

Seminarska naloga
za predmet Novi mediji

From HYPER-paper to HYPER-adaptive -media

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Izvleček

Ideja o univerzalnem znanju kot papirnati arhiv sega v dvajseta leta prejšnjega stoletja in se nadaljuje tudi po drugi svetovni vojni vse do danes. Današnja stopnja razvitosti tehnologije omogoča raziskave v smeri prilagodljive hipermedije, ki iz kognitivnega stališča, ponuja veliko več kot tradicionalni učni viri. Vključuje globoke povezave med mentalnimi procesi in sliko, zvokom in videom. Orodja za kreiranje hipermedije so danes dostopna in enostavna za uporabo.

Abstract

The idea about universal knowledge begun with a paper archival system, in the 1920's and It has continued since WW2 to the present time. Today, IT background make possible to research in a direction of adaptive hypermedia which, from the cognitive point of view, offers much more than traditional learning resources. It includes deep connections between mental processes and the picture, sound and video. Tools to create and produce hypermedia are accessible and easy to use.

Ključne besede

hipermedija, hipertekst, znanje, učenje, shranjevanje podatkov, linki, adaptivna hipermedija, asociativno mišljenje, kognicija, konstruktivizem, hipermedijska orodja

Keywords

hypermedia, hypertext, knowledge, learning, data storage, links, adaptive hypermedia, associative thinking, cognition, constructivism, hypermedia tools

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1 Lost pioneers

1.1 Paul Otlet and Henri La Fontaine - Mundaneum

Historians typically trace the origins of the World Wide Web through a lineage of Anglo-American inventors like Vannevar Bush, Douglass Engelbart and Ted Nelson. But more than half a century before Tim Berners-Lee released the first Web browser, Paul Otlet and Henry La Fontaine had already described a networked world where “anyone in his armchair would be able to contemplate the whole of creation¹.” They built a paper archival system of the world’s information which they called Mundaneum.² Their goal was to preserve peace by assembling knowledge and making it accessible to the entire world.³

Since there was no such thing as electronic data storage in the 1920's, Otlet had to invent it. He started writing at length about the possibility of electronic media storage, culminating in a 1935 book, “Monde,” where he laid out his vision of a “mechanical, collective brain” that would house all the world’s information, made readily accessible over a global telecommunications network⁴. Otlet’s vision hinged on the idea of a networked machine that joined documents using symbolic links. Otlet sketched out plans for a global network of computers (“electric telescopes”) that would allow people to search and browse through millions of interlinked documents, images, audio and film files. He described how people would use the devices to send messages to one another, share files and even congregate in online social networks. He called the whole thing “the network”⁵.

Although Otlet’s proto-Web relied on a patchwork of analog technologies like index cards and telegraph machines, it nonetheless anticipated the hyperlinked structure of today’s Web. His team created a paper database with more than 12 million individual entries⁶. “This was a Steampunk version of hypertext,” said Kevin Kelly⁷.

Otlet’s version of hypertext held a few important advantages over today’s model. Otlet envisioned hyperlinks that carried meaning by, for example, annotating if particular documents agreed or disagreed with each other. Otlet also saw the possibilities of social networks, of letting users “participate, applaud, give ovations, sing in the chorus” and to trade messages, participate in discussions and work together to collect and organize documents. He aspired to map out conceptual relationships (hyperlinks) between facts and ideas. “The Semantic Web is rather Otlet-ish,” told Michael Buckland.⁸ Otlet’s dream ended in 1940 when Nazis destroyed thousands of boxes filled with index cards. Otlet died in 1944, a broken and soon-to-be-forgotten man.⁹

1.2 Herbert George Wells - World Brain

World Brain is a collection of essays and papers written during the period 1936 to 1938 by English science fiction pioneer, social reformer, evolutionary biologist and historian Herbert George Wells. Throughout the book, Wells describes his vision of the world brain: a new, free, synthetic, authoritative, permanent “World Encyclopaedia” that could help world citizens make the best use of universal information resources and make the best

¹ Otlet, Paul: published on web page Union of International Associations, published: June 17, 2008, available on <http://www.uia.be/paul-otlet-1868-1944>, accessed: January 29, 2013.

² Mundaneum, available on <http://expositions.mundaneum.org/en>, accessed January 29, 2013.

³ Wright, Alex: The Web Time Forgot, The New York Times, June 16, 2008, available on <http://www.nytimes.com/2008/06/17/science/17mund.html?pagewanted=all&r=0>, accessed: January 29, 2013.

⁴ Otlet, Paul: Monde, 1934, Internationalorgoootle[1].pdf.

⁵ “réseau”, fr.

