**The Space of Flows: notes on emergence, characteristics and possible impact on physical space.**

by Felix Stalder
http://felix.openflows.org

Invited Talk for:
c I T y: reload or shutdown?
5th International PlaNet Congress
Paris, August 26th - September 1st 2001

Version: (August/September 2001, uncorrected English)



## The emergence of the space of flows: from the center to the network

A good entry point into space of flows is the office, one of its principle sites. The office as such is a relatively new phenomenon. It became an important place for work only in the second half the 19th century, long after the factory was established as the place of production and, in many ways, in a direct response to the factory. The rise of the modern corporation in the late 19th early 20th century raised the scale of production for the newly emerging mass markets. These markets emerged in the wake of the formation of the nation state, the growing train system and the expanding telegraph networks whose cables often ran parallel to the tracks. The speeding up of social and economic life required new techniques of administration and management. The traditional methods were no longer able to deal with the pace and volume of transactions involved in mass production.

This created the need to innovate in the management of the flows of material and information. The industrialists answered with massive production complexes and the automation of information processing. At the core of this movement were new administrative technologies filing cabinets, calculating machines with punch cards and, later, mainframe computers. They that allowed to manage high volumes of information efficiently and centrally. A possible candidate for the beginning of this movement is the year 1892. In that year, the portable typewriter was patented and machine writing replaced handwriting as the business standard. In the same year, the first machine that could add and subtract was commercially introduced, the mechanization of mental labor began in earnest. As a consequence, the modern office was born (Beniger, 1986).

For more than half a century, the main direction of change that these new technologies help to drive forward was towards the center. Industrialization can be seen a movement towards mass production, centralization and bureaucratization. German sociologist Max Weber likened this increasing rationalization and bureacratization of society to the creation of an "iron cage".

Hardly any built environment symbolizes this industrial centralization better than Henry Ford's famous Rouge Plant in Dearborn, Michigan. Construction began in 1917 of what was then the world's largest industrial complex. The Rouge Plant included all the elements that were needed to produce an entire automobile from scratch: a steel mill, a glass factory, and an automobile assembly line. Iron ore and coal were brought in on Great Lakes steamers and by railroad. They were used to produce both iron and steel. Rolling mills, forges, and assembly shops transformed the steel into springs, axles, and car bodies. Foundries converted iron into engine blocks and cylinder heads that were assembled with other components into engines. By September 1927 all steps in the manufacturing process from refining raw materials to final assembly of the automobile took place at the vast Rouge Plant, epitomizing Henry Ford's idea of mass production and offering a perfect illustration that mass production meant centralization and integration.

The unifying movement of the industrial revolution was towards the center. The center was occupied by the head of an extremely hierarchical organization. Information flowed from the bottom to the top and orders from the top to the bottom, the same way as raw materials flowed into the factory and finished products came out of it. Control was centralized, production was centralized, and often, both were centralized in the same place. This type of organization was highly efficient, but it was also extremely inflexible. Henry Ford's famous quote that customers could choose any colour for their car, as long as it was black illustrates this point. Thanks to mass production, everyone could own a car, but everyone ended up owning the same model. It must have been a nightmare to find one's car in a big parking lot.

Centralization meant that even as the scale kept on increasing, things that logically belonged together in the sense that they constituted a single process were also geographically located together.

This movement towards the center began to change after the second world war. Increasingly, places that were far away from one another became integrated. The way this integration happened was historically new and unprecedented. It was not simply a matter that distant places became more interconnected, or that what happened in one place influenced an another more directly. Such an interconnection would have been nothing new. Long distance trading played an important role in European history at least since 10 century, the influx of gold from Latin America was major influence in the early development of capitalism and international trade was integral part of industrial life.

However, what was substantially new was that these distant places started to become integrated in a fashion that allowed them to function as a coherent unit in real time. Real time is the operative world here. Locations that were geographically distant could be connected to one another as if they were right next to one another, without delay.

Many factors contributed to this development. One of the major early motors was the US army. It had fought, and won, the war around the globe, in Europe as well as in Asia. In the wake, it began to consolidate its geo-strategic position by establishing military bases around the world. These bases required a support infrastructure that made it possible to maintain and manage them in a

coordinated single web of interconnected parts. The creation of a new global telecommunications infrastructure was key to this development of linking distributed units into a single entity that could function in real time.

