Cyberspace, Cybertexts, Cybermaps

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Abstract

This paper argues that digital texts may involve four different types of space: (1) The physical space of the fictional world represented by the text. (2) The architecture of the text. (3) The material space occupied by the signs of the text. 4. The space that serves as context and container for the text. I will discuss digital texts that exploits each of these four types of space, paying special attention to the use of maps as interface.

According to cognitive linguists such as Lakoff and Johnson, language is a vast reservoir of fossilized metaphors, through which we talk about abstract entities in concrete terms. Because the fundamental human experience consists of apprehending ourselves as bodies located in space—because, in other words, the human body functions as the measure of all things—the vast majority of these metaphors invoke spatial concepts. The way we talk about recent developments in computer technology does not challenge this theory. Ever since the term "cyberspace" was borrowed from William Gibson's novel *Neuromancer* to refer to what we reach through computer networks, more particularly through the Internet, we have developed the habit of thinking of computers as machines that take us into a separate reality—a domain conceived in terms of spatial metaphors.

There is nothing inherently spatial about a collection of documents stored on computers and made accessible to us through fiber optic cables, except for the physical location of the computers and of the cables themselves. Nor does cyberspace present the basic properties of real-world geography. Far from being physically limited it expands indefinitely, as new pages are added to it, and you can homestead by building your own Web site without depriving others of the same opportunity. Rather than containing places and roads separated by more or less empty territories, it consists exclusively of places (the pages) and roads (the links), so that you cannot wander off-road: in cyberspace, you are either visiting a page, or on your way to a new page. The IP addresses and domain names not taken and the Web sites that no longer exit—the infamous "page not found" error messages of the browser--are not places that you traverse on your way to somewhere; they are non-

existing locations; and you simply cannot go there. In physical space there are long and short roads, depending on the closeness of the places which they connect, but in cyberspace all links are the same length. The speed of travel (read: of downloading) is not determined by the physical distance between your computer and the machine that hosts the data, but by the number of links to be traversed. If it weren't for delays and detours caused by traffic congestion and by the amount of data to be downloaded, movement between linked places would not be navigation but teletransportation—a mode of travel that denies the existence of separating distances. We move in physical space through a steady progression along a line, but we travel cyberspace in jumps, without experiencing a developing landscape, since there is nothing between our point of departure and our destination.

Despite these obvious differences between real and virtual geographies, the cyberspace metaphor invites us to think of the Internet as forming a parallel universe made of countless galaxies, planetary systems within these galaxies, worlds within these systems, and nations within these worlds.[1] The image of cyberspace produced by Andrew Wood, Nick Drew, Russell Beale and Bob Hendley [2] (figure 1) is a good example of this mental visualization.

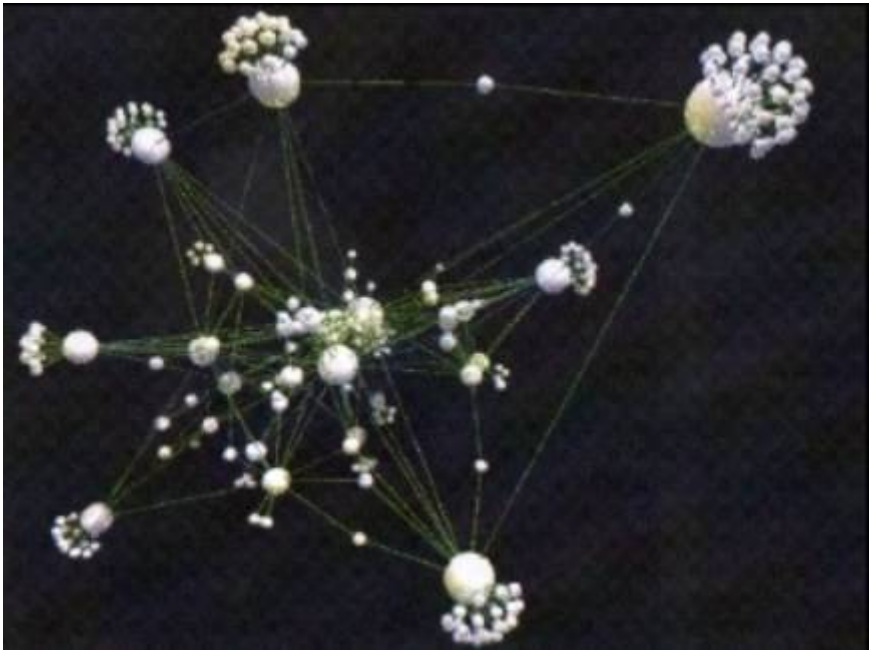

Figure 1:A visualization of cyberspace

To the imagination, Internet connections are the Rabbit Holes that allow us to slip out of physical reality, and to enter a data Wonderland where everything can undergo unlimited metamorphoses, because everything is made of bits whose value can change with every clock cycle of the machine. The technical jargon of Internet culture, with its "home" pages, suggests that Cyberspace is experienced as much a collection of places to inhabit, as an open space to be explored though aimless *flânerie*. The cybercartographers Dodge and Kitchin (relying on observations by P. Adam) observe that "cyberspace is replete with the vocabulary of place—nouns such as rooms, lobbies, highway, frontier, cafés; and verbs such as surf, inhabit, built, enter" (*Mapping Cyberspace*, 56). This sense of place is confirmed by what a cybernaut told Mark Dery: "I am staring at the computer screen. But the feeling is that I am really 'in' something. I am some 'where." (Dery, 7).

Far from being limited to the Internet, spatial metaphors have been used by scholars and developers to describe every imaginable kind of digital (or 'new media') object. Eastgate Systems named its pioneering hypertext writing software "Storyspace," and hypertext itself has been described as a labyrinth, or as a Garden of Forking Paths. Randall Walser describes the design of interactive virtual reality experiences as "spacemaking": "A spacemaker sets up a world for an audience to act directly within, and not just so the audience can imagine they are experiencing an interesting reality, but so they can experience it directly" (60). Slightly downplaying the importance of real-time action, Espen Aarseth claims that computer games are essentially "allegories of space." Lev Manovich sees the experience of moving around a simulated landscape as central to the popular appeal of games; and for Henry Jenkins, games are "spatial stories" that emerge from the encounter between the user and a world designed as a "narrative architecture" : a world made of discrete locations that contain opportunities for different user actions.

But if spatial metaphors have been invoked with respect to phenomena as different as the Internet as a whole, VR installations, computer games, and hypertext fiction, the meaning of "space" is itself a highly diversified territory. Whether print or digital, texts involve the following types of space:

1. The physical space of the fictional world represented or simulated by the text.
2. The architecture, or design, of the text itself.
3. The physical space occupied by the symbols that make up the text.
4. The space that serves as context and container for the text.

In this essay I propose to explore how these four types of space are put into play by digital texts. Since the standard interface to physical space is the map, it is only natural to expect that maps will play an important role in guiding users through the virtual spaces of digital texts. In the course of my investigation I will therefore pay

special attention to the use of maps or map-like devices, though not all four types of space have inspired cartographic interfaces.

Cyberspace cartography

The art of cartography has received an enormous boost from digital technology, and cybertexts have been quick to take advantage of the new possibilities. Dodge and Kitchin distinguish four types of maps: static, animated, interactive and dynamic (*Mapping Cyberspace* 72; reference good for all the quotes in this section). The last of the four types can only exist in digital environments.

The static type is self-explanatory: Dodge and Kitchin describe it as "the equivalent of traditional cartographic maps in that they are snapshots in time." The category is illustrated by any standard geographic map shown as a document in a cybertext.

Animated maps "portray a time series," without user intervention. A good use for an animated map would be to show how continents drifted away from each other over the past billion of years.

Interactive maps "move beyond static mappings so that the user can move through and interrogate the map from different viewpoints," for instance by zooming in and out, panning, or recentering the map around new coordinates. I would like to distinguish another type of interactivity not mentioned by Dodge and Kitchin: the map that serves as interface to a database. In this case the user's actions does not alter the display of the map, but clicking on certain spots will take the user to other Web addresses—this is to say, to other documents within the database.

Dynamic maps, finally, are diagrams "where the mapping automatically updates as the information used in its construction is updated." An example would be a weather map that is constantly redrawn, as meteorological information streams into the system. When the input comes from the user, dynamic maps are also interactive. In fact, a map could combine the three properties of interactivity, animation and dynamism.

