

The organization of space

(Lecture: Semiology of Cyberspace by Francis Hunger)

The notion of cyberspace is quite blurred at the moment and lays out many traps, so I would like to give some ideas on, what it is all about. It is really difficult to trace the appearance of the term but all the sources lead to William Gibsons novel “Neuromancer”, where he introduces the concept of cyberspace along such concepts like the sprawl, an extensive urban area or the figure of the cyberpunk, a sub cultural construction of data pirates. Gibson already uses the term cyberspace in his 1981 short story “Burning Chrome” but develops it more detailed in 1984s Neuromancer. It has been often cited and I’ll repeat it again. “A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data. Like city lights, receding...” Even more remarkably: “... the unfolding of his distanceless home, his country, transparent 3D chessboard extending to infinity.”

In an interview Gibson mentions that he wanted to transfer utopian science fiction space travel to a more emotionally convincing contemporary level.¹ Gibson also mentions his interest in arcade video games. One of the earliest appearances of three-dimensional perspective in arcade games which I could track was the 1978 Night Driver by Atari – 6 years before Neuromancer.²



(Galaxian, 1979, Namco) - Flat

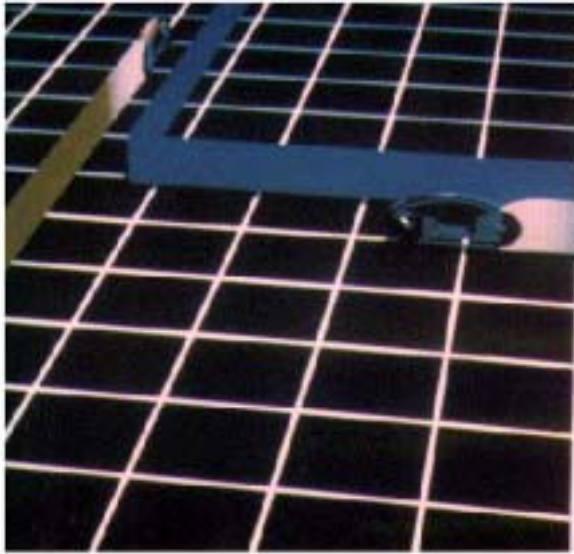


(Night Driver, 1978, Atari) - Perspective

Night driver is obviously deeply interconnected with the three dimensional perspective grid that later forms the concept of cyberspace and VR visualisation. Most of the other arcade games at that time were oriented two-dimensional, be it from a top perspective showing the XZ plane or the side perspective of the XY plane.

¹ “I invented cyberspace because traditional space travel as a metaphor, as it was in the books I read as a boy, wasn’t doing it for me emotionally.” William Gibson in: Robert Scott Martin, “Cyberspace, Outer Space”, Interview, http://www.space.com/sciencefiction/gibson_991026.html, as seen on 5.4.2004

² http://www.klov.com/game_detail.php?letter=N&game_id=8866



(Tron, Movie 1981, Screenshot) – 3D grid

Three dimensional perspective in arcade games goes along with the visualisation of virtual reality in the movie **Tron** 1981. There the code of a computer program was visualised in that way, that subprograms were represented by actors, while the data was represented by geometric objects in a spatial relation. The actors had to travel from A to B to do their performance.³ Whatever the makers of Tron or William Gibson have based their imagination on, they and many others refer to three-dimensional spatial relation of data in a grid of discrete units.

These are some traces on the term cyberspace, but it soon becomes clear that it heavily overlaps with what we call virtual reality, a term coined in 1989 by the programmer Jaron Lanier which refers to the 1970 use of the term “artificial reality” introduced by Myron Kreuger. Virtual Reality in short is an immersive simulation that allows the users to interact through tele-presence with another or with a computer, a machine. To create a certain state of immersion Virtual Reality systems usually consist of a headset and dataglove and a fast computer to simulate three dimensional space in real time. There are many fantasies connected to Virtual Reality. The basic fantasy was the Sensorama Simulator by the cinematographer Norton Heilig in 1962. The viewer could have a motorbike ride in a rumbling seat, 3D movie screened, stereo sound and even a fan simulating wind. However the interactivity was reduced to throwing a coin in, which would start the Sensorama Simulator. It seems like little has been produced to further the interactive experience since.