⁶ The Belgian government supported their project.

⁷ Former editor of Wired Magazine.

⁸ A professor at the School of Information at the University of California, Berkeley.

⁹ Today, the new Mundaneum reveals tantalizing glimpses of a Web that might have been. Long rows of catalog drawers hold millions of Otlet’s index cards, pointing the way into a back-room archive brimming with books, posters, photos, newspaper clippings and all kinds of other artifacts. A team of full-time archivists have managed to catalog less than 10 percent of the collection.

contribution to world peace¹⁰. He wished the world to be such a whole “as coherent and consistent as possible,” and that wise world citizens would ensure world peace. His idea was to hold men's minds together in something like a common interpretation of reality; there is no hope whatever of anything but an accidental and transitory alleviation of any of our world troubles. This lecture lays out Wells's vision for “...a sort of mental clearing house for the mind, a depot where knowledge and ideas are received, sorted, summarized, digested, clarified and compared.” Wells felt that technological advances such as microfilm could be used towards this end so that “any student, in any part of the world, will be able to sit with his projector in his own study at his or her convenience to examine any book, any document, in an exact replica.”

Wells saw the potential for world-altering impacts this technology could bring. He felt that the creation of the encyclopedia could bring about the peaceful days of the past, “with a common understanding and the conception of a common purpose, and of a commonwealth such as now we hardly dream of.”¹¹

Arthur C. Clarke predicted that the construction of what H. G. Wells called the World Brain would take place in two stages. He identified the first stage as the construction of the World Library, which is basically Wells' concept of a universal encyclopedia accessible to everyone from their home on computer terminals by the year 2000. In the second stage the World Library would be incorporated into the World Brain, a super-intelligent artificially intelligent supercomputer as a subsection of it. He suggested that World Brain would be completed by the year 2100 and would be able to mutually interact with humans in order to solve various world problems.¹²

2 Early visionaries

2.1 Vannevar Bush

As he was already dissatisfied with out-dated concepts of storing and searching for knowledge, Bush published an article (1945) in the Atlantic Monthly magazine entitled "As We May Think" in which he proposed an associative approach as an alternative to storing indexed information. Bush reasoned that in the current model, data could only be stored in one place, unless it was duplicated. He went on to note that the mind does not work that way but rather through association so he proposed Memex – a device in which an individual stores all his/her books, records and communications and, which is then mechanized to be consulted with the speed and flexibility.” The hypothetical device (the Memex) would use associative indexing would provide you with your choice of information At that time the idea of associative indexing was revolutionary. Nowadays almost all computer systems work exactly on this principle. In the article “As We May Think”, Bush introduces the idea of blocks of text, links and events, and network traces that describe a new form of text appearance. This scientist began to reject a fundamental starting point of the dominant information technologies that had prevailed since the time of Gutenberg. Its origin can be viewed as resistance to linear fixed methods that led to the triumph of capitalism and industrialism. At the same time, he celebrates the imagination and freedom of choice and ideas. Bush, as well as future concepts of networking knowledge, brings the promise of democratization of public space.¹³

2.2 Douglas Engelbart

Douglas Engelbart's implemented ideas played a key role in the development of thought presentation information. He was firmly convinced that intelligence will not be forever isolated resting only in the human brain, but also in technological tools. He was not a psychologist, although his work fits in to cognitive psychology, where the human

¹⁰ The dream of World Brain was first expressed in a lecture delivered at the Royal Institution of Great Britain, Weekly Evening Meeting, November 20, 1936.

¹¹ Wells, H. G.: The Idea of a Permanent World Encyclopaedia, Encyclopédie Française, 1937.

¹² Clarke, Arthur C.: Profiles of the Future; An Inquiry into the Limits of the Possible. New York: Harper & Row, 1962.

¹³ Bush, V.: As We May Think. The Atlantic Monthly, July 1945.

mind is treated as a system for symbolic elaboration. He had a goal to “enhance” the human intellect, or improve of human mental processes by portray their concepts in ways that could better harness sensory, perceptual and cognitive capabilities. In 1962 he presented his “Computer Augmentation System – extension of the computer system,” which automates symbolic calculations. With this project, Engelbart wanted to revive the ancient knowledge of network structures, which has been neglected by the traditional method of education in reading and writing. Finally, his ideas were implemented in 1968, with the NLS (“On Line System”), software for producing hypertext. In it we can see the way in which we interact with personal computers to this day – from multiple windows to hypermedia links, the precursor of modern collaborative online system, which drastically changed the way we communicate with the author’s user guide and product flow and outcome of events.¹⁴