When the concept of map applies to cyberspace, or to the digital objects contained in cyberspace, it must be taken in a broader sense than its literal definition of graphic representation of spatial data. Following once more Dodge and Kitchin (*Mapping Cyberspace*, 63),[3] we can distinguish four types of domains, or objects, and four types of maps or map-like diagrams:

1. Domains explicitly spatial with direct geographic referents: for instance, a VR simulation of a real place. The maps of these domains look like standard geographical maps.
2. Domains explicitly spatial without geographic referents, such as the imaginary worlds of computer games, or the architecture of MUDs. The

maps of these domains resemble geographic maps in their visual appearance, but they create their referent rather than modeling an external reality, in the same way fictional discourse creates a world rather than describing an independently existing world.

3. Domains with real-world referents but no inherently spatial structure, such as the structure of a computer network: you can move the computers without affecting the system of connections. The graphic representations of these objects are not maps in a literal sense but abstract, highly stylized diagrams of their internal organization. (Genuine maps, by contrast, have an iconic dimension, since they look like the territory seen from a bird's eye point of view.) Because non-spatial referents do not consist of objects located at precise coordinates on a Cartesian grid, they can be represented by many different diagrams.
4. Domains with no real-world referent and no spatial structure. The diagram of a narrative plot, for instance, is a spatial representation of a temporal process that takes place in an imaginary world. In the digital domain, one could think of a diagram of a non-spatial object used in a computer game: for instance, the player may have to study the structure of a fictional computer network in order to solve a problem, such as disabling the hub to prevent the enemy from communicating.

The cross-classification of these categories with the four spaces mentioned above yields the following associations: the space of the textual world belongs to either (1) or (2), depending on whether the text is a documentary or a fiction; the architecture of the text illustrates (3); the physical space occupied by the text is a real space of type (1); and the space that serves as container for the text can be either (1), if the text is bound to a physical location (as would be the case for a sign in an urban landscape), or (3), if this space is the computer hard drive or cyberspace itself. Alternatively, texts residing in cyberspace could be conceived as inhabiting type (4), if we draw an opposition between "cyberspace" and "real world." This would mean that "real" is interpreted as "physical," rather than as the opposite of imaginary and fictional.

1. Space of the Textual World

We cannot imagine individual objects without imagining the space, or the world that contains them. This means that whenever a text refers to or shows individual objects, it creates a textual world that extends beyond the boundaries of these objects in a three-dimensional space. (Why three-dimensional ? because we

imagine textual referents as similar to their real-world counterparts; and we experience real objects as three-dimensional volumes.) By space of the textual world, then, I mean the imaginative extension, and geographical or topographic organization of the world represented or simulated by the text. Since they are created by the imagination, textual worlds do not necessarily respect the laws of Euclidean geometry. In real space, for instance, if A is north of B, and B is north of C, then A is north of C. But in an imaginary textual space, for instance in the space of a MOO, user A may build his house north of B's house, and B may build his house north of C's house, but C may build her house North of A's house, and the relation of the three houses cannot be represented on a flat map. Some computer games, similarly, use mazes that transgress the laws of Euclidean geometry. But in the vast majority of cases the space of textual worlds is conceived by the designer and imagined by the user as a simulacrum of physical space, and it can be projected by the same cartographic techniques on a two-dimensional plane.[4]

We normally experience textual worlds in the same way we experience the real world: rather than apprehending them all at once, we discover them region by region, from the perspective of a moving body. In a novel, for instance, the geography of the textual world is revealed to us through a succession of individual descriptions, or by following the travels of characters; in many computer games we explore textual space by moving through a maze represented from a horizontal perspective, and at any given time we see only a particular corner of the gameworld. In both physical and textual spaces, however, we can use maps to transcend the limitations of our embodied point of view. As my discussion will show, these maps can be static, animated, interactive and dynamic.

Static maps

The use of static maps may seem at first sight incompatible with the interactive nature of most cybertexts, yet if interactivity is to consist of deliberate problem-solving action rather than of random clicking, the information provided by static maps can play an important role in motivating the decisions of the user. In the computer game *Myst*, for instance, the user discovers in a library some books that contain a variety of maps and diagrams. At first these documents provide no help, but if the player takes them along in his exploration of the island, he will eventually encounter the objects depicted in the diagrams, and the diagrams will offer the clues necessary to solve the problem presented by the object. Maps are consequently an indispensable part of the toolkit that enables players to advance in their quest. For instance, by consulting the sketch of a tree house found in a book in the library, the user is able to find his way through the tree-house and to locate the switches that open doors to the other levels, where he will make further discoveries.

Static maps in cybertexts are not restricted to games, as the hypertext novel *Califia* by M.D. Coveley demonstrates. An exploration of the history, geography, geology, and folklore of California, *Califia* uses an interactive navigational design based on the four directions of the compass: go North, then East, then South, then West. Each of these directions corresponds to an episode in the story. The four episodes, narrated by a character named Augusta, can be followed linearly, but the reader can always switch along the way to the "trails" of the two other characters: Kaye, who gathers star charts, Indian lore and other spiritual guides; and Calvin, who maintains an archive of documents about California. This archive includes, among other items, maps that represent various aspects of California history and topography: earthquake lines, bio-regions, Mexican land grants, Spanish explorer's maps of "Island California," and map of Indian tribes. The text chronicles a treasure-hunt, and though the treasure-seekers are the main characters, the reader feels that the success of the search depends on her ability to decipher the documents in the archive. Four of the maps are labeled "treasure maps": a map of "the land of the treasure of Califia" (Southern California), a so-called "Baja Mission gold map", a start chart of the Big Dipper (which, superposed upon the topographic map, should mark the location of a treasure); and an Indian blanket with mysterious signs, some of which represent the Big Dipper (figure 2). These clues are misleading, and the treasure is never found, but this does not mean that the quest has been in vain. At the end of the trip West, as the heroes stand at the edge of the ocean with nowhere to go, they understand that they have found something infinitely more valuable than gold: the rich cultural heritage that lays buried under the freeways and parking lots of Southern California. "*Granted we did not find the riches of which we had been told, we found a place in which to search for them.*" The riches reside in the reader's and the character's spiritual connection with the land, and by facilitating this connection, the maps provide a reliable guide to the true treasure of Califia.

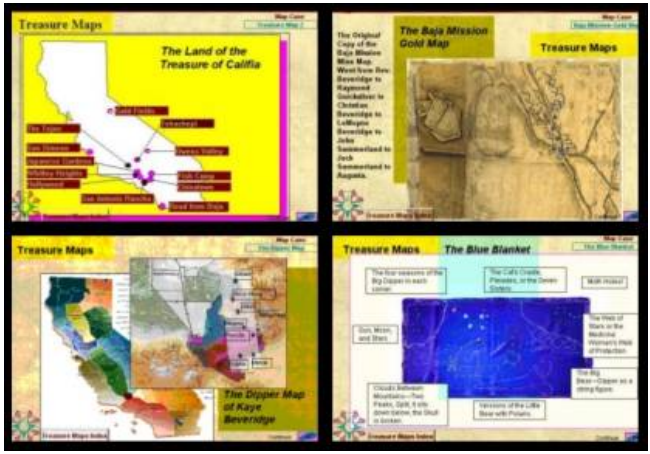

Figure 2:The treasure maps in M.D. Coverley's *Califia*

Interactive maps

For a map to function as an interface, rather than forming a mere document within a database, it must possess interactive capabilities. This means that by clicking on the map, the user will reach different parts of the text. Cartographic interfaces are particularly well suited to texts that concern the exploration of space. A case in point is the huge Web site devoted to Lewis and Clark, the two explorers who found a route through the North American continent in 1803. By clicking on the various spots of the map, the user can reach truly encyclopedic information about the corresponding stage of the journey: diary extracts, description of local Indian tribes, notable incidents, available food, campsite entertainment, and encounters with wild animals. (See map at http://www.lewis-clark.org/index.htm)

Another example of an interactive map of a textual world is Deena Larsen's *Marble Springs* (figure 3).[5]This literary hypertext tells the story of a ghost town in Colorado. Here the reader navigates the text by navigating the map of the town or the map of the cemetery. If she clicks on a house on the city map, she gets a poem that relates to its female inhabitants; if she clicks on a gravestone on the cemetery map, she gets the inscription. On the map of Marble Springs, each house, each grave holds a link, just as highlighted words do on a textual screen. These links enable the reader to move back and forth between the geographic map and the texts connected to it. Thanks to the cartographic interface, the reader is no longer cast as the external operator of a textual machine, as is the case in most hypertexts, but as an embodied member of the textual world who travels around Marble Springs through the mediation of the cursor.