³ It would lead to far to speculate if this model is already based on the knowledge of Object Oriented Programming which shifted programming from data and loop orientation to Objects which combine status and process in one entity. The concept of OOP was introduced to the public with the Programming Language Smalltalk in 1974 by the same research group which also developed the Windows-Desktop metaphor to add a little more background on this

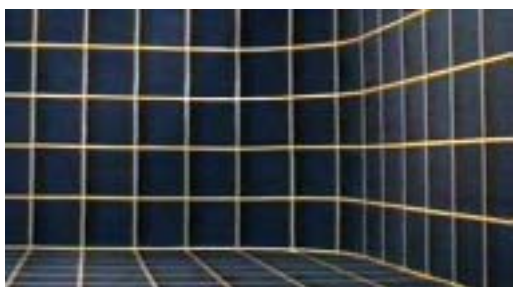


(Norton Heiligs Sensorama, 1962)

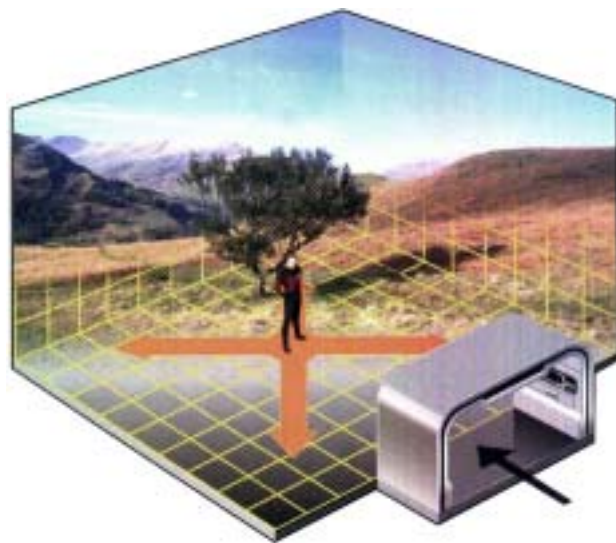


Other major conceptual steps in virtual reality were made in 1981 when viewpoint dependent imaging was developed and from 1985 on the dataglove, which could eventually replace the mouse invented by Douglas Engelbart 20 years before. However the early 1980s was the time when the mouse became the navigational instrument for personal computers. The Apple MacIntosh, released in 1984, was the first widespread personal computer to use the windows oriented desktop metaphor for user interaction together with a mouse as input device.

The technical developments of Virtual Reality found their way into broader public with the 1987 TV series Enterprise The Next Generation holodeck, which is the utopian model of total immersion into an interactive simulation space including all human senses. Enterprises holodeck thus became one of the first grounds for more public debates on the concepts of VR.

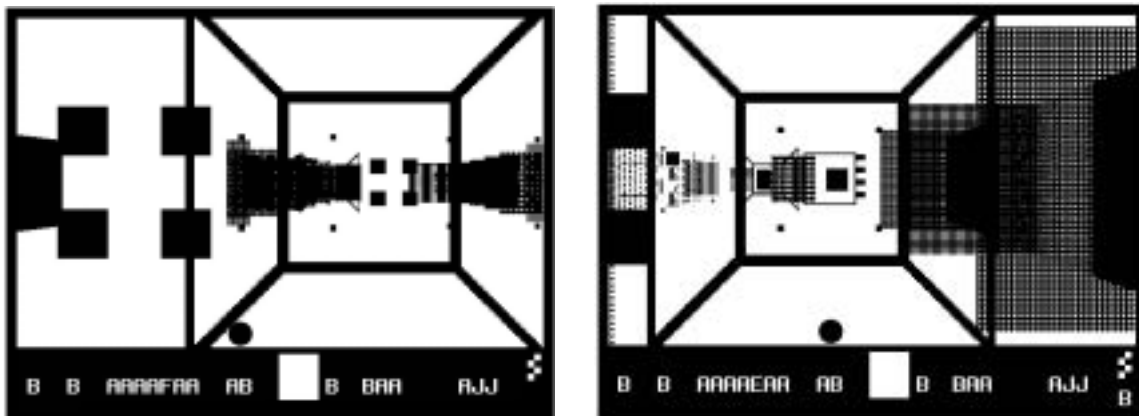


(Enterprise The Next Generation: Holodeck Grid)



The totalitarian potential of total immersion however was described already by Aldous Huxley in his novel *Brave New World* (1932). He invented the drug-related so called “feelies” which were used for personal recreation and entertainment by absorbing the user into another, a “positive” reality.

