New York: Penguin Books, 1989).
- Everard, Jerry, *Virtual states. The internet and the boundaries of the nation-state (Technology and the Global Political Economy)*, (London: Routledge, 2000).
- Gibson, William, *Neuromancer* (New York: Ace, 1984).
- Hepworth, Mark E, *Planning for the information city. The challenge and response*, *Urban Studies* (1990), Vol. 27, No. 4, pp. 537-558.
- Kallinikos, Jannis, *Technology and society. Interdisciplinary studies in formal organizations* (Studies of Action and Organization (SAO), Vol. 6), (München: Accedo, 1996).
- Latour, Bruno, *On technical mediation. The messenger lectures on the evolution of civilization*, *School of Economics and Management, Lund University, Lund, Working Paper Series of Institute of Economic Research 1993/9*, 1993.
- Latour, Bruno, *Aramis or the love of technology* (Originally published in 1993 as: *Aramis, ou l'amour des techniques*), (Cambridge, MA: Harvard University Press, 1996).
- Maxwell, Kim, *Residential broadband. An insider's guide to the battle for the last mile* (Wiley Computer Publishing), (New York: John Wiley & Sons, 1999).
- Michell, William J., *City of bits. Space, place, and the infobahn* (Cambridge, Mass: MIT Press, 1995).
- Negroponte, Nicholas, *Being digital* (New York: Alfred A Knopf, 1995).
- Porsander, Lena, *Translating a dream of immortality in a (con)temporary order*, *Journal of Organizational Change Management* (2000), Vol. 13, No. 1, pp. 14-29.
- Porsander, Lena and Pipan, Tatiana, *Imitating uniqueness: How big cities organize big events*, *Organization Studies* (2000), Vol. 21, No. 0, pp. 1-27.
- SOU1999:85, *Bredband för tillväxt i hela landet. Närings-, regional- och välfärdspolitiska aspekter på IT-infrastrukturen. Betänkande från IT-infrastrukturutredningen* (Stockholm: Fakta Info Direkt, 1999).
- Weick, Karl E, *Sensemaking in organizations* (Foundations for organizational science), (Thousands Oaks: Sage, 1995).
- Wolf, Jason and Zee, Natalie, *The last mile. Broadband and the internet revolution* (New York: McGraw-Hill, 2001).