In the 1950s The first transatlantic telephone cable was laid and could carry 36 very expensive conversations at one time. In 1976 the sixth cable was laid carrying some 4000 conversations at one time and not before 1988 the first fiber-optic cable was laid that could carry 40'000 conversations at once. In 1998, a new cable laid between Britain and the US could carry 1.6 million calls a time. In the late 1980s additional communication links via satellite were established providing an ever greater number of people with abundant communication channels (Wriston 1992, Rowland 1997, Winston 1998).

The effects are dramatic and are still unfolding. What logically belongs together no longer needs to be in one place in order to function as single unit. The traditional trade-off between the advantages of operating across different locations and the disadvantages of having to deal with a delay in communication and coordination across these places ceases to exist. For the first time ever, it is becoming possible to be geographically distributed and still act as a unit in real time. Many analysts had notices the speeding up of social relation and the changes in the importance if physical distances. The geographer David Harvey, for example, spoke of "time-space compression". By this he meant he meant that things happen faster, hence time is compressed and at the same time, they happen across larger distances, hence space is compressed.

A new space for social interaction emerged. In this space interaction took place in real time across very large distances. This space was shaping and shaped by the flows of information, people and goods. It was Manuel Castells who argued that this is not only the gradual extension of long historical trends, but that a threshold had been passed to create a new social space that has its own characteristics and dynamics. In his groundbreaking book *The Rise of the Network Society* (1996), he called this space **the space of flows.**

But was is the space of flows? Put most simply, the space of flows is a space that is organized for, and created by, the constant movement of people, goods and information over large distances. The space of flows is not so much organized to move things from one place to another, but to keep them moving around. In the space of flows, arrival becomes elusive, virtually indistinguishable from departure.

Since it was Manuel Castells who created the concept, will quote at length his definition of the space of flows. Castells (1996) writes:

Our societies are constructed around flows: flows of capital, flows of information, flows of technology, flows of organizational interactions, flows of images, sounds and symbols. Flows are not just one element of social organization: they are the expression of the processes dominating our economic, political, and symbolic life. ... Thus, I propose the idea that there is a new spatial form characteristic of social practices that dominate and shape the network society: the space of flows. The space of flows is the material organization of time-sharing social practices that work through flows. By flows I understand purposeful, repetitive, programmable sequences of exchange and interaction between physically disjointed positions held by social actors. (p.412)

This statement deserves a bit of unpacking. Castells' central argument is that the space of flows is created by the real-time interaction of distributed social actors. The space is comprised of interactions and the material infrastructure that makes these interactions possible. The reason why we need to pay attention to the emergence of this new space is that increasingly the most powerful process that shape our society are organized within the space of flows. The characteristics of the space of flows, then, affect everyone in the same way that building a new highway affects everyone, not just the people who drive on it.

Important is that the space of flows both the real time interaction of people who are physically distant from one another as well as the material infrastructure that makes this possible, in other words, the space of flow has both material and immaterial aspects.

**Material and informational dimensions**

What Ford's Rouge Plant was for the centralization of industrialism is the airport for the space of flows: a massive tangible symbol.

From an architectural point of view, airports are among the most extensive and complex projects ever. And it's perhaps only a little exaggeration to say that airports are today what cathedrals were in the middle ages, and train stations and factories were in 19th century: large collective efforts devoted to key institutions of their time.

Airports have been growing and multiplying for the last 50 years. Increasingly, airports are becoming so big that they threaten to destroy the landscapes they are supposed to serve. The growth of airports has turned into a major political battle nearly everywhere where expansion becomes necessary. One of the recent solution to the problem that airports pose to cities which need them but are in danger of being swallowed up by them, is to move them away from the urban landscape. But not just from the urban landscape, but from the historical landscape in general and place them on artificial island.

Rather than bringing the airport to the cities, new cities are being created around the airports. Or, to put it bluntly, flows create places, rather than other way around.

These islands are virtually self-sufficient hubs intensively connected to other major hubs and increasingly disconnected from the region they serve. The first major airport on an artificial island was Osaka's Kansai Airport which opened in 1994. Four years later, on July 6, 1998, the second such airport opened, Hong Kong's Chek Lap Kok. This airport consumed the gigantic amount of US$20.8 billion to be build and can handle 35 million passengers and 3million tons of cargo per year. This capacity can be gradually expanded to 87 million passengers and 9 million tons of cargo a year by 2040.