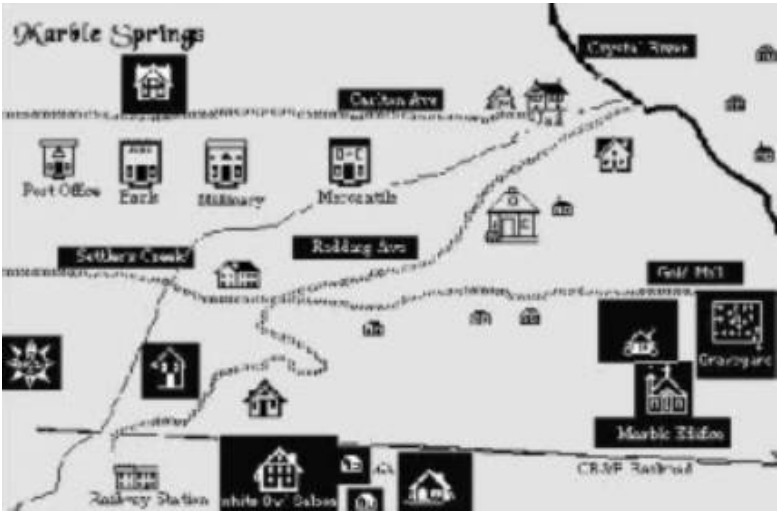

Figure 3: Map of Deena Larsen's *Marble Springs*

Dynamic, non-interactive maps

Many computer games use dynamic maps to compensate for the limitations of a first person point of view. The complementarity of the limited knowledge inherent to the first person perspective of the display and of the omniscient perspective of the map enable the game to offer both adventure in a land full of surprises, and the possibility of strategic thinking. A military-strategy game may for instance allow the player to switch from live battle action to a map-view of the field that helps him decide how to deploy his troops in the terrain. Meanwhile, an Internet-based shooter, in which gameplay consist of moving through a maze and killing enemies, may allow the dead players to watch the game from a bird's eye point of view, so that the pleasure of acting will be replaced by the pleasure of spectating. The bird's eye display is a dynamic map, because it shows the current location of all the live players, but it is not interactive, because dead players cannot—at least in principle—communicate the information to their live teammates.

The most common use of dynamic maps occurs in those games that takes place in a very large fictional world. To allow the player to orient himself in the gameworld, or to explore it systematically, the game may display a small map in the corner of the screen. As the player moves in the gameworld, so does the spot that shows his position, but the player cannot teletransport himself to another part of the fictional world by clicking on the map.

Dynamic interactive maps

What if we add interactivity to a dynamic map ? In a computer game, this combination would become a playfield in its own right. Cartographic views of the playfield are common in the so-called "god-games" or "simulation games," games that cast the player as the manager of a complex system, such as a city, civilization, or a family (Simcity, Civilization, and The Sims). The vertical projection of the map offers a panoramic, and consequently near omniscient view of the gameworld that enables the player to overview all the resources and processes that need coordinating. On the other hand, games whose interest lies in traveling across a world full of hidden dangers will favor a horizontal projection in which the objects in the foreground hide those in the background, shielding enemies from the player's field of vision.

Some older computer games, such as Pac-Man, consisted entirely of action on a playfield that presented the gameworld from a vertical point of view. The playfield was at the same time a maze, and the plan of a maze. But the pure vertical projection presents the disadvantage of allowing travel in only two directions—the x and y axes—and of rendering most objects unrecognizable, since the normal way of apprehending the world is from a horizontal point of view. To increase the realism of the display, and to restore the z axis, most recent simulation games rely on a

three-dimensional aerial perspective that represents a compromise between the vertical projection of a pure map and the horizontal projection of a landscape picture.

Figure 4: Playfield of the computer game Civilization

In Civilization (figure 4), the presence of a small vertical-projection map in the left-hand bottom corner of the screen may mark a difference between what is perceived as "the world" and what passes as its cartographic image; but the difference is mainly one of mapping technique: "the world" looks itself like one of those panoramic maps that are used to represent relief as well as topography. The cartographic look of the display reminds us that building civilizations is a deeply map-altering activity—a project with lasting consequences for the appearance of the world from the air. In The Sims, similarly, the playfield is a compromise between a plan view of a house taken from a vertical perspective and an elevation view taken from a horizontal perspective. In both Civilization and The Sims, players can move around the map, add features to it, watch the map evolve, switch perspective, zoom in and out, and trigger animations. We could say that these games let the map become a world, or conversely, that they let the gameworld serve as its own map, as did the people in this anecdote by Lewis Carroll:

> "We actually made a map of the country on the scale of a mile to a mile !" [said Mein Herr]
> "Have you used it much?" I enquired ?
> "It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole country and shut out the sunlight! So we now use the country itself, as its own map, and I assure you it does nearly as well." (*Sylvie and Bruno*, 726.)

2. Textual architecture

What I call textual architecture is the internal organization of the text, the system of relations that connects its elements. These relations, described by literary critics as "spatial form", have traditionally been semantic, phonetic, or broadly thematic, but with the introduction of hyperlinks, the digital medium has added "accessibility" or "contiguity" to this list. In contrast to the space of the textual world, whose properties are similar to those of physical space, the architecture of the text is not a literally spatial phenomenon, but an arrangement of largely immaterial semiotic objects. The mapping of this formal architecture illustrates therefore the case of a spatialization of non-spatial data.

In the digital medium, the notion of textual architecture is most commonly associated with the network of links and nodes that underlies hypertexts, both in their Web page manifestations, and in their literary applications, such as Eastgate hyperfiction. The nodes of the network stand for certain areas of memory starting at specific addresses, and the links for "go to" instructions that lead the reader from these areas to other addresses. But in the memory of the computer, the text is stored as a one-dimensional string of zeroes and ones. Since the two-dimensionality of the diagram is nothing more than an effect of the visual transposition, the spatiality of hypertext so dear to theorists such as Bolter and Landow is a purely virtual space.

Another difference between physical space and architectural space, more precisely the architectural space of hypertext, lies in the fact that the units of hypertext have no coordinates on Cartesian grid, while the elements of physical space are situated objects. While physical space is topographical, textual space is topological. This means that the position of textual units on a diagram is arbitrary. In physical space, a certain area can be represented by different maps, but when two maps of the same area show common items, these items must be placed in roughly the same spot on the map. No matter how schematic, a map of Europe must locate Stockholm north of Rome (= above it, according to the widespread convention of associating north with the top of the map). This is not the case with maps of

hypertext: since the graphic representation of the structure of hypertext is a network of links and nodes, and since in a network what matters is the system of relations between nodes, not the exact position of elements, the same textual organization can be represented by two visually different diagrams. The poem *True North* by Stephanie Strickland illustrates this lack of isomorphism between map and territory by allowing the reader to modify the position of the nodes on the text map by clicking and dragging them. This operation has no consequences for the accuracy of the map as a representation of the internal organization of the text.

Interactive maps

In their interactive form, maps of textual architecture provide a convenient way to navigate hypertexts. Since the primary mode of moving though hypertext is clicking on the links on the screen, the display provides a built-in instrument of navigation which may tempt us to say that the text serves as its own map, making the use of an external map superfluous. But the visible links on the screen function more like signs at a crossroad pointing in various directions than like a road map that covers a large area. This is why many hypertexts supplement their various screens with a global text map. These maps exist in three forms:

External maps, automatically generated. There exists a number of mapping utilities that, given the address of the home page of a web site, will produce a visualization of the internal organization of this Web site: for instance, the ASTRA system will take any Web site address and will produce a diagram of its structure that supposedly facilitates navigation. (See for instance the map at http://www.cybergeography.org/atlas/astra.gif.)

These maps are external, since they are not attached to the web site, and since only a small minority of people will actually use them.

Semi-internal maps, automatically generated. Authoring programs such as Storyspace, Director and Flash produce graphs of textual organization to assist the author with the design of the text. These maps can remain strictly a design tool, or they can be made available to the user. In some Storyspace hypertexts, for instance, the reader can access the system-generated map by clicking on a certain button of the interface. I call these maps semi-internal, because it takes a movement in and out of the text to consult them, or more precisely, a movement from the inner layer of the text—the part composed by the author—to the interface, or paratext, provided by the system. These maps make it possible for the reader to reach any lexia shown on the screen by clicking on its image. But literary hypertexts typically comprise a far more complex system of links and nodes than what can be displayed on the screen at any given time. Storyspace maps are therefore most useful when the text is structured in layers, i.e. as a collection of semi-autonomous modules which can be reached from a main menu. In Shelley Jackson's *Patchwork Girl*, for instance, the

map of the top level shows the main sections of the text; by clicking on each of its elements, one gets a comprehensive map of each section; each of these maps in turn can be clicked to reach individual pages. The map represents consequently a way to by-pass the system of links designed by the author. But the usefulness of Storyspace maps as orienteering tools is limited by the presence of another system-generated device that performs a similar function: the button that offers an alphabetical list of all the lexias, and lets the reader access any of them with a click of the mouse. To overcome this redundancy, many hypertext authors have strived to develop other textual functions for maps. For instance, the map of the section Crazy Quilt in *Patchwork Girl* is not only a navigational device, it is above all an aesthetic device that mimics the visual appearance of a quilt (figure 5).

