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Galina J. Kedrova / Maria V. Volkova / Anatoly M. Egorov

Principles of effective Internet design for the correct presentation of hypertext and hypermedia information in education

The modern World Wide Web has already evolved into a fully functional global mass-media resource. Though it seems to be congenial to other well-known conventional mass media, this mass communication resource reveals itself as crucially different from all other means of information communication that have been invented and previously widely used as universal practice in human society. Today one could even affirm the emergence of a new special Web-based communication code, a kind of Internet koine. The code could be characterized as resting on two foundations that we define as 'non-linearity' and 'polymodality'. Thus, its peculiarity ensues primarily from the ability of the Global Network to store, process, and expose to users in arbitrary (or pre-defined by the hypertext author) order pieces of information (information chunks) containing highly polymorphous (multimodal) information that is at the same time fully integrated into an all-in-one entity.

Non-linearity of the Web-based information is a complex phenomenon generally defined as 'hypertext', or 'hypertextuality'. It has already become obvious that hypertext systems represent a radically new type of information system, which is originally related to information databases but differs from them in some special way of providing access to the information stored in these bases. As has been mentioned earlier, hypertext systems provide unique possibilities of nonlinear (not consecutive) organization of information, assuring therefore an extremely flexible information search and access to the desirable information fragment of any sensual modality by means of *a priori* organized navigation services and/or an arbitrary browsing trajectory through the information hyperspace via a system of pre-defined hyperlinks.

The fast global extension of hypertext technology results from the multiple useful and highly attractive opportunities it affords, namely:

– hypertext provides a simple and easy way of establishment of relationships between information fragments and a high speed of transition from one information block to any other;
– hypertext provides a simple and easy way of updating existing information relationships and establishing new ones;

– hypertext provides a simple and easy way of updating existing information content within a fragment and adding new ones;
– hypertext encompasses intentional plurality of structuring schemes and representation modes of the same information field (i.e. hierarchical vs. non-hierarchical scheme, logic/associative scheme, verbal/visual/auditory perceptual mode, etc.)

Thus, hypertext provides a vast variety of content editing and knowledge management techniques, multimedia content processing included. It should be emphasized that hypertext references (hyperlinks) do not only structure and organize an information field, but very often would be intentionally used as an effective tool for the formation of new semantic references, sometimes drastically changing initial intentions and even the very substance of the communication. The unconscious nature of perception of multimedia makes hypertext an even more powerful and effective tool for knowledge management than any other provided by traditional, linearly organized texts. Though standard formatted text closely connected with audio and video information is common practice on the Web today (and modern scientists even promise further integration of other forms of human perception in the near future, namely: olfactory and tactile sense), some basic mechanisms of hypertext's functionality, as well as optimization patterns and practical recommendations of effective use, especially for applied aspects of hypertext technologies, are not yet explored and described. Therefore, one could state that the formation of the theory of hypertext and the development of recommendations for its practical use in various applied areas are now of great interest and utmost importance.

Substantially, hypertext is isomorphic to some information fields, organized as a multidimensional space. Structurally, hypertext represents a network of information fragments (hyper-nodes) connected by referential marks (hyperlinks). Its composition is often visualized as an oriented graph with two-way connecting arrows between its elements. As far as external appearance is concerned, hypertext systems have engendered a new and very specific outward representation consisting of the combination of numerous elements of the visual design often defined as a fusion of various design principles and patterns. The complex nature of Web-based information at the very beginning predetermined the effectiveness or mismatch of many Web-design canons and artistic manner styles observed on the Net.

The symbiosis of polymodality and non-linearity in hypertext macrocosm has led to the genesis of an essentially new type of communicative interaction in which the dominating means of knowledge and meaning formation are not

only text, nor any other form of verbal information, but all kinds of interactive multimedia. Any webpage is perceived by the user as an integral unit that can not be resolved into separate constituents presented on the page: verbal information only, visual information (pictures or video-clips), virtual modeling of an object, or a process (virtual reality), an interactive exchange of messages of any modality (text, sound, video exchange), etc. Each Internet page is thus a complete communicative message, which has a complex multilevel and multilayered organization where all elements (verbal and nonverbal, visual and auditory) actively interact with the sense organs of the individual. Therefore, Internet design becomes a key factor of successful communication on the Web.