This year, the New Inchon International Airport in Korea opened. The promoters call it "winged city" but it might as well be called a city of flows. In promotional material it is heralded as, and I quote, "an off-shore airport for 24-hours-day operation, that is free of noise. Time differences between countries will not affect Inchon International Airport because it will be operated around the clock."

This is a place outside the confines of real space.

The new airport has currently a capacity of 27 million passengers. When its fourth and final phase is completed in 2020, Inchon will be able to handle from 80 million to 100 million passengers per year on four runways. This is about twice the entire population of South Korea (47.5 million).

In Europe, the Schipol airport is facing severe limitations to grow in the densely populated agglomeration of Amsterdam. As a solution Rem Koolhaas proposes to build a new city - a kind of branch office of the Netherlands, on an artificial island in the Atlantic ocean. At its center would be a giant airport, a new European hub. But the new island is not just an airport, it is a full featured hub in the space of flows. It envisioned to incorporate a vast complex of entertainment and business centers that would fund the development, along with housing for a growing international population that Koolhaas calls "the kinetic elite," borrowing a term coined by the philosopher Peter Sloterdijk.

The kinetic elite are the people who live predominantly within the space of flows, people who travel hundreds of thousands of miles every year, who need not a home but a home base, a comfortable and convenient place in which to recuperate while waiting for the next flight.

While it has not yet been decided I believe if and how this new airport will be built, the logic of removing the airport from the local city and recreating it as self-contained hub for the flows of people, goods and information is very compelling.

Similarly to the way the air transportation system is built as a structure of hubs of different sizes global, regional and local so are the information networks, the public Internet as well as the closed, proprietary networks.

Three aspects define topology of these networks:
Sprocessing power,
Sbandwidth, and
Sprotocols.

Let's start with the most obvious one: processing power. Processing power defines the types of operations that can be handled by the given piece of hardware and the time it takes to complete the operation. Every operation requires a certain minimum of processing power. If the hardware does not meet the requirements, the operation fails. If the operation needs to be completed in real time for example the graphic rendering of financial data then the minimum requirements of computing power increase dramatically. Processing power shapes the topology by defining the types of connection a given node can make within the network. If you have slow computer, it will crash under the load of a big java script.

However, in order to process really complex information, you do not only needs an advanced computing infrastructure. You need an advanced infrastructure on all levels, including a lot of services to maintain the infrastructure and to make sense out of the information processed. Equally critical, you need to have the resources to act based on the knowledge created out of the masses of data. Saskia Sassen (1991) talked about this clustering of advanced and mundane

professional services in major centers of information flows in her books on "global cities".

The second parameter that creates the topology of the network is bandwidth. The bandwidth of a connection defines the amount of data that can be transferred in a given time. Hence bandwidth defines the maximum connection speed in the same way that the size of a hose defines how much water can be pumped through it. The higher the bandwidth, the higher the data throughput. As George Gilder used to say before his stock index collapsed, bandwidth changes everything. Well, perhaps not everything we see now, but bandwidth is very important. Filesharing systems like Napster, for example, would never have become important if we all were still using only dial-up modem connection. A high bandwidth does not only speed up the transfer, it makes different kind exchange patters possible. Particular for real time applications, bandwidth is critical. While I may be willing to wait have an hour to download an MP3 file that I really want, video conferencing is impossible if the data cannot be transmitted in real time.

In terms of topology one can say that high bandwidth nodes tend to connect to other high bandwidth nodes whereas low-bandwidth nodes tend to communicate other low bandwidth nodes. If you have a 14.4 connection to the Internet, you are not going to access multi-media rich sites, but you will stick to simple text-based sites. Since the speed of a connection is limited by the slowest link in the chain of transmission, if consistent high speed is required, a dedicated network has to be created. This is what happened with the so-called Internet2. Internet2 is an experimental network that connects some of the premier research sites, many in American universities, to another through connections that run parallel to the existing Internet in order to guarantee consistent extremely high bandwidth. On the Internet2, things like fully immersive video conferencing are possible, but only with other sites connected to this elite network.