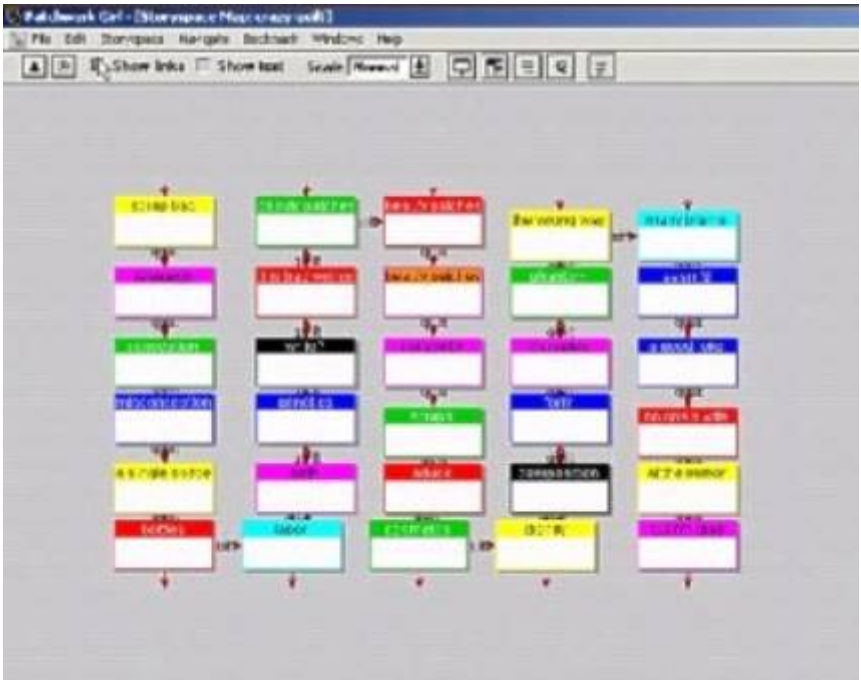

Figure 5:Storyspace map: Crazy Quilt, in Shelley Jackson's *Patchwork Girl*

It offers consequently a double image of the text: a cartographic representation of textual architecture; and a pictorial representation of the crazy quilt theme, which is itself an emblem of the architecture.[6] But the aesthetic and mimetic possibilities of system-generated maps are rather limited, since all that can be done is arranging the squares on the screen in different patterns.

The expressive potential of hypertext maps is vastly expanded in my third type, *Internal maps, manually generated.* For instance, the map in Stuart Moulthrop's hypertext fiction *Victory Garden* reflects the title of the text: as Robert Coover has observed, the diagram can be seen as a map of a garden with paths and benches. When the user clicks on its four subsections she gets a more detailed map, and this map can be used to access the lexias represented on the benches, but even these larger scale maps are far too schematic to give random access to the 993 lexia of the text. Another example of an emblematic map is this screen from Shelley Jackson's *Patchwork Girl* (figure 6), a text that uses both system-generated and manually produced maps.

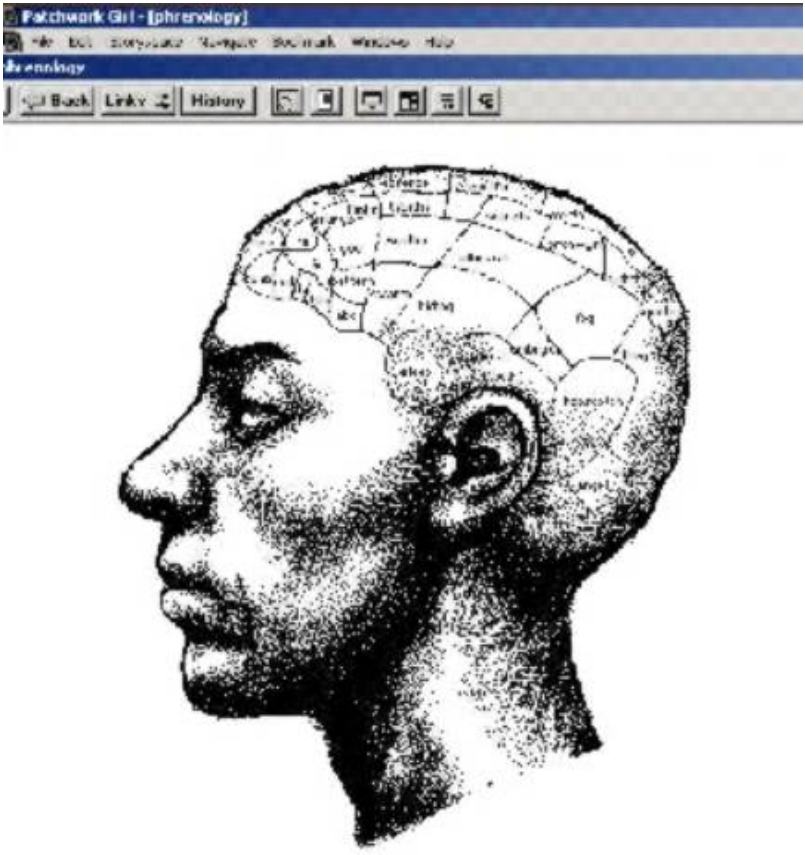

Figure 6:Picture as text map: "Phrenology,"
from Shelley Jackson's *Patchwork Girl*

Here the text is mapped by the various parts of the human brain, and the act of reading is framed as the exploration of a mental geography. The pictorial interfaces of *Victory Garden* and *Patchwork Girl* come close to the case of *Marble Springs*, but they represent a symbolic textual geography, while the map of *Marble Springs* is a literal representation of the topography of the textual world. When I call these maps text-internal, I mean that they occupy one of the nodes of the network, rather than being accessible at all times through a button on the interface. Readers must find their way to the node that contains the map—and the map, consequently, is not always available. This is another reason why internal maps are more useful as decorative and symbolic items than as genuine orienteering tools.

In assessing the function of maps of textual architecture, we should remember that even geographic maps are not merely navigational aides; they also help us visualize what cannot be seen from the perspective of a normal human being. By giving a visual identity—a recognizable shape—to features such as continents, countries, provinces, islands, lakes and rivers, maps create an emotional bond between people and geographic entities. Most people are indeed able to draw by memory the outline of their country. Similarly, hypertext maps create visual emblems of the text that compensates for the inaccessibility of its inscription in computer memory, an inaccessibility that makes it impossible to tell how much of the text remains to be seen. Just as a map of France inscribes the country as an hexagon in the mind of its citizens, a map of hypertext tells the reader what the text "looks like", and it inscribes the text in the reader's mind as an object with a stable visual identity. Even though textual architecture is not an inherently visual nor a spatial phenomenon—no more than other phenomena that are commonly mapped, such as the fluctuations of the stockmarket or the market share of various products-- this visualization facilitates comprehension and motivates the reader to explore the text, even if the map is not used as a tool in this exploration. The idea of a stable visual identity for hypertext may conflict with the postmodern aesthetics of fluidity and kaleidoscopic effects, but it compensates for the dizziness that readers may feel, as they face too many choices with too few reasons to chose, by telling them that beneath the apparent chaos of links is order and design.