While cyberspace originates from concepts of real time constructed space in arcade games, Virtual Reality grew from the concept of immersion in motion picture. These two different threads are connected with different concepts of how a better immersion can be reached. One concept was named the constructivist approach. Another approach was data oriented. The data-oriented view would insist that a greater immersion would be reached, by increasing the amount and the quality of data streams to the human sensoric organs. This clearly refers to movies and the Sensorama. The constructivists on the other hand would argue, that if the human mind would be engaged in the construction process of the reality much more, it would be possible to limit sensory input.. The constructivist approach refers to early computer games with their reduced graphics display. Other good example could be MUDs and MOO-environments.⁴ After the increasing processor power over the last 20 years the most popular virtual realities in form of ego shooter games prefer the data-oriented and not the constructivist structure. Artists like JODI tried to reveal this development with their modifications of ego-shooters, called SOD and *Untitled Game*.⁵



(Screenshots of JODI's ego shooter modification SOD, 1998, from perspective to flat)

Although VR is not the same as cyberspace, many of their concepts overlap. When I'm talking furthermore about cyberspace, not mentioning Virtual Reality, we still should keep that in mind.

⁴ see Coyne Richard, Heidegger and Virtual Reality: The implications of Heidegger's thinking for computer representations. *Leonardo Journal*, Nr. 27, 1994

⁵ <http://sod.jodi.org>, <http://www.untitled-game.org>, see Hunger, Francis: *Perspective Engines – An Interview with Jodi*, in *Transformreality*, ed. by Andy Clarke and Grethe Mitchell, anomos, Paris, 2004

Cartesian Coordinates

What is obviously inherent to these major concepts of cyberspace is the use of the Cartesian model of a grid that allows us to allocate coordinates. But it wasn't just Descartes, after whom the Cartesian model is named, who introduced this way of understanding perspective.

Perhaps the first notion of dimensions in geometry is known to be from Nicholas Oresme of France who published his treatise "De configurationibus qualitatum et motuum" (around 1350). It was a critical discussion on the widespread Aristotelian ideas of space and motion. To support his critique of Aristotle, Oresme developed systems of polar coordinates, a three-dimensional coordinate system and even something which we could roughly understand as four-dimensional coordinate system in order to establish his ideas of objects and motion differently. Of course at this time there were no means of mathematical or geographic description in form of equation. At that time spatial theorems were a text based discussion of ideas.



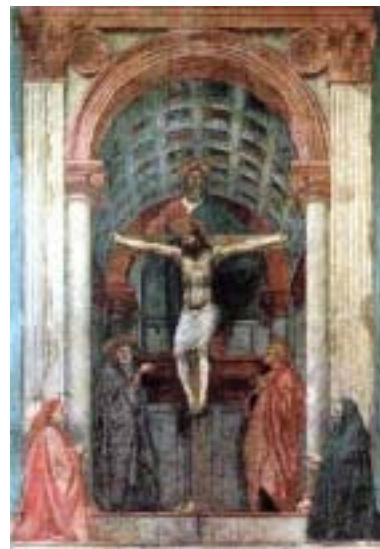
(Nicholas Oresme)

Brunelleschi in 1425 however was the first architect to employ mathematical perspective to redefine Gothic and Romanesque space and to establish new rules of proportioning and symmetry which is seen in the San Lorenzo Church in Florence. He invented a technique for representing three-dimensional images on a two-dimensional plane using a system of mirrors and a calliper.⁶

In the same time the Italian painter Masaccio developed perspective in painting deeply influenced by Brunelleschi from whom he learned how to apply perspective.



(Masaccio, "Crucifixion" 1426, 83 x 63)



(Masaccio, Trinity around 1430)

⁶ It was the same years that Michelangelo worked on the chapel of the San Lorenzo Church.

Leone Battista Alberti, who studied the representation of three-dimensional objects, wrote the first general treatise “Della Pictura” describing the laws of perspective in 1435. He was a good friend of Brunelleschi.⁷ He explained the rules and optical methods for rendering a three-dimensional image onto a two-dimensional plane, establishing the “view through an open window” as the main method for perspective painting. He thus introduced formally the concept of a single, fixed vantage point from the eye of the artist leading to an objectification of spatial awareness in the renaissance. He thus initiated what we know now as perspective image, a reduction of the real in favour to an abstract surface, mathematical coordinates and a uniform, continuous and homogenous space. It is also a step towards a simulation of “the real” in fine arts eventually leading to the realism in visual art.⁸