There is an obvious parallel to airports here. Large airports are the high-bandwidth nodes in the flows if people and goods. Like high-bandwidth nodes in all flows, they tend to privilege communication to other high-bandwidth nodes, that is, to other mega airports. That is one of the reasons why it is often several hundred $ cheaper to fly from, say, Toronto to London, than to fly from Toronto to Timmins, even though the London is on another continent while Timmins is within the same province.

The third and final topological parameter of a computer network are the protocols used to exchange data. For computers to communicate, they need on a two sets of protocol. First, the communication protocol that let's them exchange data. The Internet, basically, is defined by a communication protocol called TCP/IP which stands for Transmission Control Protocol/Internet Protocol. Any computer that does not communicate by TCP/IP is inaccessible through the Internet. The second type of protocol are what one might call application protocols, such as HTTP which stands for HyperText Transmission Protocol and is the protocol that makes it possible to access web pages. There are any number of these application protocols for different applications such as email, telnet, file sharing systems and so on.

The important thing about protocols is that is relatively easy, and very effective, to make nodes or content inaccessible by switching to a different type of

protocol, or to control network traffic on the basis of protocols. During a recent visit to China, for example, I noticed that publicly accessible cybercafes all block so-called secure shell connections, by which it is possible to establish an encrypted connection to another computer that makes eavesdropping on the content transmitted very hard. For obvious reasons, the Chinese government does not want people to connect to foreign servers in a completely private manner. All the government had to do was to block this protocol. Closer to home, many universities have used a similar approach to block Napster traffic which uses a specific protocol that can be easily posted and isolated in the overall traffic.

In a decentralized computer network such as the Internet every node *could* be connected to every other. The network *could* be entirely flat. The entire world is at our fingertips, we know the hype. However, the unequal distribution of computing power, bandwidth and the flexible architecture of communication and application protocols introduced a complex topography that shapes what kind of connection can be made, and creates new centers as well as new peripheries.

**Immaterial aspects.**

Within the parameters of this topology, which itself is rather flexible, the flows of information are fast moving and generally extremely flexible. While they cannot jump outside this topology, butwithin it virtually any direction and connection is possible. However, how the information flows is not random but itself shaped by a number of characteristics. I will mention two pairs: Interdependence and differentiation on the one hand, and Time-dependence and change on the other.

First, flows connect, pure and simple. There can be no flow in one place, flows necessarily are between place. This creates interdependence. Isolation is death. Like all electronic currents, electronic information flows between differences. Data is turned to information through context, that is by relating it to other data. The two pieces of data need to be different enough so that when related to one another, a difference can be seen. As Gregory Bateson (1972) noted: Information is the difference that makes a difference.

On the other hand the two pieces of data need to be similar enough so that they can be related at all. The value of data, or anything else within the space of flows for that matter, is not intrinsic, but it's based to what is can be related to.

Marshal McLuhan (1972) once said "the meaning of meaning is relationship." By this he meant, that there is no content without context and that the importance of a piece of information, its real meaning, changes depending on what it is related to. What turns data into information is the creation of a context. What turns information into knowledge in the expansion of this context. The difference between data, information, and knowledge is the amount of relationships that are contained within it. Data is meaningless: If I say, 23 degree Celsius that means nothing because it doesn't relate to anything. 23 degree Celsius of what? If I say today in Paris it's 23 degree Celsius, data becomes information. the temperature is related to a place and a time. From a relationship, meaning emerges. If I say, today in Paris it's 23 degree Celsius and I better take a jacket with me because in the evening it can get cold and I

probably won't go back to the hotel, information is transferred into knowledge because it relates the data to a great deal of other information, my previous experience of Paris weather, the expectation of my itinerary for the rest of the day, the stuff that's in my suitcase and so on.

This need to be sufficiently different while at the same time compatible in order to attract and contribute to the information flows, reinforces to some degrees the topology of the network. Hubs that are similar tend to communicate with one another, while, at the same time, they intensely compete against one another. Under these circumstances, the difference between competition and cooperation is blurring. This, of course, does not mean that networks foster a more harmonious communication style, not at all, but it means that within larger processes, elements of cooperation and competition intermix.

