Textual Modes of Hypertext

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Introduction

Human beings depict their own activities using text as an outlet. By the end of the previous century, however, we have encountered a great shift of paradigm concerning the support materials. Not only textual documents with letters but also pictorial images, which are commonly drawn on canvas or other tangible materials, have changed their support material to digital. Furthermore, their distribution has come to rely on digital technology, such as e-mail, Web and other procedures. The digitization of expressive media has not been limited not only to two-dimensional representations, but it has gone to multi-dimensional ones like artifacts or motion pictures, for which the technologies have given chances to share and consult with the computer. We confirm this tendency of digitization accelerates even in the 21st century.

The examples given above share following concept: all activities of human beings may be converted and stored in forms that the computer can use and then consulted with the computer on demand. If we do not use the term of "text" to express the concatenation of letters, but to mean all human expressions deliberately, we are allowed to call all representations consulted on the computer "digital text".

The digital text outstands in three respects, at least: 1) the facility of duplication, 2) the facility of retrieval of data, and 3) the manageability of mass volume. The hypertext as a part of digital text also shares these characteristics. In this paper, we will survey the origin and the existential modes of the hypertext to found a methodological basis of study on hypertext.

1. Origins of hypertext

The term of "text", before the advent of "hypertext", may be defined linear succession of representation of signs in respect to human communication. Contrary to

the definition of traditional text, hypertext is considered "text which is not constrained to be linear", and "text which contains links to other texts"[1]. Simple and linear succession of signs puts into a "file" which contains a "link" to point out another file; then more than one file get together making a whole or a referential system to be called as "hypertext". As we referred to the World Wide Web Consortium's definition of "hypertext", the term of "hypertext" is used in the field of computer technology. Thus when we browse through web sites with a web browser over the Internet, the software commonly displays the Uniform Resource Locator, "the syntax and semantics of formalized information for location and access of resources via the Internet"[2], with abbreviated signage of "http" for "Hypertext transfer Protocol" to designate the protocol to be used for consultation of data over the network. As the example above shows, the term of "hypertext" may be considered almost synonymous to the World Wide Web today.

1-a) Vannevar Bush and his Memex system

A question arises: when the idea of hypertext was born? There are various views on the origin of the hypertext, especially in respect to its definitions. General agreement tells us that the origin can be tracked back to an article written by Vannevar Bush, former vice-president and dean of engineering at the Massachusetts Institute of Technology from 1932 to 1938: "As We May Think" (1945)[3]. Bush gave a rough sketch of a system he called "Memex". His idea of Memex proceeds to such a grasp of academic circumstances around the end of the Second World War that pursuing "for the making of strange destructive gadgets, who have had to devise new methods for their unanticipated assignments", the physicists "who have been thrown most violently off stride" have to "find objectives worthy of their best" as peace approaches. In this respect, Bush sketches very roughly the system of Memex, with newly established technologies like photocells or thermionic tubes. The Memex is thought to be distinguished by four functions: 1) function of archiving and browsing: the Memex can store as many special microfilms as "a library of a million volumes could be compressed into on end of a desk" and search the archive and project data on the screen; 2) function of recording personal notes on microfilm: the Memex adds personal notes of user to its archival library, prepared preliminarily; 3) function of link: with this function named "trail", personal notes and preliminary data may be linked by user and archived; 4) function of searching linked data: users may retrieve any linked data stored in the archive of the system.

These four functions allow us to imagine the Memex as a device of computer but with storage not of magnetic disks but of special microfilms. Unfortunately, though, the idea of the Memex was too early to be realized and remained a device of dream,

1 Definition given by the World Wide Web Consortium at the URL below: www.w3.org/WhatIs.html (visited on January 30th, 2009).
2 RFC 1738: Tim BERNERS-LEE and al., "Uniform Resource Locators", December, 1994.
3 Vannevar BUSH, "As We May Think", in *Atlantic Monthly*, 1945. (republished on the Atlantic online at www.theatlantic.com/doc/194507/bush, visited on January 30th, 2009)

when a computer is of as huge proportions as a warehouse, because not all the technologies were improved enough at that time.

As we introduced the Memex as an original device of hypertext, the former explanation on the Memex reminds us of a database system or of a personal computer; thus, we may feel discomfort to call the system as a kind of "text". The concept of linking plural files each other to form a hypertext is analogous to that of world wide web system, which represents mainly hypertext, the fact justifies we think the Memex of an original concept of hypertext. It is, however, to note that the term of hypertext had not been used in the article of Bush.