Dynamic maps

Dynamic maps, maps that modify themselves in real time, are rare, but not completely unheard of in the area of textual architecture, as Marek Walczak and Martin Wattenberg's project *Apartment* demonstrates. The map created by this project, which operates on the word level rather than on the level of lexia, is not only dynamic, but animated and interactive as well. Literalizing the idea of textual architecture, the system asks the user to input words or sentences, and it creates the floor plan of an apartment to accommodate this verbal furniture. Words are assigned to rooms on the basis of semantic content. Twelve types of rooms are

paired with twelve semantic categories: living room is themed around the idea of group, dining room needs glamour, kitchen holds food, closet is a place of secrecy, hall suggests motion, foyer stands for change, bedroom means intimacy, bathroom caters to the needs of the body, library is associated with truth, office is where one works, and windows afford vision. (Dillon, *Writing with Pictures*, ch. 6, p. 9). The various rooms are created as they are needed, and their size and the thickness of their walls increases with every new piece of furniture that needs to be brought in. Different inputs will consequently generate different floor plans. The system ignores the words that it cannot categorize (mostly articles and prepositions), and it tries to pair new words with old ones into meaningful phrases. When the components of the resulting expression come from different rooms, these rooms are made adjacent to each other, the wall between them is taken down, and the group of words floats in the area where the two rooms meet each other. The same rearrangement and tearing down of walls occurs when a word hovers between two categories. Matching the fluidity of the architecture of the floor plan, an architecture undergoing constant transformations, the fluttering of the words and phrases around the rooms suggests the polysemy of language and the impossibility to immobilize its words into rigid semantic categories. We can read the result as a kind of aleatory poetry, or as a story of daily life, with different episodes taking place in different symbolic locations. Users may try to build up the apartment systematically by deliberately selecting words that will trigger the addition of certain rooms (the bedroom typically coming first), but another interesting way to use the system is to input a well-known poem and to watch the system rearrange it as a domestic drama. Figure 7 shows a snapshots of the apartment created by the system for Dylan Thomas' poem "Do Not Go Gentle into that Good Night."

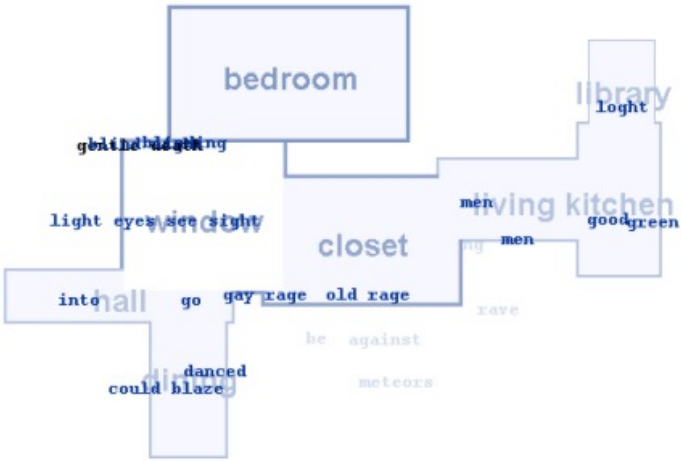

Figure 7: Screenshot from Marek Walczak and Martin Wattenberg's *Apartment*

3. Material space of the text

In contrast to the types of space previously discussed, the material space occupied by the text does not normally need to be mapped, because the texts that highlight this kind of space are not constructed as networks, this is to say, as labyrinths in which users need to orient themselves. The texts discussed below either show their whole body on the screen, or they play themselves like a movie, taking the reader for a ride through their space.

The dimensionality of the space occupied by the signs of a text varies with the medium, from the zero-dimensionality of spoken language (a medium that exists only in time), to the (quasi) one-dimensionality of a written line, the two-dimensionality of a page, and the three-dimensionality of an inscription carved in stone. With digital texts, the dimensionality of the material realization of the text is a more complex issue, since the text exists both as data and code permanently stored in memory as a one-dimensional sequence of binary digits,[7] and as a temporary two-dimensional visual display on the screen when the code is executed. But the image on the screen may mimics spaces with different numbers of dimensions, just as a flat two-dimensional painting may mimic three-dimensional space through the use of perspective. In addition to the material space actually taken by the text, there is consequently the virtual space that the text seems to occupy, the pseudo-materiality of its appearance. It is with the pseudo-materiality of this virtual space that I will deal in this section, since on the level of actual materiality, all digital texts that run on a PC share the same type of spatial extension. As we shall see in the examples to be discussed below, it is though animation effects—this is to say, through the exploitation of their temporal dimension—that digital texts foreground the spatiality of their inscription.

Foregrounding one-dimensionality

The default status of the material support of printed texts is the two-dimensional space of the page. Printing a text on a single line would be impractical, because it would either limit the length of the text, or require the scrolling of a very long tape. But in electronic systems—and here I mean not only computers, but also television news lines and electronic billboards– lengthy texts are easily projected on a single line, because their characters are not permanently inscribed on the viewing surface. By changing the value of the elements of the display, be they light bulbs or pixels on a screen, the system gives the impression that characters are moving from side to side, and there is practically no limit on the size of the text that can be made to scroll before the reader's eye.

A digital text that takes advantage of this possibility to collapse the two-dimensionality of normal written text into a one-dimensional space (or rather into a

two-dimensional space with a vastly dominant dimensions) is the art CD ROM "Things Spoken" by Agnes Hegedüs.[8] Each screen of the work consists of two windows (figure 8).

Figure 8: Screenshot from Agnes Hegedüs' *Things Spoken*

One of them contains a static, two-dimensional image of an object from the author's personal archives: kitschy tourist souvenirs, gifts from close friends, family heirlooms, or treasured childhood relics. The other window contains two independent line of texts that scroll from right to left, explaining the emotional value of the object for the narrator and the memories evoked by the image. Running parallel to the written words is an oral performance of the two linear texts. The reader can alternate between the texts, sometimes spoken by a male voice and sometimes by a female voice, by moving the cursor on one or the other of the two lines. The fact that neither the written words nor the oral version can be stopped suggests that the one-dimensionality of the written version is a visual transposition of the evanescent temporality of both spoken language and of the mental life that language tries to capture. The reader moves through the text by catching highlighted words with a click of the mouse; once a word has been caught, the text shifts to another screen that describes a different object by means of the same

word. The capture of the keyword stands symbolically for the firing of associative chains in the brain that lead to the resurfacing of buried memories. Through its dynamic unfolding and linear presentation, "Things Spoken" thus literalizes the metaphor of "stream of consciousness."

Foregrounding two-dimensionality:

An efficient way to attract attention to the spatiality of the textual display is to block its normal functioning. This is what happens in "Cruising," a digital text by Ingrid Ankerson and Megan Sapnar (figure 9).

Figure 9:Two screenshots from "Cruising" by Ingrid Ankerson and Megan Sapnar

Here again the text is reduced to a line, and here again the running of the text on the line is paralleled by an oral performance, at least the first time around. But in contrast to "Things Spoken," the text is juxtaposed to a frieze of picture, so that text and image combine to form a two-dimensional window. The size of the window, as well as the speed of its scrolling are unstable: by moving the cursor, the reader can make the text and its graphic background grow or shrink, move left or move right, and move at different speeds. The goal is to get a combination of size, speed and direction that allows the text to be read; for most of the time, the text is too small, and moves too fast for the eye to make out the words. The user's control of the speed and direction simulates the driving of a car; and indeed, driving a car is what the text is all about: "I remember cruising Main Street with Mary Jo and Joanie, the heat pumping full blast, windows down, night rolling through Mary Jo's father's station wagon like movie credits." The text runs in a closed loop that underscores the repetitive aspect of the favorite activity of small-town teenagers: up and down, up and down the same street, the only difference between two runs residing in the speed of the car and the resulting legibility of the landscape framed by the car window. At low speed we see distinct images, and we can read their details, while at high speed the images look like the frames on a strip of film. The interface thus underscores the hybrid status of digital poems between text that we can read at our own pace, and film that rolls before our eyes, blurring the distinctions between its images. The interface is much more than a way to manipulate the text—it is a simulative mechanism that enables the reader to participate symbolically in the experience of the speaker. What literary critics once hailed as "the unity of form and content" has now become the triple unity of interface, theme, and image.[9]

Foregrounding three-dimensionality:

Three-dimensionality is a rare feature in textual displays, and it usually contributes to visual effects rather than to the creation of truly verbal meaning. This is why we mainly see it at work in advertisements or in the titles of films. In *Star Wars*, for instance, the words Star Wars tip over, flatten out and vanish in hyperspace with a perspective effect that makes them look like objects cut out from solid material. But to the digital poet Aya Karpinska, three-dimensionality should be able to produce meetings of words in textual space that leads to sparks of poetic meaning. As the author writes, "extending poetry beyond the printed page into three dimensions will lead to novel ways of representing relationships between words, as well as the evolution of new patterns and rhythms." The title of her experiment in three-dimensional textuality, "The Arrival of the Beebox" (figure 10) is borrowed from an eponymous poem by Sylvia Plath.