Saskia Sassen's world cities New York, Tokyo, London are a good examples for this. In terms of the network topology, they are very similar. They are major hubs in the global financial networks. Hence they are well able to communicate with one another. However, it's the differences that link those three cities to one another. In particular and most obviously, their location in different time zone which allows them to operate as a 24 hour unit. Large financial services firms routinely pass portfolios from one hub to the next so that they can be worked on all the time. These cities are highly interdependent and differentiated from one another at the same time.

Let's move to the second pair of characteristics of information flows: change and time-dependence. The flow of data does not simply connect two nodes. By connecting they change what they relate. A bridge does not simply couple two independent villages across a river, it creates a new city. Immaterial flows of data are extremely malleable. Out of changes new relationships arise, bringing into a sudden interdependence what once seemed to be independent. On the other hand, cutting existing flows can separate what was once closely related.

The current wave of mergers and out-sourcing reflects the reorganization of institutional structures as they struggle to adapt to the changes in data flows.

Change, however, is neither additive nor subtractive in the space of flows. It is integral or *ecological.* A single change can accelerate into dynamics that lead to total change. If one removes a species from a given habitat, one is not left with the same environment minus that one species: one has created a new environment and reconstituted the conditions of survival. In a similar way, change ripples through an environment of electronic information. New flows of information can change everything. The interdependence of the nodes creates a world in which flows can travel through the entire environment and, according to the way it is reshaped in each node, they increase or decrease in size or velocity.

In an environment where change is ubiquitous and sudden, the mode of survival is adaptation instead of optimization, which has been the key strategy under the linear development in the industrial age. The newest version of a software product is not better because it has fewer bugs, indeed, often it has more bugs, but it is better because it incorporates new capabilities adapting to the fast-paced changes of the environment.

The second aspect of the his type of change is the increasing importance of time. In an environment where data flows very quickly, at the speed of light through computer networks, and the new interrelations arise as fast as old connections die, time is a central factor in the process. Nothing is fixed, unless it is continuously supported. A server that is no longer maintained disappears with the next crash, which is usually not far away. But this fragility is not primarily on the level of the infrastructure, which has proven to be, overall, quite stable, despite viruses and various kinds of attacks. The fragility of the electronic environment comes from the speed at which the flows change. Sometimes this change comes with such a force that entire institutions are unable to adapt and are destroyed. Quick moves in the capital markets can wipe out institutions that were once the foundation of global empires, as the fall of the oldest British merchant bank, Barings Plc., dramatically demonstrated in the mid 1990s. In this particular case, the volatility of financial markets was, in part, caused by the volatility of the earth's crust, the earthquake in Kobe, a rare concurrence of two flows that move at very different speeds.

Data can be turned into valuable information only as long as it is timely. The time span in which information really makes a difference is not intrinsic to the data itself, but is determined by the relation that are created with it. For the dealer in the capital markets 15 minutes old quotes are worthless, for the journalist who prepares the daily summary for a newspaper they are valid, and for the analyst who tries to develop models for predicting the future movements the quotes of the last couple of years may be of crucial importance as a testing-ground for his models.

**The possible impact on the organization of physical space.**

The space of flows emerged when it became necessary and possible to integrate entities that are physically far apart into the single units than can work in real time. Networking previously isolated computers reversed the trend towards centralization, which dominated the industrialization. A new, networked mode of organization is becoming typical for the information society.

Increasingly, our societies are depending on, and organized through, ever larger flows of people, goods and information. On an informational level, these flows are characterized by an extreme flexibility and distinctive patterns. I identified the pairs of interdependence and differentiation as well as time-dependence and integral change as characteristic for the flows of electronic information.

Within computer networks, distance is binary. This means that information is either here or not accessible at all. Everything that is available is available at equal distance. Everything else is unreachable. There is no approaching in cyberspace. It's on or off.

Quick to spot new trends, the business press has pronounced the Death of Distance. In September 1995, for example, the Economist wrote:

Carrying a call from London to New York costs virtually the same as carrying it from one house to the next. The death of distance...will probably be the single-most important economic force shaping society in the first half of the next century. (The Economist, September 30, 1995, pp. 15, 27)

I hope it comes as no surprise that I think the death of distance is a useless concept for understanding the effect the space of flows has on the space of place. Already the example chosen, a telephone call between London and New York, is revealing. The death of distance implies the optimistic vision that everything becomes more closely connected. The example, however, indicates that major cities around the world are growing into one mega complex. It's seductive to believe that this is one and the same movement, but in fact, that is hardly the case. Like Gill Gates' vision of the friction-free capitalism, the death of distance is a highly selective extrapolation of a few technological trends.