1-b) Theodore Nelson and the Evolutionary List File (ELF)

It was Theodore Nelson who coined the term "hypertext" and established its definition used today. Twenty years after Bush proposed the prophetic concept of the Memex, Nelson gave in the 20th National Conference of the Association for Computing Machinery held in 1965 a lecture titled "A File Structure for The Complex, The Changing and the Indeterminate"[4]. Nelson points out to implement "a file for writers and scientists, much like the personal side of Bush's Memex, that would do the things such people need with the richness they would want" and "a simple and generalized building-block structure, user-oriented and wholly general-purpose" (84, NELSON). Nelson develops the idea on the basis of the file structure of the ELF and proposes a new file language of PRIDE for it in the article.

The ELF is designed to work with three elements: "entry", "list" and "link". Nelson describes:

> An entry is a discrete unit of information designated by the user. It can be a piece of text (long or short), a string of symbols, a picture or a control designation for physical objects or operations.
> A list is an ordered set of entries designated by the user. A given entry may be in any number of lists.
> A link is a connector, designated by the user, between two particular entries, which are in different lists; […]. An entry in one list may be linked to only one entry in another list. (89-90, NELSON)

Based on these features of each element, Nelson describes file operations on the ELF system in four respects: 1) each *entry* in a *list* can be sorted out in the *list* or duplicated in another *list* by the user freely and a *list* may hold sub lists; 2) a *link* correlates an *entry* to another *entry* held in another list, which may be made by the user without restrictions; 3) when the user duplicates a *list*, duplicated *list* retains all information including *links*; 4) the user may modify the order of *lists*, and the modified order may be linked to another *list*. These operational characteristics reflect only at the conceptual phase of the file system, while Nelson modifies the concept in his late

4 Ted Nelson, "A File Structure for The Complex, The Changing and the Indeterminate", in Proceedings of ACM 20th National Conference, 1965, pp. 84–100.

project named "Xanadu", in which he introduces a similar idea of the World Wide Web.

It is in the article that we confirm the term of hypertext in modern definition for the first time in the history.

> a body of written or pictorial material interconnected in such a complex way that it could not conveniently be presented or represented on paper. It may contain summaries, or maps of its contents and their interrelations; it may contain annotations, additions and footnotes from scholars who have examined it. (96, NELSON)

As we confirm in this citation, Nelson coined the term of hypertext to designate a computer related system that enables to link files (which are considered to be identical to "text" of traditional understandings) and to consult them easily. His definition of the term of hypertext may be regarded as redefinition of Bush's Memex, which remains machinery with microfilm, with terms of computer technologies and virtual entities of file structure. Unfortunately, again, the hypertext system of the ELF designed by Nelson does not get a real shape, at least in the period when he made the presentation at the conference.

1-c) Douglas Engelbart and his NLS

We introduced two original concepts of hypertext proposed by Bush and by Nelson. Both of them have not been realized or constructed at the publication of the articles. It was the On-Line System (NLS) that won the prize of the first hypertextual machinery produced in the history.

The NLS, called as the "Augment System" later, is the first hypertextual machinery implemented on computer by a team at the Stanford Research Institute, lead by Douglas Engelbart, who is adherent of Bush. As Engelbart tells in the interview published on the magazine *BYTE* (December 1988)[5], the NLS is a composite system with tools "that led to the empowering of both collocated and distributed work groups collaborating simultaneously and over time on common knowledge work" (ENGELBART & LEHTMAN). We may associate the product with what we name commonly "groupware" today.

The NLS provides four main functionalities as below:

> outline editors (for easy manipulation of ideas); hypertext linking capabilities fully integrated into the system; a system of recorded group dialogue that transcends most mail systems; user programmability and customizability of the system; […]. (ENGELBART & LEHTMAN)

We must also advert to the invention of "mouse" by the Engelbart's team. The team

5 Douglas C. Engelbart and Harvey Lehtman, "Working Together", BYTE Magazine, December 1988, pp. 245–252. Republished on the Site at the URL below: www-sul.stanford.edu/depts/hasrg/histsci/ssvoral/engelbart/append1-ntb.html, visited on January 30th, 2009.

demonstrated the system publicly in 1968, known today as "mother of demonstration", and filmed documents of the demonstration are still available at the SRI's web site[6].

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In this chapter, we picked up three pioneers of hypertext, and overviewed their concept of hypertext. What they had in their minds differs each other, of course, we may observe, however, common concepts on hypertext in three respects: 1) linking capabilities to illustrate relevance between files (or documents, or texts), which asks also plurality of relevant files; 2) optionality of linking, which assures users to make links between files (or documents, or texts) widely authenticated or personally made; 3) indispensability of a device to consult files (Bush's Memex, Nelson's ELF and Engelbart's NLS). With difference from texts printed on paper or other materials, hypertext asks a system or a device to be consulted. In other words, hypertext has the specific mode of existence, which acquires its existence only working with an inherent system.

