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СОВРЕМЕННЫЕ ЦИФРОВЫЕ ТЕХНОЛОГИИ И ИННОВАЦИИ В ИНТЕЛЛЕКТУАЛЬНОЙ СФЕРЕ ЧЕЛОВЕКА

Аннотация

Современные цифровые технологии не только “изменяют язык” (Дэвид Кристалл), но и оказывают влияние на интеллектуальную сферу человека, побуждая его совершать множество не свойственных для него ранее операций. В данной статье рассматриваются наиболее существенные инновации в интеллекте человека, которые порождаются новыми информационными технологиями. Эти инновации включают, по мнению ведущих специалистов в области современных компьютерных технологий, такие операции, как многозадачность, “серендипность”, коннективность, гипермодальность, визуальность и киберсемиотическая конвергентность объективной и виртуальной реальности. Статья основана на исследованиях, в первую очередь, следующих ученых: Лари Розен, Джей Дэвид Болтер, Стивен Даунз, Джей Лемке, Гюнтер Кресс, Сёрен Бриер и др. В их работах особо отмечается значительное влияние цифровых технологий и интернет-коммуникации на все стороны жизни общества, на внутренний психологический и интеллектуальный мир человека, на профессиональную и образовательную деятельность, а также подчеркивается важность соответствующих исследований и недостаточное использование преимуществ интернет-коммуникации и цифровых технологий в научной, просветительской, образовательной, общественной и культурной деятельности. Особое внимание в статье уделено тенденции к визуализации в глобальных информационных потоках и ее роли в обработке информации и трансфере знаний. В статье подчеркивается также, что влияние современных цифровых технологий на все стороны жизни человека, включая интеллектуальную деятельность, нуждается в дальнейшем углубленном исследовании.

Ключевые слова: инновации в работе интеллекта человека, киберсемиотика, трансфер знаний.

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CONTEMPORARY DIGITAL TECHNOLOGIES AND INNOVATIONS IN HUMAN INTELLIGENCE

Abstract

New digital technologies not only “change language” (David Cristal), but also “upgrade” human intelligence making it perform new and uncommon operations. The present paper is an analysis and a survey of most prominent innovations in human intelligence, which are instigated by the latest digital information technologies. These innovations include, according to the point of view of outstanding specialists in contemporary digital technologies, such operations as multitasking, serendipity, connectivity, hypermodality, visuality, and cybersemiotic convergence of objective and virtual reality. The paper is based on the data presented in the publications of such outstanding “digital” specialists as Larry Rosen, Jay David Bolter, Steven Downes, Jay Lemke, Gunther Kress, Soren Brier, etc. In their works they particularly stress the impact of digital technologies and internet communication on all spheres of human activities, their role in the inner psychological and mental states, in professional and educational domain, as well as the importance of their investigation and a gap between the intensive development of digital technologies and their insufficient usage in scientific, didactic, social and cultural life. Special attention in the paper focuses on the tendency towards visualization in the global information flows and its role in information processing and knowledge transfer. The paper particularly stresses the fact that the impact of contemporary digital technologies on all spheres of human activities, including the intellectual one, needs further and profound investigation.

Keywords: innovations in human intelligence, cybersemiotics, knowledge transfer.

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Introduction

Digital/ information technologies not only promote automatic information retrieval and processing, as well as human language, but also introduce various kinds of innovations into almost all spheres of contemporary human activities. Besides, digital technologies promote all kinds of knowledge transfer and its integration, instigate creative and intellectual human activities, generate new digital culture, communication and education, give rise to various convergent socio-technical interfaces, etc. Of particular importance and interest are those new mental/ intellectual operations, states and processes that are provoked in the human mind by contemporary technological innovations.