This does not mean that the example is incorrect, it's just very very selective. London and New York are becoming more integrated. However, this is not so much the effect of a general death of distance. Rather, it's a indication how the space of flows connects places to one another that are similar and thushow the space of flows is actively reconfiguring the space of places. I have already talked about the fact that airports the quintessential hubs in the space of flows are becoming so big that they threaten to destroy traditional cities. The solution is to create new artificial landscapes that are entirely built to accommodate and support flows.

As my discussion of the network topology has indicated hubs of similar size tend communicate with one another, so the merging of London, New York and Tokyo into a 24 hours financial network-space is not surprising. The same happens on the low end of the space of flows: the cheap export processing zones full of sweatshops. They are also merging into a integrated global network-space. Within such space, the flexibility is great. It takes comparatively little to move the production of Nike shoes from Guatemala to Sri Lanka.

The space of flows is highly stratified and a new geography of distance is emerging. Distance is increasingly defined functionally, rather than geographically. As Saskia Sassen reported, the real estate prices in certain areas of Manhattan fluctuate in close association with the real estate prices in comparable areas of Frankfurt and London. They are, to some extent, independent from the general ups and downs of the real estate markets in the greater New York area. In other words, as much as there is a horizontal integration and a merging of distant places that have a similar profile, there is a vertical growth of distance within existing locales.

At the same time, not only the relationships across places changes through highly specific patterns of integration and disintegration. The structure within places changes to due to their connection to the space of flows. Most importantly, flexibility and adaptation to change becomes more important as change becomes more faster and more a regular feature. Organizational structures change and with this, the spatial needs of those organizations change too. As I mentioned, the dominant mode of industrial organization was centralization, whereas informational organization tends to be more network oriented because such a mode is flexible and can adapt more easily to the what I called *ecological change* in the space of flows.

The cars that Ford produced at its Rouge Plant in Dearborn Michigan were all black. Millions upon millions of black cars. This is industrial production. Nike, on the other hand, allows its customers to choose from a number of variables to design of a single their pair of shoes through a web page, right down to the

having a personal name stitched into the shoe. Essentially creating a shoe that is produced exactly once. This is informational production.

My hypothesis, which perhaps we can examine in the discussion or this afternoon during the panel discussion, is the following: The power of and in the space of flows will drive cities to re-invent themselves. Given the highly differentiated network topology, the cities are, of course, by no means obsolete. However, their new role is less a center of a region to which they are closely linked, but as a hub within a global or regional network of cities of equal size and characteristics.

**References:**


Bateson, Gregory (1972). *Steps to an Ecology of Mind.* New York: Ballentine Books

Beniger, James R. (1986). *The Control Revolution: Technological and Economic Origins of the Information Society.* Cambridge, MA: Harvard University Press

Castells, Manuel (1996). *The Rise of the Network Society, The Information Age: Economy, Society and Culture,* Vol. I. Cambridge, MA; Oxford, UK: Blackwell

Harvey, David (1989). *The Condition of Postmodernity: An Inquiry into the Origins of Cultural Change.* Oxford, UK: Blackwell Publishers

McLuhan, Marshall; Nevitt, Barrington (1972). *Take Today: The Executive as Dropout.* Don Mills, Ont.: Longman Canada Ltd

Rowland, Wade (1997). *The Spirit of the Web: The Age of Information From Telegraph to Internet.* Toronto: Sommerville

Sassen, Saskia (1991). *The Global City: New York, London, Tokyo.* Princeton, NJ: Princeton University Press

Winston, Brian (1998). *Media Technology and Society: A History from the Telegraph to the Internet.* London: Routledge

Wriston, Walter (1992). *The Twilight of Sovereignty. How the Information Revolution is Transforming Our World.* New York, Toronto: Maxwell Macmillan


---

Visualisaties / cartografie van elektronische netwerken:

www.cybergeography.org

"An Atlas of Cyberspaces"