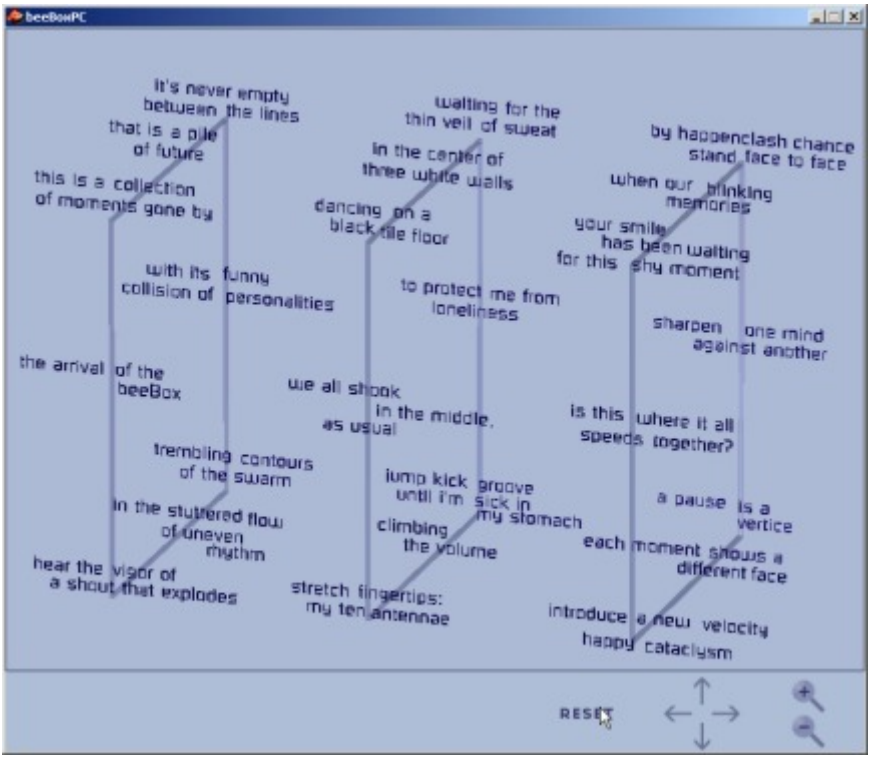

Figure 10: Screenshot from Aya Karpinska's "Arrival of the Beebox"

In Plath's "Beebox," the bees held prisoner in the box represent the thoughts and images that haunt the poet, clamoring to be set free. Yet the speaker fears that if she opens the box, the bees will fly away, never coming back to her, never using her as a source of honey, an image that I interpret as meaning that the liberated thoughts will be lost, rather than swarming around the speaker as a poem. In contrast to Plath's poem, which represents a temporal unfolding of thoughts, so that the sequence of lines cannot be modified without loss of meaning, Karpinska's Beebox is written as a collection of relatively independent verses loosely held together by common themes and oppositions: an intense, sudden experience; loneliness versus meeting with an other; containment versus explosion. The three-dimensional mechanism functions as a shuffling system that recombines these elements into different mini-poems, creating temporary configurations similar to the figures created by the bees as they swarm in the box. The poem presents itself visually as three squares, or planes (the box), with eight verses (the bees) arranged along their outline: one at each corner, and one in the middle of each side. At first the text is one-dimensional: the characters of the verses are superposed upon each

other in a single line, forming an illegible graffiti. By clicking on each segment, the reader expands the various inscriptions into verses of two or three lines reminiscent of haikus. Now the text has two dimensions. The third dimension unfolds when the user sets the text in motion by mousing over four arrows at the bottom of the screen.[10] These arrows trigger four different types of rotation: along a vertical axis, along a horizontal axis, and each of these in two directions. While the rotation along the horizontal axis preserves the relative location of the squares with respect of the viewer, the rotation along the vertical axis brings different squares in the foreground. Half of the time during the rotation the words are seen backwards, and they can only be read with the help of a mirror—but the reader may just as well wait until they are in the right position. The rotation allows the edges of the different squares to overlap, bringing together fragments of text that belong to different squares, or it inverts the vertical order of the verses on the same square. The result is a digital version of what the Oulipo poet Raymond Queneau achieved in "Cent mille milliards de poèmes," a poetic contraption that recombines the 14 verses of ten sonnets into 14**10 poems by letting the reader flip a book whose pages have been cut into strips. Faithful to the surrealist concept of beauty as the energy released by the random meeting of found objects, both Queneau's and Karpinska's design are aleatory mechanisms, in which the system brings the words together, and the reader brings the meaning.

4. Spatial environments

Texts exist in a real or virtual space that serves as a container for a large number of other texts: a shelf in a library, where books are arranged alphabetically or by call number; the hard drive of a computer, where individual files are stored at specific memory addresses, or the entire World Wide Web, where documents are identified by numeric URLs. The alphabet, call numbers, memory addresses and URLs represent one-dimensional organization and allocation systems, but these systems are visually represented by two- or three dimensional diagrams: for instance, the map that tells us where a certain book is to be found in a library; the tree diagram that shows the organization of files into folders; and the visualizations that represents Web sites as planetary systems, or the entire Web as an outer space filled with galaxies of documents.

Postmodern texts acknowledge their situatedness within a larger textual space through intertextual allusions, and hypertexts do so through links, but because they are produced by executable code, digital texts have developed much more dynamic ways to relate to their environment: they can explore it actively, bring back materials from their exploration, build themselves up in real time from these materials, or

produce microcosmic image of the macro-space of which they are a part. In this section, I propose to explore some of the modes in which digital texts situate themselves within these larger fields of data.

Static relation to surrounding space

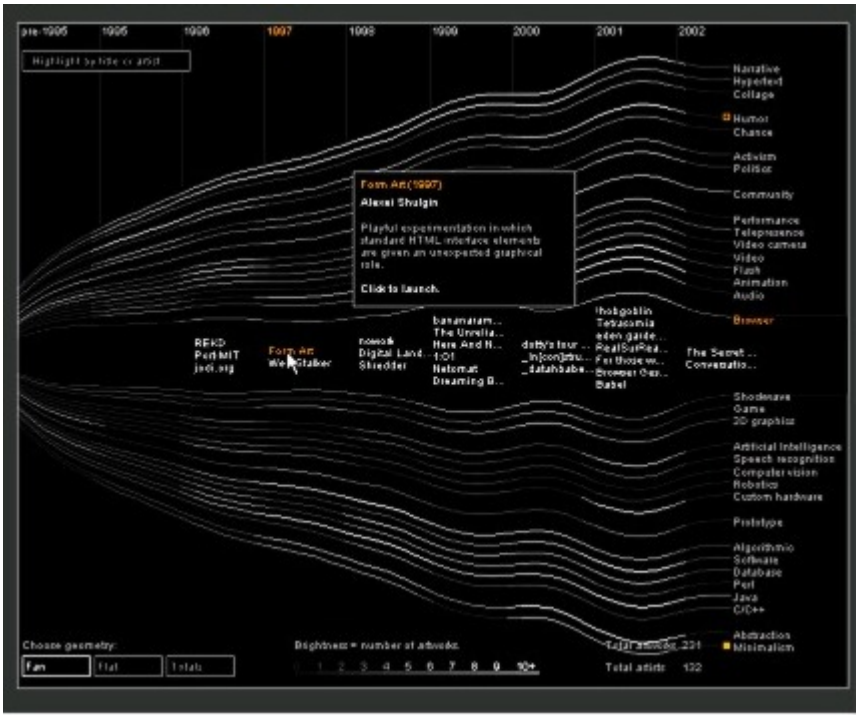

Figure 11: Screenshot from “A Net Art Idea Line” by Martin Wattenberg

A digital text can relate to the surrounding space in either a static or a dynamic way. In a static relation, the text points to other locations in its environments, it may even offer a mode of transportation to these locations in the form of hyperlinks, but it does not visit these locations by its own initiative, and it cannot expand by itself its network of connections to other sites. As an example of a static relation to cyberspace, consider for instance a artwork titled “A Net Art Idea Line” by Martin Wattenberg, also the co-author of “Apartment” (figure 11). Conceived as a portal to sites of digital art, the text is both an animated and an interactive map. As the author describes it :

> The Idea line displays a timeline of net artworks, arranged in a fan of luminous threads. Each thread corresponds to a particular kind of artwork or type of technology. The brightness of each thread varies with the number of artworks that it contains in each year, so you can watch the ebb and flow of different lines of thought over time.

When the user mouses over the threads, they open up gently, creating a wave that gracefully spreads through the entire fan. Titles of works appear in the space between the threads; if the user mouses over the titles, she gets a description of the work; if she clicks on this description, she is sent to the corresponding Web site. This cleverly expanding design enables the map to give access to far more titles, and to contain far more information than the screen could hold at any one time; and yet, the user never loses sight of the whole bundle of threads, and never leaves the map for a more detailed image. With this beautiful, vibrant creation, which reminds the spectator of a delicately breathing jellyfish, aesthetic appeal overshadows utilitarian function, as it did in the great decorative Dutch maps of the seventeenth century: most people will appreciate it as an artwork in its own right, rather than use it as a portal. But in its the relation to cyberspace, "A Net Art Idea Line" is no different than an ordinary Web pages with hyperlinks pointing to other Web sites. It does not find the URLs, as would a search engine like Google; the URLs are given to it (authors of artistic texts are invited to submit their work), and the code must be rewritten for every new addition.