2.3 Ted Nelson

The word “hypertext” was first coined in 1963 by Nelson.¹⁵ His vision involved the implementation of a “docuverse”, where all data was stored once, there were no deletions, and all information was accessible by a link from anywhere else (by telephone, satellite etc.). Navigation through the information would be non-linear, depending on each individual's choice of links. Nelson has continued to develop his theory in Xanadu, a high-performance hypertext system that assures the identity of references to objects, and solves the problems of configuration management and copyright control. Anyone is allowed to reference anything, provided that references are delivered from the original and possibly involving micro payments to the copyright holders.¹⁶

2.4 Tim Berners-Lee

A young researcher, Tim Berners-Lee used the combine version of Bush and proposed a new project at CERN in Geneva in 1990. The HyperText Project (W3) was successfully realized and confirmed in a few months. At that moment, Berners-Lee did not think anything of universal hypertext. He tried to connect all the information contained “in all CERN owned computers”. The idea of hypertext has been fully extended; there is a universal Internet access. Given the strong grounding in topic provided by the likes of Bush and others, everything Berners-Lee had to do was “easy” – to marry hypertext and the Internet and create web page. Currently, web structure is not the only example of hypertext, but it is the most popular due to its use on the Internet, where the reader has the highest degree of participation and freedom of choice. Finally, the information in the world occurred with the emergence of the WWW irresistible to true online revolution, which began to integrate knowledge across the world.¹⁷

2.5 Early hypermedia in practice

Parallel to the global development of concepts for the integration of knowledge, new methods of acquiring knowledge were developed, incorporating the principles of hypertext thinking. In practice, process- and project-design methods to address the problem effectively preclude linear and passive methods of the past.

2.5.1 MultimediaLab / Fabrice Florin: Life Story: The Story of the Discovery of DNA (1990)¹⁸

Life Story is an interactive learning environment built around a film (by Adrian Malone) dramatizing the discovery of the structure of DNA. Life Story enables students to explore key scenes from the drama, to view

¹⁴ Engelbart, Douglas C.: Augmenting Human Intellect, Summary Report AFOSR-3223 under Contract AF 49(638)-1024. SRI Project 3578, Stanford Research Institute, 1968.

¹⁵ It was first found in print in a college newspaper article about a lecture Nelson gave called "Computers, Creativity, and the Nature of the Written Word". Nelson later popularized the hypertext concept in his book *Literary Machines*.

¹⁶ For example, the Xanadu system would enable an artist to post their work in electronic form and let it be accessed any number of times, without having to worry about suddenly receiving an insupportable bill for network bandwidth costs.

¹⁷ Berners-Lee, T.: World Wide Web: Proposal for a HyperText Project, CERN, November 12, 1990.

¹⁸<http://vimeo.com/8938945>, accessed January 29, 2013.

documentary interviews with the real people portrayed & to refer to molecular animations & still photographs. Innovative, interactive maps such as a navigable plot or scene map were created. The video material was edited to fit on one side of a laser-disc, the soundtrack was transferred to CD Audio, & the software was developed on the CD to access the content on the CD & videodisc. A Teacher's Guide was produced for classroom use.

2.5.2 Robert Winter: Ludwig van Beethoven 9. Symphony (1989)¹⁹

Work represents a "pocket" guide through the structure of Beethoven's 9th Symphony. Winter was invited by the Voyager Company to produce its first original interactive software title. This product is widely regarded as the first commercial and educational interactive publication.

2.5.3 Robert Abel: Guernica²⁰

Back in the late '80s, Apple introduced a unique technology called the HyperCard. It combined database capabilities with a graphical, flexible, user-modifiable interface. HyperCard was the first consumer product that introduced the concept of "hyperlinking", being able to access external information with a single link. Inspired by the anti-war painting "Guernica" by surrealist Pablo Picasso, Abel realized the potential of the technology and set about to create a very ambitious production. Abel enriches Picasso's symbolic imagery by providing access to archived interviews, footage and news coverage by different witnesses. Users can click on various portions of the painting by choosing from an array of „witness“ tools and glean different types of information about the painting, the artist, the economy at that time – or the war itself. Abel saw "Guernica" as the ultimate self-paced and self-directed educational tool.

3 Hypermedia as an important factor in modern knowledge sharing

The very first examples of realized hypermedia suggest broad applicability for educational purposes. Hypermedia as a significant component includes connectivity and interactivity. There are plenty of theories, exploring the link between Hypermedia and knowledge sharing (teaching/learning). All agree that high-level of information control and flexibility are the main advantage given by environment to the learner. A lot of theories explain that hypermedia easily support collaborative behavior in learning process. Interactivity allows the user to create own paths, investigating and reading and active participation, as well as the reverse effect in real-time. Psychology stresses that hypermedia much more models structure and process of thinking, compared with printed learning materials.