This development lead to an objectification of the thing, when the grid transformed *land* into *landscape* and allowed the observer to apply a distance to the observed. This process also lead to reduction and eventually to segregation. The evolving perspective consciousness allows a single viewpoint. This single viewpoint enables the viewer to look through a window onto the world. This raises the self, the “I”, which now appears to be fixed, unchanging, and independent from the phenomena. “By taking up a position or vantage point, the self could impose its meaning on the world. The self [is] now identified with its unique ‘point-of-view’.” (Ronald Purser)⁹



And this is where **Rene Descartes (1596-1650)** steps in. However this not the place and time to satisfactory discuss Descartes. I just would like to mention that I’m aware of the criticism on his dividing of object from subject, body from brain and so on. Descartes emphasized, that he would like every science to rely on the accuracy of mathematics. This retrospectively makes him one of the founding fathers (sic!) of the ideology of scientific objectivity or how he called it: “The truth without doubt”.¹⁰

However coming back to Descartes influence on geometry and algebra it is important to understand that he was the one who created a model that includes both. He made it possible to handle geometry with algebraic equations, which until then was thought of as being absolutely different things. This crucial paradigm shift

⁷ see Dr Russell Naughton: “Adventures in Cybersound - Leone Battista Alberti: 1404 – 1472”, http://www.acmi.net.au/AIC/ALBERTI_BIO.html

⁸ see Ronald E. Purser “Cyberspace and Its Limits: Hypermodern Detours in the Evolution of Consciousness”, <http://userwww.sfsu.edu/~rpurser/revise/pages/Cyberspace%2012.htm>, accessed on 27.3..2004

⁹ *ibid.*

¹⁰ Critique of mathematic formalism c.f. Heintz, Bettina 1993: "Die Herrschaft der Regel. Zur Grundlagengeschichte des Computers", FFM: Campus

from medieval conception and perception of space was partly influenced by the writings of Oresme 300 years earlier.¹¹

In 1637 Descartes who in the meantime had settled down in Holland, published three appendices alongside his treatise “Discourse on the Method of Rightly Conducting the Reason in the Search for Truth in the Sciences”.¹² One of the appendices was “La geometrie”. I will cite the achievements of Descartes resumed by Joseph Scott in 1952:

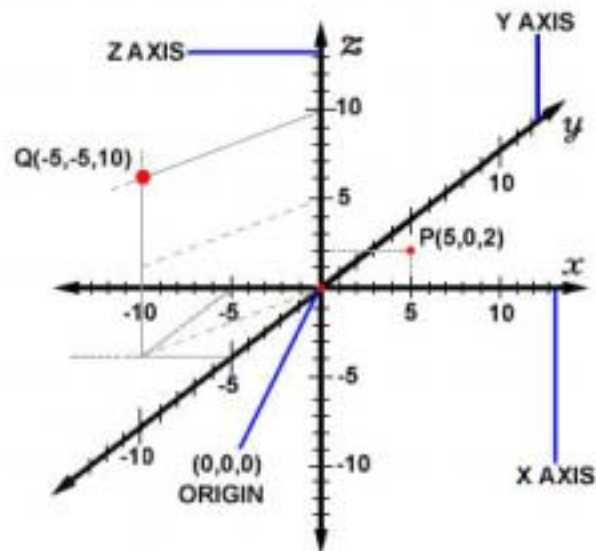
“[...]”

2. Algebra makes it possible to recognise the typical problems in geometry and to bring together problems which in geometrical dress would not appear to be related at all.

3. Algebra imports into geometry the most natural principles of division [...].

4. Not only can questions of solvability and geometrical possibility be decided elegantly, quickly and fully from the parallel algebra, without it they cannot be decided at all.”¹³

Here we have the red dots which can be connected with a line. Luckily we can read the coordinates of the dots so we can equate if any other line is parallel to the first line with only the help of algebra. We don't need the graphical representation anymore but can apply algebra to all given coordinates. Descartes showed how to translate problems in geometry into algebraic problems by using a coordinate system to describe the problem.



3 DIMENSIONAL CARTESIAN COORDINATE SYSTEM

(ill. From wikipedia.org¹⁴)

Today we rely strongly on what is called Cartesian bias, which means that our perception of space is deeply interwoven with the three-dimensional Cartesian coordinate model, where space is perceived as being divided into fixed, discrete units.