2. Hypertext as system

As we overviewed in the previous chapter, different from simple digitized text, hypertext in cunabula required technological progression in two respects: development of computer system and of computer networks. When Bush first proposed his Memex, no computer system was put to practical use; that is because Bush put emphasis on the photocell and other non-electronic technologies for storing documents. Following to the end of the Second World War, we encounter the first construction of computer system like the ENIAC [Electronic Numerical Integrator and Computer] or its successor EDVAC [Electronic Discrete Variable Automatic Computer] in 1945[7]. We thus entered another phase of making documents not with microfilm but with electronic property. This transition in the subject of support materials of hypertext enables hypertext to handle even pictorial images or movies, just as Bush sketched out his Turkish bow scenario in the article[8]. Thus, all documents stored in digitalized format took on the possibility of making part of hypertext, as far as a document is stored in a computer with network connection.

Both Bush's Memex and Nelson's ELF envisage a self-contained system exist only in a closed space of a stand-alone computer. Hypertext of today, however, is not limited into the inner space of a computer. With the development of the Internet, the origin of which extends back to the ARPANET [Advanced Research Project Agency

6 Movies are available on the "Mouse Site" at the URL below: sloan.stanford.edu/MouseSite/, visited on January 30th, 2009.

7 Martin CAMPBELL-KELLY and William ASPRAY, *Computer: a history of the information machine*, Westview Press, 1996. See also: Howard RHEINGOLD, *Tools for Thought*, Simon & Schuster, 1985.

8 Cf. BUSH, *art. cit.*; Taking example of Turkish bow, Bush explains how the user of the Memex builds trails to illustrate relation between different documents and personal notes.

Network] developed by the initiative of a department of Pentagon, the Internet connection empowers hypertext to extend over the network. In other words, hypertext took on a specific extensity. Despite of finite resources that the hypertextual extensity assumes, resources keep expanding over the Internet so that we never consult all existing hypertexts. We thus may call the extensity infinite with this perspective. With these two features acquired, hypertext overcame restrictions associated to traditional text, and it actualized the identity mentioned at the end of the previous chapter as three common concepts in origin.

What is eminent for the linking capability, hypertext allows to link authorized text, such as published dictionary, with non-authorized and personal text, such as diary or memoranda by users' own volition. Bush embodies the capability into his concept of Memex, as sketched in his Turkish bow scenario. He premises that printed texts like dictionary or encyclopedia may be converted in the form of microfilm and be distributed through the same channel as traditionally published texts: "Most of the memex contents are purchased on microfilm ready for insertion. Books of all sorts, pictures, current periodicals, newspapers, are thus obtained and dropped into place. Business correspondence takes the same path" (BUSH).

With this respect, authorized texts may be considered to take on a "public" nature, whereas memoranda or diary "private" nature. These two natures of text have never coexisted in a text before the advent of hypertext. A great textual evolution consists in this capability, which enables to constitute a systemic whole as hypertext.

The coexistence of public and private natures in hypertext brings ambiguity in terms of social status of hypertext, as George P. Landow pointed out[9]: "One can imagine hypertext presentations of books (or the equivalent) in which the reader can call up all the reviews and comments on that book, which would then inevitably exist as part of a complex dialogue instead of as the embodiment of a voice or thought that speaks unceasingly" (LANDOW, 63). The hypertextual ambiguity asks to modify our basic idea of text in printing tradition: the authorship[10]. As we reprised in previous study of this paper, the hypertext is not composed of substances like pieces of paper, but of what we call files, which ensure the virtual consistency, realized by electronic properties and computer devices. The hypertextual properties disengage from limitations of traditional printed text, and establish its own mode of existence, which enables hypertexts to spread out from inner space of traditional text. In other words, traditional text converges to the inside, whereas hypertext diverges to the outside of single file to establish linkage with other files. The textual convergence assures us to distinguish private space and public space, while on the other hand the hypertextual divergence disables the distinction.

This transubstantiation of textuality for hypertext may also affect acts of reading.

9 George P. LANDOW, *Hypertext, The Convergence of Contemporary Critical Theory and Technology*, The Johns Hopkins University Press, 1992, pp. 35–70.

10 Cf. SHIGEMI Shinya, "The Textual Identity of the Web", in *Identity in Text Interpretation and Everyday Life*, Proceedings of the Third International Conference Hermeneutic Study and Education of Textual Configuration, Graduate School of Letters, Nagoya Univeristy, 2008, pp. 63–73.

The reading act leads readers linearly from the first page to the end for traditional printed texts. The linearity of reading act derives from one of the limitations that the printed texts hold as self-contained substance. We may suppose, of course, different procedure with which reader does not follow the linearity of text. For example, readers may put emphasis on each componential unity such as chapter or clause and pick up to read disregarding the order of such textual components that the traditional text gives; or readers may break their reading act when they encounter a note (or even when they don't have no apparent reasons) to read other texts. Hypertext enables to place no physical limitations of the linearity for readers. For those who want to start their act of reading hypertexts, neither apparent entrance nor exit is fixed. Even more, following hyperlinks embedded in hypertext, readers may easily skip over to another text and continue their reading. The advent of hypertexts announced against the traditional printed texts the transubstantiation in two respects: the lost of self-contained substance and the textual linearity.