Designers of computer interfaces have long understood that the starting point of any good interface design – that is, program interfaces that are both user-friendly and intuitive – should be a metaphor. The metaphor principle demands that both monitor screen layout and basic means of interaction with the computer system should appeal to a situation familiar to the user. Thus, the well-known 'window' application interface metaphor exploits an intuitive notion of a desktop with documents. Using the metaphor principle in the process of interface design construction solves several deep problems in one swoop. Firstly, it is much easier for the user to get an overall understanding of the website, and at the same time to interpret the current image displayed on the screen. Secondly, the user does not need to refer to the management manual every single time to learn how this or that interaction with the computer program should be carried out. Thirdly, the user has a relaxing feeling of psychological comfort, comparable to encountering something familiar and already well mastered, having been adopted long ago.

Today the metaphor principle in the construction of interface design is widely used for the Internet representation of conventional mass media, i.e. Web-based versions of traditional newspapers and magazines. Figure 1 shows an entrance page of the Internet version of one of the oldest Russian newspapers, "Izvestia", as a good example of the metaphor principle, which has been taken as the basic idea for the newspaper's website layout. It is also worth noticing that the overall integrity of perception of this webpage is strongly supported by the regular use of two other design principles, namely that of association and of complementarity of all the design constituents within the uniform Constructionist style (character type, page topography, restricted palette, etc.). The fusion of these basic website design principles assures in our case the genre affiliation of the site, alongside the marked distinction of the newspaper's Internet image from other functionally similar Web resources.

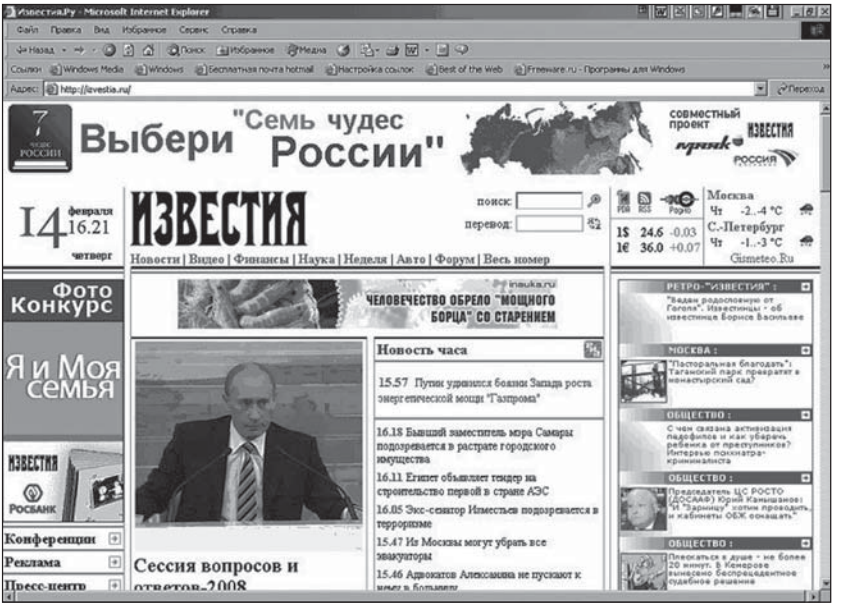


Fig. 1: An example of the domination of the metaphor principle in the webpage layout of Russia's oldest newspaper "Izvestia" combined with the Constructionist allusive elements (http://izvestia.ru/)

(a)

(b)

Fig. 2: Examples (a), (b) of incoherent information space (various collections of Haiku poetry from an open set of authors), where the webpage design is mainly based on a metaphorical principle (http://haiku.ru)

It should also be stated that if the website's information was considerably diversified and heterogeneous in nature, it would be mainly the metaphor principle that would be responsible for achieving the assemblage of incoherent information fragments into an aggregated and consistent information resource (Figure 2).

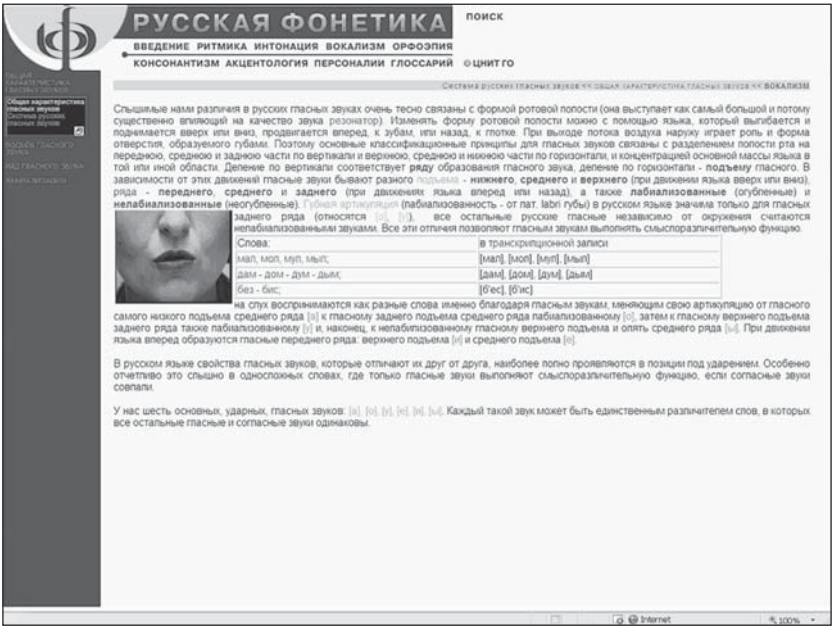
The metaphor principle determines many other valuable parameters of hypertext design providing information integrity, information consistency and information density. Various aspects of the underlying metaphor could help to outline a formal system of all basic interaction patterns at the earliest stage of the design processes, and to determine thus an inventory ('alphabet') of reusable design elements, each of them being assigned a special, context-dependent function and meaning. It is well known that the small-scale alphabet of distinguishable navigation signs (or icons) along with the codified design of all other congenerous textual and hypermedia elements ensures a user-friendly and intuitive design of the Web interfaces.