¹¹ I found no evidence of a direct influence of Brunelleschi and Alberti but for sure they influenced the development of the concept of subject-object differentiation which is crucially to Descartes way of thinking. There is no proof for this. Indeed Descartes stated that he perceived all the ideas on his own. However, different sources say that he most likely knew about Oresmes findings, because Oresmes treatises were widely spread at this time.

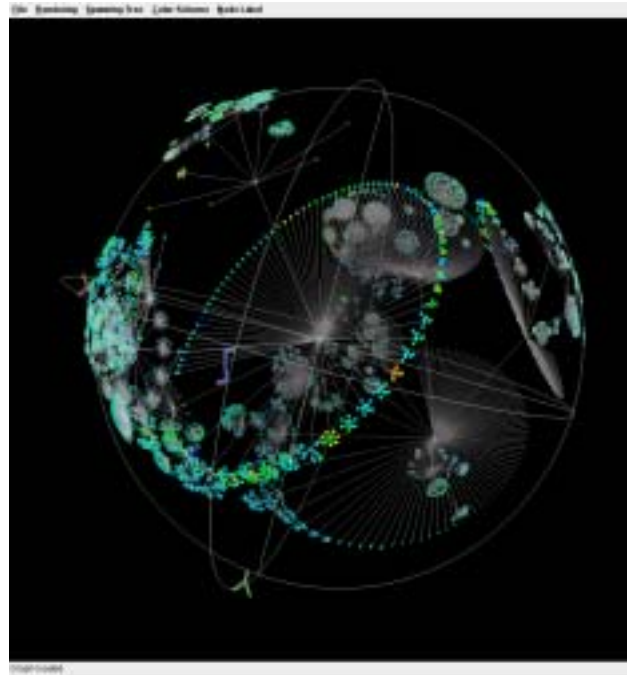
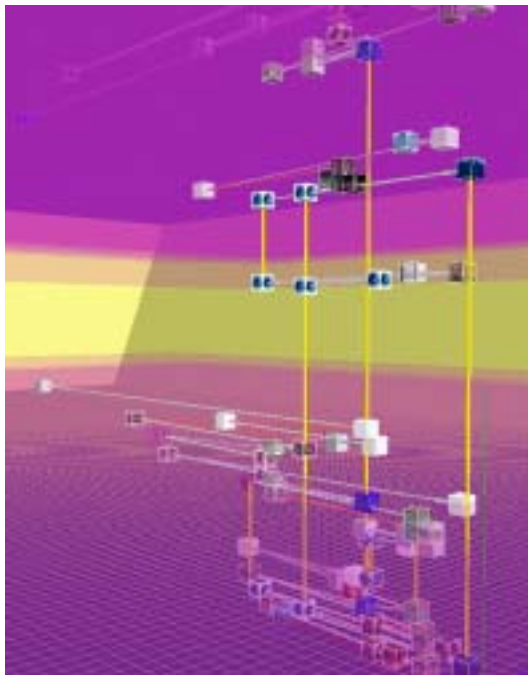
¹² J J O'Connor and E F Robertson : René Descartes <http://www-history.mcs.st-andrews.ac.uk/Mathematicians/Descartes.html>

¹³ J F Scott, The Scientific Work of René Descartes (1952, reprinted 1987)

¹⁴ http://en.wikipedia.org/wiki/Cartesian_coordinate_system

To cite the philosopher Chris Lang: “According to the Cartesian view, space exists independent of the objects that may or may not exist inside it. This contrasts to geometries, such as that of cyberspace, in which “space” is no more than a property of objects, a metaphor describing their relationships to each other. Since humans only measure space and time by bounding them with objects, we will never be able to empirically prove which of these kinds of space/time most accurately describes reality (nor should we care). Einstein's theory of relativity reflects these limits of our perspective by expressing space and time as functions of the objects they hold, suggesting that space and time “bend” in response to the velocity and force between the observer and observed objects.”¹⁵

Luckily this brings us back to cyberspace. As Lang notes, cyberspace is constituted from the relation of objects rather than from discrete unites. I would mark this comment as a philosophers wishful thinking, as still many models explain cyberspace in discrete unites independent from the objects contained in the space. While looking through www.cyberspace.org (9th April 2004) most of the visualisations which could be found there where based on a continuous space in discrete units, wherein data-objects where placed. I’ve found two main models: Cartesian coordinates and Polar Coordinates.