Dynamic relation to surrounding space: exploring the hard drive

Digital texts that entertains a dynamic relation with their surrounding space may do so in two (and a half) ways, depending on how they delimit their environment. In the micro-spatial version, the text visits the other files on the hard disk of the computer on which it operates. In the macro-spatial version, the text performs a walk—also known as a crawl, or stalk—through cyberspace itself by following the links of a given Web site toward other Web sites, and then the links of this new Web site toward still other sites , in a potentially infinite recursion. In the "half" way, it visits the Web sites whose references are found on the user's computer.

As an example of text that operates in a micro-spatial environment, consider [Phage], a Director program created by the digital artist Mary Flanagan. [Phage] browses the hard drive of the computer, collecting bits and pieces of data, and throwing them back at the user (or should one say throwing them up ?) as a collection of decontextualized fragments that blow, rotate, and swirl on the screen like pieces of trash on a windy day at the dump (figure 12).

Figure 12: Screenshot from [Phage] by Mary Flanagan

The users who miss the theoretical significance of this deconstructive activity can turn to an essay on the project's web site in which the author explains her work in terms of several interconnected metaphors:

The benevolent virus. Taking her clues from "bacteriophages, " viruses used for healing, Flanagan envisions [Phage] as a virus that invades the hard drive, but instead of pursuing a malicious intent, this virus destroys harmful bacteria that threatens your prosthetic mind. (This is all metaphorical, of course: in reality, [Phage] does nothing to your hard drive.)

Feminism and space. Woman have been traditionally excluded from spatial practices, such as architecture or computer design. They have consequently developed their own idea of space and their own relation to it. Flanagan describes [Phage] as a "feminist map" of the machine, in which space will no longer be organized according to the "masculine" principles of order, control and hierarchical directories. This feminist logic reconfigures the computer from a rationally organized "tool for daily use" into a poetic engine that exploits the creative energy of chaos and randomness.

What then does [Phage] claim to do ? It "eats" your hard drive and its hierarchical organization, curing your computer's architecture from the "masculine" diseases

of logic, order, and control, and it restores it to you as a reconfigured space that changes your relation to your data and to your machine: as long as [Phage] is running, the computer is no longer an instrument of work, but a map of your personal experiences, and a site of poetic activity.

What does [Phage] actually do ? The project offers a discovery trip into the depth of the mind, and many users will take pleasure in the temporary resurfacing of long forgotten text or images. Unfortunately, these fragments swirl too fast, are too small, or are shown from the wrong angle (i.e., backwards) for the user to read them: it was only when I captured a screen as a still picture and saw some French words that I recognized the fragments as being actually taken from my hard drive, rather than created by the program (as are the sounds that accompanies the show). But the claim of the author that by throwing objects in the user's face [Phage] offers a "feminist map" of the machine must be taken with a grain of salt, because the art of cartography relies on order and rationality, and represents consequently the modes of thinking that Flanagan dismisses as masculine. The program implements an original, not-to-be-reused idea, as should any genuine work of conceptual art, but I share the opinion of George Dillon, who writes: [Phage] is "the anti-mapper to all mappers, since it presents the hard drive's contents as disconnected, unrelated fragments" (*Writing with Pictures*, ch. 6, 15). And this, of course, is the exact opposite of what a map should do.

Dynamic relation to surrounding space: exploring the Web through the user's scrapbook

While Phage limits its snooping to the micro-environment of the user's hard drive, another space invader, "The Impermanence Agent" by Noah Waldrip-Fruin and Brion Moss, opts for a compromise between the macro-space of the web and the micro-space of the user's computer: the text explores the Web by looking at the content of the user's "browser window", or "scrapbook"—the area of memory where text and images from recently visited Web sites are temporarily stored, so that the user may revisit the site without having to download images and text all over again. The text consists of a window with two columns. One of them contains a chronologically scrambled, but very readable, in fact moving story inspired by the death of the author's grandmother, Elinore, illustrated with family photos. The other window contains theoretical texts from various authors and memorial imagery from multiple cultures. The content of the windows scrolls down slowly by itself, then returns to the top in an infinite loop, so that the reader can take an occasional glance as the text and catch bits and pieces of either the story or the theoretical texts during breaks from other computer activities. A parody of the so-called Artificial Intelligence "agents" that search the Web for materials suited to the user's interest, "The Impermanence Agent" modifies the content of the window by gradually integrating materials culled from the user's scrapbook. A "lightweight artificial

intelligence model" selects "interesting" or frequent words from the user's scrapbook, and makes sure that they fit syntactically into the text, but the model does not check the output for semantic coherence. The visual material undergoes similar blending with pictures from the scrapbook. Below is a passage from the original text, followed by three successive stages of transformations. (For an example of the transformation of the visual material, see the illustration in the author's essay at http://www.impermanenceagent.com/agent/essay2/.)

> It is 1933. The small writing table from the railway auction. The cool green felt of the blotter. A five cent pad of cotton paper turned for left hand writing.
>
> It is 1933. The webcam picture of a restaurant in the railway auction. The cool green felt of the blotter. A crap green banner is going for left hand writing.
>
> It is 1933. The shock of it, the hair, counsell'd with the railway auction. The clouds—washed over as with a blotter. A woods flit and left handIt is 1933. The shock of it, the hair, counsell'd with the railway auction. The main from a blotter. A climax of Act 1 emerged, in one form or left hand writing. [12]

The authors claim that this algorithm customizes narrative discourse to the reader's interests, but their definition of narrative is so loose that it accepts any grammatical sequence of words. After a whole week of running the program, the text is completely invaded by fragments of other texts that may point towards, but never fully tell their own stories, and the original narrative is replaced by a random collage. Though the user may take pleasure in the serendipitous resurfacing of souvenirs from her cyberspace travel, the result is not a customization of narrative meaning, but a disintegration of the mapping of human experience that takes place in its narrative organization. "The Impermanence Agent" enacts the loss of memory, and consequently the loss of storytelling ability, that affects Elinore, the heroine of the original narrative: the mind that was once occupied by meaningful representations of the past is now the theater of a chaotic swarming of disconnected elements. On a more allegorical level, I read "The Impermanence Agent" as a demonstration of the falling apart of story that takes place when personal preoccupations interfere with the reader's ability to immerse herself in a fictional world and to share in imagination the concerns of others: Elinore's moving story crumbles under the onslaught of the trivial phrases and visual fragments culled from the user's favorite Web sites. If "The Impermanence Agent" ends up telling a "story" capable of catching the user's interest, this story resides on the level of process rather than on the level of product: in the gradual destruction of the input text, rather than in the resulting inscription. It is above all an example of virtuoso programming, where the code and the design idea command greater aesthetic attention than the output itself.

Linking texts to the world

The notion of spatial environment for texts need not be restricted to digital storage. Texts inhabit the world as much as they inhabit paper, audiotapes, film strips or silicon chips. By inhabiting the world, I mean not only that their material support is an object within the world—usually a movable object—but more importantly, that they may anchor themselves in the world as semiotic objects by referring to specific locations. Our sense of place is strongly indebted to the stories that circulate about a certain area. For instance, by telling us how striking landscape features came into being, or what happened in a certain site, the narratives of myth, legend and oral history build the "spirit" of a place—what the Romans called the *genius loci*—and contribute to our emotional attachment to a geographic area.

Will digital technology facilitate the connection between texts and the world, the filling of space with stories ? To answer this question we must venture into the slightly futurological domains of ubiquitous computing and Augmented Reality. Instead of taking the user to an alternate world entirely constructed out of bits of information, as does VR, Augmented Reality will project digitally generated images, text and sound upon the real world, thereby turning human-computer interface into a three-way relation involving human, computer and the physical environment. The proponents of the technology foresee applications in the military sector, in construction, in the tourist industry, and in video games. Soldiers will see strategic information superposed upon the terrain; technicians will find identifiers or how-to-use directions on the parts to be assembled; tourists will find bits of history floating in front of buildings; and instead of fighting enemies on a screen, game-players will face three-dimensional computer-generated creatures profiled against the realistic background of a real-world setting.