Methods of investigation

Digital technologies make human intelligence and cognitive system function in a new info-intellectual space – the cyberspace. Its impact is being traced in various investigations directly and indirectly connected with cognitive studies. The identification, qualification and systematization of the relevant data are the main principles of investigation undertaken in the present study. It shows that digital technologists consider the following innovations in human intelligence, provoked by digital technologies, most important and perspective: 1) multitasking [54]; 2) serendipity [17]; 3) connectivity (of hypertext and thus of human consciousness, cognition, intelligence, science, education, etc.) [26]; 4) hypermodality (of displaying, processing, retrieving and combining information of different types/ modes in digital systems and thus in the human mind)

[40]; 5) the tendency to visuality of information flows in contemporary cyberspace and in the style of information processing in the human mind [16]; [63]; 6) cybersemiotic convergence/ transfer of the objective and virtual reality into the “mixed” reality and thus the emergence of the ability of the human mind to operate in the new “augmented” information sphere [17]; [18]; [19]. These new operations, states, processes and tendencies closely interact, have a dynamic, heuristic and cognitive character, have their “traditional precursors” and reflect innovations in the human intelligence, provoked and promoted by modern digital technologies.

Results and discussion

Multitasking. Multitasking is a term introduced in its present meaning and discussed in detail by Larry Rosen, computer psychologist Number One in the world. His experiments and data testify to the effect that: 1) The younger generation is eager to use all kinds of digital targets and in most cases – at the same time, *simultaneously*. 2) They listen to the music *while* chatting with their friends and browsing the net, editing their new photos, doing their homework, etc. 3) Multitasking is provoked by *multimedia* character of digital technologies, and thus promotes a new intellectual “habit” of *combining* adjacent mental activities and fulfill them simultaneously.

Larry Rosen stresses that “The stark reality is that today’s kids just can’t do one task without wanting to do a bunch of other things at the same time. It’s a way of life for them. The natural inclination to multitask in these young kids probably has many sources, including the cool, dazzling, multifunctional new devices that permit and encourage multitasking... Cell phones, laptops, iPods, and other portable computing devices are spreading at an incredible rate. Some of these devices that started out as single-purpose machines, such as the cell phone, are being turned into general-purpose computing devices that allow users to perform a variety of functions, sometimes simultaneously. The cell phone evolved into a smartphone and is now literally a portable computer. Psychology has shown that certain physical and mental behaviors can be encouraged by physical objects. Modern technological devices... automatically encourage multitasking by their users. Just take a look at any computer screen and you will rarely see just one open window. Right now, for example, I have my word processor open along with my email, instant messenger, and six web browser windows [54, p. 76-77].

It is quite illuminating that the first published use of the word “multitask” appeared in an IBM paper (dated 1965) describing the capabilities of the IBM System [45], and the first (and the only) world-known “multitasking” person (in the history of mankind) was Caesar. At present it is obvious that multitasking provokes a new cognitive style of acquiring and applying knowledge and experience by using innovative digital technologies [48] which give rise to all other intellectual innovations in the human mind, *serendipity* being one of them.

Serendipity. Serendipity is a complex heuristic process which was detected by an outstanding computeriser Jay Bolter, who came to the conclusion that new computer technologies give rise to innovative mental processes and operations which the user has to accomplish in order to fulfill his information processing tasks. Jay Bolter’s most famous words in this connection are the following: “Digital culture is a browsing culture; for better or worse, serendipity is a fundamental feature” [17, p. 38]. Contemporary browsers evolve very quickly and become more and more user

friendly: they facilitate all kinds of information retrieval and processing in various modes and “directions”, thus making the human—computer interface more convenient and thought provoking. Now browsing is becoming a new type of breathtaking journey with quite unexpected ways of getting to the point of destination because it is *accompanied* by getting “adjacent” types of (more or less) relevant knowledge and experience.