¹⁵ Lang, Chris: Cartesian Bias, 1999, <http://philosophy.wisc.edu/lang/pd/pd17.htm>, continuation: “The Cartesian view of space and time also includes the notion that each object has its own position and trajectory, independent of other objects. Again, this is something we’ll never be able to confirm, since space and time (in terms of which we measure positions and trajectories) is supposedly “bent” by surrounding objects. Thus, as far as we can tell, the positions and trajectories of objects may only exist relative to other objects. Quantum theory circumvents this issue by modelling positions and trajectories as probability distributions. By thus sacrificing the notion of singular position and trajectory, we avoid the need to account for all of the influences of surrounding objects. This permits us to preserve the notion that objects have independent positions and trajectories.

Since we don’t usually face relativistic and quantum extremes directly, it was natural for humanity to evolve an instinct for the Cartesian view. By 1781, Immanuel Kant even mistook this viewpoint to be a fundamental property of intuition. Now, unfortunately, we must struggle against it to reach a full understanding of relativity and quantum mechanics. That’s why these theories are usually addressed fully only at the culmination of a scientist’s education. Much as young children find it difficult to understand how short wide vessels could possibly hold as much as tall thin ones, it takes a great deal of intellectual maturity to understand how the geometry of our universe could possibly differ so much from the Cartesian geometry we’ve instinctively assumed all our lives.”

Left: WebPath, "... a tool that unobtrusively visualises a user's trail as they browse the Web", developed by Emmanuel Frécon, a researcher in the Distributed Collaborative Environments group at SICS, and Gareth Smith in the Computing Department, at Lancaster University (1998) It obviously uses a raster based on Cartesian Geometry

Right: A directory tree, visualised with Walrus, a tool for interactively visualizing large directed graphs in three-dimensional space. By employing a fisheye-like distortion, it provides a display that simultaneously shows local detail and the global context. This is based on polar coordinates, with longitude, altitude describing the position of an object in space.

To furthermore illustrate Cartesian Bias lets examine another artistic visualisation of cyberspace of the movie Hackers.¹⁶



Visualisation from the 1995 movie Hackers, clearly based on a coordinate model, with discrete units¹⁷

Of course we also have artistic approaches, in the realm of net.art dealing with the visualisation of cyberspace. There is the gorgeous work of Lisa Jeffbratt named 1:1.¹⁸ She describes it: "*1:1 was a project created in 1999 which consisted of a database that would eventually contain the [IP] addresses of every Web site in the world and interfaces through which to view and use the database. Crawlers were sent out on the Web to determine whether there was a Web site at a specific numerical address. If a site existed, whether it was accessible to the public or not, the address was stored in the database.*" Each unique server was represented by a pixel, where each IP address relates to the colour of that singular pixel.

¹⁶ I'll not discuss The Matrix movie here, in case someone expects it, because personally I need some more distance. The matrix has to become more historically to me until I would say anything on that.

¹⁷ A renegade group of elite computer hackers zip through New York City on their roller blades by day and ride the information highway by night. When one of their laptop invasions makes them the prime suspects in a high-stakes industrial conspiracy, they recruit the best of the cybernet underground to help clear their names.,

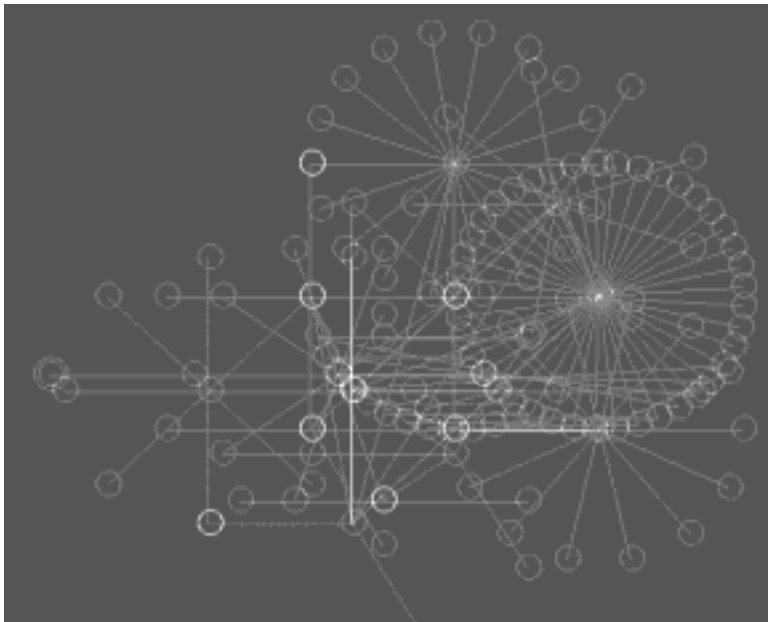
<http://movieweb.com/movies/film.php?1869>