This approach has proved its unique efficacy in the construction of vast Internet portals, normally containing hundreds of interconnected webpages, each of them enriched with multimedia and hypermedia information. It is important

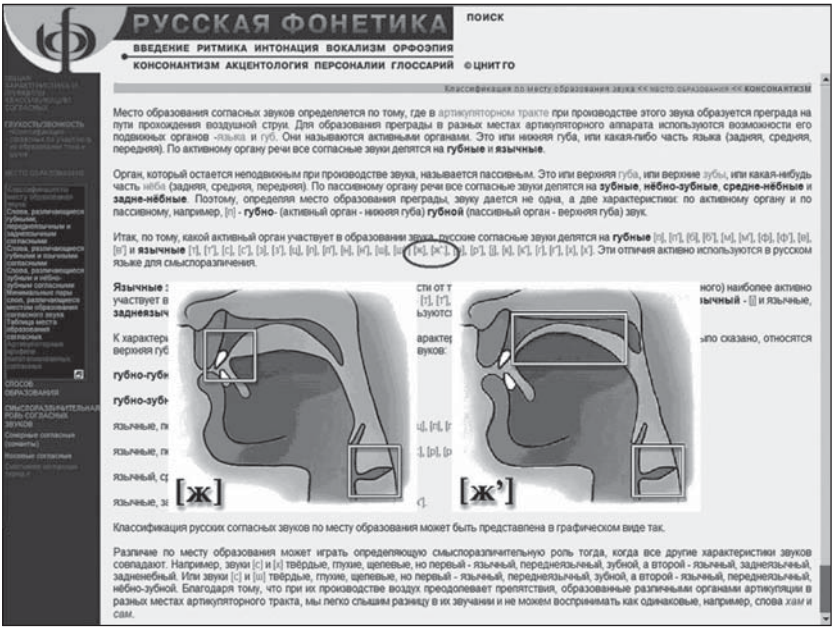
to emphasize that the latter capacities require additional special design reasons and procedures, while psychology research in human perception has revealed that the activation of any new perceptive modality – a new perceptive experience (for example, dynamic, animated, or sound objects incorporated into a text fragment or placed inside graphic elements, and vice versa), would disturb the continuity of the perceptive processes, divert the attention of the users and could thus produce strong distracting effects in general. Therefore, a correct representation of multi- and hypermedia webpage components (i.e. a combination of text, animation, video and sound) would be the key element for adequate information processing, both preserving the psychological safety and stability of users and safeguarding their mental comfort. The synthetic nature of hypertext perception and non-linear processing procedures impose special demands on the semantics of the color palette, the harmony and conformity of a color scale on a page and throughout the website, the significative balance of the color markers of hyperlinks and corresponding sound, the color markers of hyperlinks and interconnected images, animation, or video-clips palette, etc.

The multi-media Web portal of Russian Phonetics could be one of the pilot projects within the Russian-speaking sector of the Global Network realized through the task-oriented implementation of the above-mentioned design principles. This project, being one of the most successful projects and having been quoted 'an authoritative source on the subject' by Wikipedia, has initiated a series of similar educational and scientific e-resources. Sample webpages of the Russian Phonetics site as well as a fragment of the succeeding Web-based project on Russian Dialectology are presented in Figure 3. Here, all the organizing and design elements of the Web portal, i.e. logo and navigation bars, background and text character colors, font type, the layout of the text, color and type of hyperlink markers, etc., play their own special role and function in determining various meanings, or in marking various interaction patterns. Thus, one could state that the pre-planned and pre-determined small-scale symbolic 'alphabet', easy to learn and to manipulate according to its distinct design patterns, would be a crucial factor in an effective and successful Web design. It should be added that for aesthetic reasons the overall color palette of the website should also be thoroughly harmonized within the general webpage layout, as well as across the whole set of webpages constituting a certain information hyperspace. These principles of Internet design enable text and multimedia elements to be melted into a perfect whole either within an integrated communicative message on a single webpage, or across the pages on an Internet site. Only this kind of systematic integrity will achieve such information and aesthetic value when all consists of everything, every constituent