The notion “serendipity” has derivatives *serendipitous*, *serendipitously* and *serendipitor*. It is used in various communicative situations and is quite matter-of-fact because its new meaning is closely connected with its traditional ones (dating back to 1754): **1.** The faculty of making fortunate discoveries by accident; **2.** The fact or occurrence of such discoveries; **3.** An instance of making such a discovery [56]. Cf. “good luck in making unexpected and fortunate discoveries, (hyperonym) good luck, fluke, good fortune” [57]; “the faculty or phenomenon of finding valuable or agreeable things not looked for: *Serendipity seemed to follow the lucky winner where ever he went*” [58].

In the 20th century, the word *serendipity* was sometimes used by researchers to attract attention to “unintentional” scientific discoveries (for more detail, see [21]; [11]; [55]). Now it is used in a more “subject-matter” manner. In 2010, ISMAR, an international academic conference on Mixed and Augmented Reality (Seoul), selected three artworks for the related exhibition; one of them was *Serendipitor*, by Mark Shepard. It was an alternative GPS navigation software application for mobile phones that determines a route to a destination that the user has not previously taken, designed to facilitate finding something by looking for something else. *Serendipitor* was developed during Mark Shepard’s Summer Session 2010 at V2_Lab and was part of his broader project Sentient City Survival Kit. [32]. (By the way, analogously, the word “justification” was first registered in 1551 (for detail, see [47, p. 134]), but at present it is used mostly for naming a text formatting task in a computer).

At present, the intellectual state of “serendipity” is also called “browsing” and is adjacent to another one, *connectivity*.

Connectivity. “At its heart, connectivism is the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks”... thus, “our knowledge is literally the set of connections between neurons in the brain (or between bits in a computer, or between people in a society...)” [26, p. 85, 16].

At present, connectivity is considered to be a most characteristic and prominent feature in internet communication [27, p. 25]. It is displayed by hypertextual links and exposes connections of various types not only in digital technologies and texts, with the help of which it makes all types and pieces of information interconnected with each other, but also shows cognitive links between everything that has to do with the intellectual sphere of the human mind [13]; [28]. These are consciousness, cognition, science, knowledge and information processing, education, creativity, communication, behaviour and action [39]; [14]. Their “connectivity” gives rise to a number of new cognitive perspectives in science and education, e.g. *connective knowledge*, *networked knowledge*, *knowledge management*, etc. [20]. Hypertextual links connect every text with all adjacent texts and thus make it a “super-text” with quite new, unexpected, creative and cognitively charged characteristics. Thus, evolving digital technologies provoke new creative abilities and “habits” in the human mind and transfer the

cognitive into the intellectual [6]; [8]. In particular, hypertextual links, along with multimodal way of information retrieval, give rise to quite new, *hypermodal* way of information and knowledge representation and processing [25].

Hypermodality. “Hypermodality is the conflation of multimodality and hypertextuality. Not only do we have linkages among text units of various scales, but we have linkages among text units, visual elements, and sound units... In hypermedia, there are more kinds of connection than those provided for in print genres” [40, p. 301].

Hypermodality of information and knowledge representation, perception, processing, transfer, disseminating, displaying, retrieving, etc. in digital communication means using and combining various modal (semiotic, visual, multimedia) resources for navigation, information layout and their combination in order to make the way to information and knowledge shorter, easier, more direct and even language independent [40; 41]. Consider the new “computer” meanings of such symbols as “plus” (*to enlarge*), “minus” (*to diminish*), “crossing” (*to close a file*). Increasing hypermodality of information processing in digital communication is aimed, on the whole, at making information retrieval more creative and user friendly [64]; [1]; [3]; [5]. J. Lemke «cites the “hypermodality” of digital text to result in its creation by both the ‘user’ and the ‘reader’, making it ‘far less predictable’ for the designer» [40, p. 300].

Zhang and O’Halloran [64], in their turn, show how the analysis of a range of hypermodal and semiotic resources such as colour, links, and the representation of social actors on University webpages “reveal the way that marketisation has changed over the past decade, shifting away from a more corporate type branding into more personalised relationships... In our societies semiotic resources are continually used in new and fresh ways, and as is the nature of communication, these will be harnessed by different kinds of interests to disseminate discourses that serve strategic ideological purposes. These discourses will always have a fundamentally multi-semiotic nature, and while people may feel their power in different ways, these may be experienced as fun, play, leisure, and simply as part of the almost invisible micro details of our sociality” [44, p. 354], as well as intellectuality.