¹⁸ http://128.111.69.4/~jevbratt/1_to_1/index_ng.html



(Lisa Jeffbratt, 1:1, 1999)

Next one is a section of the IOD Webstalker, a browser made with Director and Lingo to depict the html content of websites, extract a list of links from the page or three-dimensionally display the relation of the links within a website, as we see it here.¹⁹



(IOD, Webstalker, V.4 1998)

Both these works in my opinion are some of the most advanced artistic attempts to create another representation of data and information in cyberspace, but still they are caught in the Cartesian grid. This is not to blame them on that, rather to show, where we are now and to discuss the potential if we want to step further than that.

¹⁹ <http://www.backspace.org/iod/>

As far as I know, the following is usually *not* represented in depictions of cyberspace:

1. discontinuity of space, depending on the objects residing in the space
2. notion of time or even discontinuous time
3. sonification - use of sound to describe status and relations

Time and Space were discussed already earlier while point three needs some explanation: Of course it is not just about sound. From Virtual Reality we learn, that also touch, temperature, smell and so on are important pieces of information. I just pointed out sound to emphasize that all these elements can be used in a realistic manner, but they don't have to. They also could be used in a constructivist, abstract approach. People can recognize sound very easily. Even in a restaurant where music is running and people are talking, even in this noisy environment, we can clearly filter a talk from the neighbours table or listen to the singers voice of the background music. The use of a beep sound of the heart-beat on intensive care units in hospitals is another example that clearly shows that sound information can be very useful. So the use of sound for the depiction of data seems to be underestimated. To illustrate it, we could think of a browser emitting deep noisy sounds when approaching a "heavy" data entity. Then there could be another layer of sound - a high frequency click, like that of a Geiger counter - to illustrate the rate of exchanged data packets and so on.

I think I have unrolled many threads now. I can not follow each of these threads in detail and discuss it until I come to a "solution", whatever this would mean. I rather see this discussion as an inspiration for my past, recent and future works. This maybe also explains, why I only discussed one part of the notion of Cyberspace. There is however another part, characterized by notions like "Independence of Cyberspace",²⁰ "Information Superhighway", or "Access and Bandwidth for all". Anyway, when it comes to the "politics" of signs one might find out, that what I'm talking about is more political then one might think at first glance.

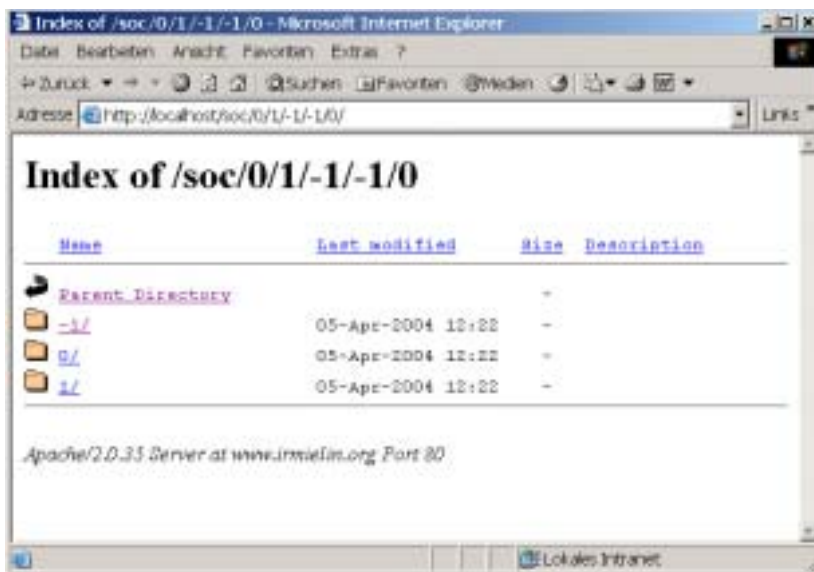
²⁰ Barlow, John Perry. „Cyberspace Declaration of Independence“, <http://www.eff.org/~barlow/Declaration-Final.html>

Semiology of Cyberspace

My work SOC which I produced during my stay here in Rotterdam at V2 deals primarily with these issues, although it does not address them directly. I'll give a short description of it. Some of the people attending have already heard this, so please forgive the repetition.