While this brand of Augmented Reality will require the cumbersome head-mounted displays of VR, a purely textual version can be implemented by means of mobile phones equipped with GPS—global positioning systems. By locating the exact spatial coordinates of the user, the GPS system makes it possible to compose messages on the mobile phones, to attach them to particular geographic locations and to upload them on the Internet. These geographically coded messages, known as "user-generated location-specific content" (or more colloquially, as "wireless digital graffiti"), will only be retrievable from the server by people who happen to be in the proper location. "Ultimately, the logical conclusion of wireless graffiti systems would be an ability to attach information to any object or place on earth with an accuracy of a meter or less" ("The Revenge of Geography," 22). The idea came to one of its developers, Jim Spohrer, during a hike: "He saw an unusual sort of plant, and wished he could look it up on the Internet; he then realized that other passers-by might also want to know the same thing, and wished he could somehow stick this information on to the plant, like a virtual Post-it note" (*ibid*). Digital graffiti answers a need for the transparency of a fully legible world, a need to know

everything that is to be known and everything that has been said about our surroundings. The idea can have both practical and artistic applications: when leaving a restaurant, you could attach to the location a review of your dining experience for the benefit of prospective customers; or when visiting a sublime landscape, you could record the deeply philosophical meditations that the environment inspires to you. Wouldn't it be marvelous, if the passing thoughts of D.H. Lawrence were incrusted for later generations in the landscape of New Mexico, or the musings of Baudelaire in the cityscape of Paris ?

Yet there are reasons to be skeptical about the technology. Will the landscape turned into its own map, with explanations, stories, and other people's personal experience superposed upon its features enhance our appreciation of the external world ? Will the Shamanistic vision of a world echoing with the murmurs of the spirits of things be realized through GPS and cell-phone technology, or will the true voice of nature be silenced by the human chatter that will attach itself to everything? Do we really want to walk, armed with a palm-pilot, in a reality augmented by the passing thoughts of every would-be poet, amateur philosopher, or traveling salesman, and will we be able to filter out the unwanted messages ?

The alternative to an uncontrolled proliferation of graffiti freely created by every cell-phone owner is to coordinate the texts for a global narrative experience. For instance, bits and pieces of story could be attached to the objects of a building, and by touring the site, in whatever order they choose, visitors would walk into the life stories of the people who lived there and eventually gain a comprehensive view of the family saga. Or a fictional murder could have been committed in the building, and the visitor would solve the mystery by retrieving the clues attached to certain objects.

One GPS-supported project that implement this idea of a designed experience is *34 North 118 West* by Jeff Knowlton, Naomi Spellman and Jeremy Hight. Whereas natural landscapes generally borrow their creation stories from myth and from legends, urban landscape, as man-made environments, speak the language of culture and history. Conceived as an exploration of the "narrative archeology" that underlies a decrepit district of downtown Los Angeles, *34 North 118 West* bears testimony to the forgotten lives that clustered around the landmarks of the area, such as the railroad tracks or the La Grande station. These lives are commemorated not through actual historical documents, but through prose poems that articulate the unspoken experience of the anonymous people who worked in the area. For instance:

> 35 years I cleared the tracks. Those men, along the rails, tired. Death by train we called it. They waited and wandered. Hoped….for the sound that comes too late. To take them from this life. It was my job to assist……..to help……kind words…..or help clear the tracks after the impact… Such failures. My failures.

> Such small horrors. And it is not the most dramatic: an eye open tomato red with blood, a nose with ice covered nostril hairs that looked like a crab emerging from a shell, an ear lying by a man's feet like some dead wingless bird, a cheek punctured with teeth exposed, a wound open steaming in the snow. (Hight, "Narrative Archeology.")

The texts are stored as audio files on a laptop computer attached to a GPS system, which users carry along in their walk through the district. On the screen of the laptop is a dynamic map that shows the walker's current location, as well as the locations of some hot spots. Whenever the GPS detects a hot spot (for a surprise effect, not all of them are shown on the map), the text that relates to these coordinates is played through earphones to the user. Walking around the area thus becomes a treasure hunt for hidden stories. (See http://www.xcp.bfn.org/hight.html for pictures of the project.) Different itineraries will dig out different artifacts from the narrative underground of the city, creating, in the author's words, "a sense that every space is agitated (alive with unseen history, stories, layers.) …Movement and reading now bring a narrative of what is unseen and what has been lost in time, only for it to quiet again once passed" (Hight, "Narrative Archeology").

With this "revenge of geography," as an anonymous technology writer calls the use of GPS and WiFi technology,[13] the space odyssey of the text reconnects the micro-space of computer memory and the mega-space of the Internet with the measurable, human-scale space of the world. At the start of this odyssey, in oral cultures, the text did not occupy any space of its own, but as a unique performance, it was bound to a specific site, the location of the participants in the act of communication. With the development of writing, texts acquired a permanent physical support with a spatial extension that turned them into potentally movable objects. Inscriptions on stones or on the walls of caves were still tied to specific coordinates, and the manuscripts of the Middle Ages were too precious to leave the libraries of monasteries, but when the invention of print allowed the mechanical production of multiple copies, and when the invention of the codex book made the material support of the text easily transportable, texts were freed from their spatial mooring, and they began to travel around the world. With the invention of digital writing, the space physically occupied by the text became the electronic chips of computer memory. This space was so tiny, so inaccessible, that it disappeared from sight. All that was left for the senses to contemplate was the graphic display of fictional space created by the text, as well as the virtual body of the text projected by the code on the computer screen. This virtual body soon began to explore its own pseudo-spatiality—one, two or three dimensional--, its architecture—now conceived as relations between non-spatially-situated, floating elements--, and its connections to other documents in the same environment. The move of texts to the Internet resulted in a total mobility that obliterated the separating effects of physical distance. But this seemingly straight trajectory leading out of the constraints of real

space into the freedom of virtual space is now beginning to curve back upon itself, as the text rediscovers its roots in real world geography. The GPS applications described above may be a passing fashion, and they will probably never become a dominant mode of textuality, but they signal the possibility of a reconciliation of real space, in which GPS texts are anchored, and cyberspace, from where they come to us. In order to reestablish a connection to place, location-specific texts sacrifices mobility, since they can only be downloaded from a certain area. But if they renounce the postmodern nomadism of their Internet companions, they make us rediscover the world, by insisting on being read in the *presence* of their referent.

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Endnotes

1. See for instance the numerous virtual nations that have been created on the Internet: Bergonia (www.bergonia.org), Talossa (www.talossa.com) , the principality of Fredonia (www.freedonia.org), and the founder of the breed, the no longer existing Lisbekistan.
2. To be found http://www.igd.fhg.de/archive/1995_www95/proceedings/posters/35/2.gif
3. I borrow the categories from Dodge and Kitchin, but I use my own examples.
4. For an example of a textual world with an impossible spatial lay-out, see David Herman's discussion of Flann O'Brien's *The Third Policeman*, in *Story Logic*, 285-96. For an example of a non-Euclidean map in a computer game, see Marc J.P. Wolf, 62.
5. In the demonstration version of this text on the Internet, the map is not literally interactive. Rather, the locations on the map are listed below the image, and it is by clicking on these verbal links that the reader accesses the correponding texts.
6. Other mimetic uses of Storyspace maps are found in Carolyn Guyer and Martha's Petry *Izme Pass*, as well as in Stephanie Strickland's *True North*.

7. As Alan Turing has demonstrated, all computers can be simulated by an automaton that operates on n infinitely long tape, consequently, on a one-dimensional object.
8. See Roberto Simanowski's discussion of this project in *Interfictions*, pp. 97-99. (review in dichtung-digital)
9. My presentation of "Cruising" is indebted to an insightful reading by Daniel Punday.
10. From a strict geometric point of view, the three-dimensionality of Karpinska's poem is nothing more than an optical illusion. The program with which the poem was written, Director, is not a genuine three-dimensional design system, such as 3D Studio, but a "two-and-a-half" dimensional system that creates an impression of depth by superposing layers of two-dimensional objects. A genuine 3D program would allow the construction of cubes, and it would be possible to rotate these cubes along three different axes with geometrically correct changes of perspectives. But the objects of Karpinska's poem are planes, not cubes, and the impression of three-dimensionality arises from the distortion of their shapes, not from a genuine real-time calculation of perspective.
11. In her discussion of the computer as palimpsest, Flanagan alludes to hose files that have been deleted, but not overwritten, and thus remain technically recoverable, but I have no evidence that her program can actually access this type of data.
12. From a transcription of a sample run. I am thankful to Noah Waldrip-Fruin for making the file available to me.
13. See the article by that title in the references.