In other words, combining information of different types/modes and modalities in digital systems makes the human mind more “semiotically and hypermodally oriented” and easily operate with new meanings of mathematical, graphic and all other “visual” symbols, icons, pictures, figures and their combinations and blendings. All these are extensively used for various and important information processing goals: to provide a many-faceted access to information, to propose various navigation stiles in detecting it, to switch from verbal to non-verbal, visual form in presenting it, etc. [33]. Kress and Van Leeuwen define hypertimodal texts as “making meaning in multiple articulations” [36, p. 4]. Where the elements give the composition a whole meaning *visual* grammar can be applied [43, p. 130].

Visuality. The tendency to visuality of information flows in contemporary cyberspace and in the style of information processing in the human mind [16] was triggered and fostered by rapid and absolutely unexpected revolutionary development of digital video cameras which are now installed almost everywhere. Thus, the global information flow is changing its character: it becomes much more video-oriented than text-oriented [63]. Cf.:

“The video surveillance industry is undergoing strong growth in demand worldwide... which evolve into **intelligent**, integrated and «networked» systems. Current market needs imply that users must access video, audio and data surveillance networks which are not just stationary. They must be fully mobile and portable in nature. They must provide real- or near-real-time sensory inputs, collected from mobile vehicles and stationary locations. Such inputs must be aggregated at a central location in real-time with the goal of providing a **cognitive reaction** to a condition or event. These networks enable real-time **monitoring** and require **integration** with analytics and sensor data **analysis** and the ability to «push» information to mobile users for the purposes of reaction and **response**... to video streams” [51] (*Bold is added – N. R.*).

In this connection, many scholars believe that we are now faced with a new cognitive revolution that is gaining ground in information perception, dissemination, and processing [29]; [35]; [36]; [37]; [34]; [7]. Cf. «The sheer volume of new technologies devoted to the transfer, transmission, and production of graphics and visual imagery would appear to have given rise to a new cognitive field... because electronic images are “a new form of visibility”» [31].

Thus, we are becoming more visually oriented in cognition and communication, and much more engaged in decoding, transcoding and deverbilization of verbal information and verbalization of visual information, etc. [42]; [65], cf. “The tension between verbal and visual representation seems more important than ever... We are living in a space, a cyberspace, with a specific new culture where visualisation as a form of communication is becoming predominant” [16, p. xii].

This particular tendency to visuality in the contemporary digital and thus general culture is exceptionally important for education and training, cf. “Visual communication is the sort of culture that stimulates the right hemisphere in a special way... If new experiences imply new developments while the plasticity of the brain enables them, educators must be aware of their role because the brains of today’s children are being structured in language patterns antagonistic to the values and goals of formal education” [38, p. 234–235]. As a whole, “Human versatility, creativity and search for novelty have not been inhibited but rather instigated by the electronic technologies. Teachers have to think very seriously of... profiting as much as they can from the learning facilities offered by the new technologies” [24, p. 242]; “The use of pictures is a quick and efficient technique for committing words to memory” [61, p. 102].

Thus, educators must be also aware “of the existence of different forms of representation and of their implications in the different information processing styles: different forms of representation or the use of more than one form of representation may lead to better results in terms of the rapidity and the efficiency of comprehension of the contents and in terms of expressing our thoughts” [16, p. 76]; cf. [60]; [52]. Moreover, “The children... are better prepared for dealing with computing concepts, the virtual reality world of cyberspace, the internet and hypertext than their parents are because they have acquired a repertoire of social practices that link computerbased artefacts to the structure of self” [59, p. 221–222]; [23]. That is why «The new generation... possesses a “new literacy”, as “computency” or “computent” and may feel more receptive to new kinds of educational methods. This may mean that the ability to read print and the possession of background knowledge that makes reading

meaningful are necessary but not sufficient for today's young... Besides, "computency" requires the connection of the technology to a constellation of cultural associations» [59, p. 229].