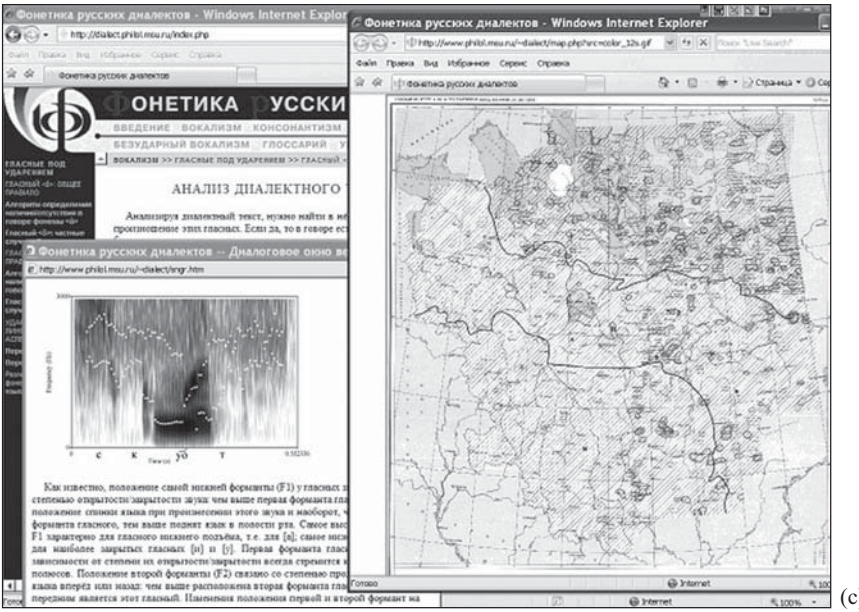
element is in harmony with the other elements, any new element could be easily integrated into the whole comprehensive structure and is supported from other elements of the system.



(a)



(b)



(c)

Fig. 3: Examples (a), (b) of the webpages of the Web portal "Russian Phonetics" and (c) of the Web portal "Russian Dialectal Phonetics" containing elements of multi- and hypermedia, incorporated through the semantics of the design of the color palette (http://fonetica.philol.msu.ru/)

A systematic approach in hypertext/hypermedia construction design should be undoubtedly considered as the main principle of effective hypertext authoring processes. The systems approach in website design is first and foremost directly connected with the bibliographic theory of conventional printing practice, its basic typographic models and their main stylistic components. Usually an Internet page opens in a two-dimensional layout, so it is intuitively considered by users as an image on a level surface similar to a canvas, or a graphic piece of art aiming to produce, as any other work of art, an integral emotional impact along with the information function. Therefore, any information object designed for presentation on the Web is initially perceived and processed similar to the general rules of human perception of a book (or of a set of pictures). Thus, the notion of artistic and/or functional styles, over centuries developed and elaborated in the production of manuscripts and printed books, has proven to be very efficient in the construction of websites as well.

The main postulates of the theory of typographic (publishing) styles rest mainly on two pillars: that of information integrity and of style consistency. In the traditional (printed) text the information integrity could be reached firstly through various graphic design components and is based upon the physical separate-

ness of the book in a spatial sense. Informational openness and principle incompleteness of hypertext structures thus pose the most serious challenge to the principle of effective design in the construction and exploitation of websites. Therefore, the maintenance of information integrity and style consistency is of primary concern. It is necessary to use the complete inventory of design tools and means for the maintenance of information integrity and style consistency of a website.

The style consistency of a website should first be organized by the following parameters of its visual constituents: harmonized color palette, character font types, size and form of graphic elements, overall image dissection and orientation (vertical, horizontal and diagonal alignment of the main components, i.e. text blocks and graphics; symmetry axes vs. asymmetric layout, etc.); composition and incorporation of animated graphics, sound elements and so forth. An example of well-chosen design principles based upon stylistic consistency and integrity of visual components is presented in Figure 4.

Fig. 4: An example of a website demonstrating consistency of style of the text and graphic elements: the website "History of the Russian script" (http://character.webzone.ru)

We assume that the main requirements for efficient and useful Web design as discussed in this paper will become general practice as approved recommendations within the community of Web authors and website development initiatives.

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