Unique existential modes of hypertext surpass what we have studied and confirmed up here. Hypertext asks a numeric system to be consulted; and the system allows hypertexts to be rendered differently depending on users or numeric devices. All who have browsed Web pages with different browsers might have found that a rendered Web page varies according to the browser. The Windows version of Internet Explorer renders a Web page differently from the Mac OS version of Internet Explorer, even if we consult a same Web page. It is unusual to have the same experience in case of traditional printed text. Taking an example of a literary work of *Nausea* by Jean-Paul Sartre in French literature, the work in a specific edition always appears in an identical mode. Different editions give a different existential mode like *Nausea* in the "Pléiade" collection and in the "*folio*" collection. Even in this case of different editions of a work would not contain different texts. In case of web pages with different browsers, however, it is usual that an image file is not rendered, or that specific software needs to be installed to render properly the Web page. Malfunctioning of this sort makes clear the existence of numeric system. A system in the domain of computer asks standardization. The standardization is achieved in two respects: 1) code system to describe web pages, which standardizes the source of hypertextual communication, 2) rendering engines for browsers to represent generated code into web page, which standardize the reception. The standardization for web texts, however, causes dissimilarity in actual consultation with different browsers.

3. Modes of hypertext

The standardization of hypertext consists in both ends of communication: generation and consultation. Study on hypertext, thus, should consider these aspects. As these understandings are based on the idea that a text or a hypertext can be studied, taking them as communicative tools, we may have right to ask what they have in between generation and consultation of hypertext; in other words, structure of hypertext. We have also discussed on what are specific existential modes of hypertext; we have then

resumed in the terms of *divergence* and *convergence*, following the term proposed by Landow. Here we may be good to ask the relationship between two existential modes and the hypertextual structure. We believe that it is inevitable to know the relationship, when we want to find a theoretical basis for studies on hypertext. This chapter presents, however, only a rough sketch of future theory.

Thus, we propose to study hypertext in two "layers". We may, first, suppose "textual layer" to say what users see as web page. Constituents of this layer are strings of characters, still images, moving images and audio. Among these constituents, strings of characters have unique properties for computer, which is then called "character data type" or "text-type data". Other constituents are called "binary data type", which may be varied from a simple image file to a software program running on computers. Both character data type and binary data type constitute a basic unity to represent a web page; we thus call the unity "textual segment".

Aside from these four constituents, we may suppose that a textual layer includes another segment: "user-interface segment", which attests that web page can be present only as a part of numeric system. Features we suppose by the term of "user-interface segment" are implemented in browser software; buttons as "reload", "back", forward" and field to show URL or "address".

Main difference between the "textual segment" and the "user-interface segment" resides in a fact that the "textual segment" may be changed by each browsed web page, whereas the "user-interface segment" remains same as long as users use a same browser.

We may also distinguish another layer of hypertext: "source layer". Unlike the "textual layer" that users read as web text, the "source layer" will not to be displayed on computer screen unless users expressly choose a command to show it. In fact, the reason we use the term "source" for this layer, resides that the "textual layer" is rendered only on the basis of a "source" file, or a "HTML source file" that comprises only character data to point out linking information for binary data. The layer is relevant only to numeric procedure within a computer, but web programmers should acquire expertise in procedure to build a complex web site.

We have studied and confirmed two existential modes of hypertext, divergence and convergence, in previous chapters. When we think of two layers discussed in this chapter, we come to find a parallelism between the hypertextual modes and the hypertextual layers. Web pages we navigate are constituted on the textual layer of hypertext that assures a hypertextual property of convergence, whereas the web pages rendered onto the browser based on "source files" that enables hypertexts to acquire another property of divergence on the "source layer".

Final remarks

The development lead by three pioneers of Bush, Nelson and Engelbart ends up to adopt the electricity as support material of text. The fact happens to enable hypertexts to spread over computerized network along with the expansion of the Internet.

Hypertext thus acquires properties and existential modes different from what we knew as text by tradition. Source files of hypertexts exist spread over the network, and, with the help of the linking capability of hypertext, browsing software compiles them into a computer screen without any material support but the electricity.

As the new textual type of hypertext is widely used in communication, it would be natural to turn hypertexts into a textual study. We have studied and confirmed our supposition that two layers linked to two existential modes serve as theoretical basis for a study of hypertext. However, it will be necessary to put what we have studied in this paper into broader context of textual studies such as narratology developed in study of literature, approaches of pragmatics, discourse analysis, functional grammar or other studies in the domain of linguistics.