SOC is a sculpture in cyberspace made out of pure data. I wrote a small script in PERL, a widely available language on web servers. This program creates three directories, named -1, 0, 1 and within these three directories it creates the same structure again. Depending on the iteration depth, a complex, symmetrical structure emerges from the starting directory.

This is how the result of it looks in a common browser, depicting the data structure.



It would be interesting to see a depiction of the same data in 3D, but at this time only experimental approaches to depict data three-dimensionally in real-time exists. It still needs some time until the real beauty of the sculpture unfolds. One can imagine it perhaps resembling a 3D-snowflake.

The nice thing about these empty directories containing other empty directories is,

that it eats up a lot of webspace. Under Linux, each empty directory allocates a so called i-node which is usually worth 4 byte. Producing millions of directories thus can really cause some trouble. With the five iterations, illustrated above we thus produced already 363 directories, respective 1452 byte. In the 24th iteration the total number of directories sums up to 423 million directories which is about 1578 Gb or 1,5 Tb.



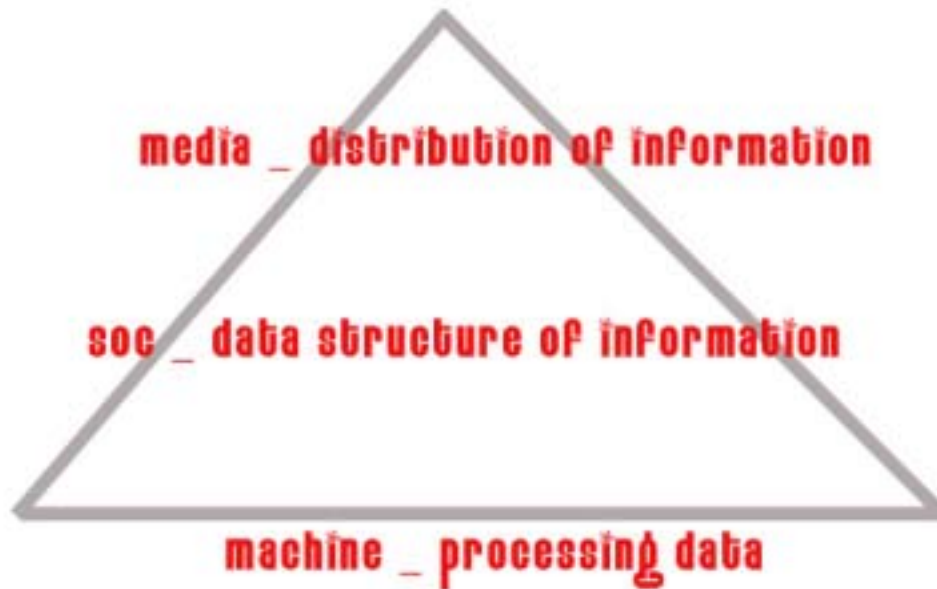
So my approach is to make this structure as big as possible. Until now I am still wait for the promise of sponsors to host this huge sculpture. The problems with hosting the structure don't start with the extraordinary dimensions. I'm also interested in keeping the structure online for at least 10 years.

To keep a marble sculpture for 100 years or more is relatively easy. Visual arts based on digital material is much more difficult do keep over a period. One of the questions raised is, what to do, if a certain part, a substructure of SOC falls apart, maybe due to a crashing hard disk. I decided to not restore it, so it resembles a sculpture in a museum. If some kids fool around with Michelangelo's David and destroy it, that's it. Of course you could try to glue it together again, depending on the kids aggression.

What is important in the context that I have drawn here is, that I'm just producing the data-objects. How these are depicted is up to the browser-software. I'm only producing signs, each

directory is just a reference to a container, which could contain any kind of other data like image, text, movie and so on. In simply producing the empty containers I'm thus indicating as well that which is being absent.

The computer can be seen as machine, processing data. SOC is made of pure data. SOC strongly refers to a machine like aesthetic. We also know that the computer is not only a machine but a medium as well. The networked computer as media has the ability to distribute information.



SOC is situated on the border area between machine and media. The directory structure is the machine, the absence of files refers inversely to the media. Everything that goes through the media is also going through the machine, as abstract data. If someone wants to discuss the politics of cyberspace, he or she can look to power relations, ownership, or copyright policies. I'm pointing to the performativity of code and to those who write code.

(April 2004)

<http://soc.irmielin.org>