3.1 Cognitive psychology and hypermedia junction

Cognitive psychology nurtures the idea of an active-minded individual that expands and develops their knowledge in a constructive process where new information take integrated into existing knowledge. In the wake of the described benchmarks, a constructivist interpretation of the phenomenon of learning is developed. Jean Piaget²¹ describes it as a constant and active process of construction, expansion and as organization of knowledge. Knowledge is the organized experiential world of the subject; it is individual, flexible and constantly changing. It is seen as part of the interpretation and intentions. It encourages self-regulated and spontaneous learning and the creation of entirely new approaches and models of learning.

Such determinations results in recommendations for the design of educational processes, which require that a learner re-examine, check, reject, modify or accept its construct of reality.

¹⁹ http://musicology.ucla.edu/index.php?option=com_content&view=article&id=183:robert-winter-bio&catid=6&Itemid=225, accessed January 29, 2013.

²⁰ <http://siliconvalet.blogspot.com/2010/09/bob-abel-father-of-interactive.html>, accessed January 29, 2013.

²¹ Piaget, J.: Characteristics of Constructivist Learning & Teaching, <http://www.ucs.mun.ca/~emurphy/stemnet/cle3.html>, accessed January 29, 2013.

In educational literature, there are many papers in which argue for a high degree of the attitude is expressed as a high degree of **complementarity** between cognitive-constructivist trends and computers. In the 1960's, before the invent of hypertext, researchers such as Seymour Papert²² had already explored the possibilities of the computer as a tool to manage students. He also argued its open architecture would allow the construction of the proper knowledge.

Often referring to the analogy between mental structures based on associative processes of human learning and hypertext, which is also based on relationships that reflect the semantic structure of the document. Hypertext, therefore, as a semantic network mimics the mental structures which further promote constructive learning processes. Multimedia is an important characteristic of the new technologies due to its perceptual characteristics and its motivating and interacting effect.²³ Sensory experiences complement and enrich each other and contributes to a variety of types of learning.

The new pedagogical paradigm is based on the premise of constant interaction with the modern and complex information environment, where students construct rather than passively receive knowledge, being involved in its discovery and learning from interaction with available resources. In the new context of information sources, mentors are "information navigators". They suggest and guide research methods in education. A non-linear, multi-dimensional view of content that promotes cognitive flexibility will be created, rather than a predetermined sequence of learning.²⁴

4 Adaptive hypermedia

In contrast to traditional hypermedia where all users have been offered is a pre-planned series of hyperlinks, adaptive hypermedia adapts contents to learner's objectives, capabilities, interests and prior knowledge. It is closer to the needs of constructive pedagogy. It provides an answer to the problematic situation of a learner being given links but not having the appropriate knowledge to select them to suit. Adaptive hypermedia creates such a selection of the hyperlinks, tailored for the user.

5 Common software for hypermedia applications

Software such as Adobe Flash, Adobe Director and Macromedia Authorware can be used to create hypermedia applications which emphasize content navigation. Applications for development of databases such as Oracle Application Express, MySQL and Visual FoxPro also support the development of hypermedia applications, with a strong usability in education and management.

Standardization of scalable vector graphics have provided the opportunity for the use of hypermedia in mobile devices (Inkscape and Ikiwo Animator). Mobile devices based on Windows Mobile, Android and iPhone platforms default supports this specification and can use it.

Hyperlinks can be added also to the "classical" files (limited support to script and hyperlinks). A typical example would be seen in Microsoft Office that each application (PowerPoint, Word, Excel ...) allows one to create hypermedia. Adobe products also support hypermedia. Acrobat, Dreamweaver, Indesign and others can accommodate hyperlinks.

²² <http://www.papert.org/>, accessed January 29, 2013.

²³ Baumgärtner, T.: Lehren und Lernen mit neuen Medien in der universitären Ausbildung, 2002, p. 105-115, <http://digbib.ubka.uni-karlsruhe.de/volltexte/1000005835>, accessed January 29, 2013.

²⁴ Bannan-Ritland, B., Dabbagh, N. & Murphy, K.: Learning object systems as constructivist learning environments: Related assumptions, theories, and applications, In D. A. Wiley (Ed.), *The Instructional Use of Learning Objects: Online Version*, 2000, <http://reusability.org/read/chapters/bannan-ritland.doc>, accessed January 29, 2013.

6 Conclusion

Officially, the history of hypermedia is short in that it has existed for less than a century; However, in this period humans have discovered many ways to explore the unlimited opportunities it offers. Its influence grows exponentially into our habit and it is all around us.

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