In general, all these tendencies show that our cognitive system and communication become more and more deverbilized and semiotically, hypermodally and visually oriented. For example, the simple "verbal"/ discursive idea of "very much" can be expressed in the following "semiotic" way: Goooooooooooooogle [cf. 62]. "Few (if any) linguistic anthropologists would argue with the idea that linguistic practice draws on diverse material and embodied resources. Nevertheless, close attention to the role of visual semiosis in communicative ecologies is not as common a part of our analyses as might be expected... explicit and sustained attention to multimodal integration remains a frontier for our field... as well as ...kinds of tools that are necessary to account for the multiple ways in which visual forms interact with other linguistic modalities" [4, p. 352], as well as with one another, particularly in the case when there is a *cybersemiotic convergence* of the objective and virtual reality.

Cybersemiotic convergence/ transfer of the objective and virtual reality. The cybersemiotic convergence/ transfer of the objective and virtual reality into the "mixed" (blended/ mediated/ enhanced/ augmented) reality and thus the emergence of the ability of the human mind to operate in the new "augmented" information sphere [17] is "visual innovation" number one in today's cyberspace. "Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called mediated reality, in which a view of reality is modified by a computer. As a result, the technology functions by enhancing one's current perception of reality. By contrast, virtual reality replaces the real world with a simulated one.... With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable" [12].

Augmented ("mixed") reality is a new type of visual information. It integrates objective and virtual reality, surpasses the boundaries of human perception, promotes imagination and makes the human mind function in an innovative way. The technology itself is becoming wildly used in various professional, educational and other fields, particularly in training, fulfilling difficult tasks that need "the third/ artificial" eye, etc. Many specialists are sure that digital

technologies and the systems of augmented reality are making human mind more flexible and effective [22].

A Mixed/ Augmented Reality (AR) environment "enhances the users' perception and improves the intuitive interaction with the real world. Virtual Reality (VR) technology completely immerses a user inside a synthetic environment. While immersed, the user cannot see the real world around him. In contrast, AR allows him to see the real world with **superimposed**, virtual objects. Therefore, AR **supplements** the real world rather than completely replacing it. In most cases, a VR environment includes a very complex technical installation and thus its technology is mostly used for expensive training simulations (e.g. flight simulators, ship simulators, etc.). One of the main goals of AR is to reduce costs and to use cheaper hardware with the goal to achieve the same results. ... Of course, we will find more possible AR applications and we believe that it is just a starting point to get new ways of using this fascinating technology" [30] (*Bold is added – N. R.*).

Conclusions and implications

Digital communication and technology are an absolutely new and a most creative sphere of human activities. Its impact on human mind, consciousness, cognition, communication, behaviour and social interaction [46], [2] is particularly important because it helps realize that human intelligence is evolving so that to meet the challenges of virtual reality and its blending with objective reality. Thus we are making a step "from augmented reality" to "augmented human" [49]: this is a transition from technological "human—computer *interaction*" to intellectual "human—computer *integration*".

Multimedia, browsing, hyperlinks, digitally processed visual information, augmented reality and, as a whole, a cybersemiotic character of digital technologies cannot but make human mind operate in quite new and "intelligence-promoting" circumstances. These not only enhance mental operations that we have to fulfill, but also give an impetus to all spheres of human activities.

As far as human intelligence is concerned, it becomes obvious that digital technologies make it more flexible, active, open and effective. (For more particulars and detail about the influence of digital technologies on human language, mind, behaviour, culture and social life, briefly outlined here, see [15]; [50]; [4]; [9]; [10]; [53]). It thus also becomes obvious that the impact of contemporary digital technologies on all spheres of human activities, including the intellectual one, needs further, profound and complex investigation.

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