BRAIN, ICT AND SOCIAL CHANGE.

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ABSTRACT

The paper tries to describe the social consequences of changes in the cognitive strategies that are taking place under the influence of information and communication technologies diffusion. Author reviews the latest sociological and psychological research in the human brain evolution caused by the explosion of digital technology. Review of the dominant scientific approaches and making profit and loss account in humans' basic cognitive processes allows answering the question, about the changes in social relation forms and cultural participation patterns. Social aspect refers to the problem of social bonds atrophy based on loss of empathy in electronic communication. The cultural aspect of the problem is based on coexistence between two knowledge systems: expert system and system of dispersed knowledge. These issues are described in the context of generational gap, which exist between people, for whom digital world is the only known environment (digital natives) and those who immersed in it during their adult life (digital immigrants).

Key words: knowledge, cognizance, information society, internet, new media, digital natives, digital immigrants.

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1. Introduction

Discovery and dissemination of magnetic resonance (MRI[1]) as a new tool to measure biochemical processes occurring in the human brain allowed many important neurobiological discoveries. Two or three-dimensional images obtained by recording changes in magnetic fields and emitted radio waves also helped to expand the analysis on the impact of the use of new ICT[2] technologies on various functions of the human brain. Despite many, often conflicting opinions concerning the nature of that impact, the use of ICT in a marked degree influences the basic cognitive processes (attention, perception and memory). These in turn are important in how we form our social relations and how we participate in culture.

2. New media and cognitive processes

Each stimulus affecting us has its representations in our nervous system. How the use of the Internet influences human neurons? This problem was studied, inter alia, by the team at the University of California in Los Angeles, led by Gary Small (Small, et al., 2009). The researchers worked under assumption that working with the Web produces measurable biodynamic changes in the cerebral cortex, changes which could be ascribed only to the use of this medium. Using a laboratory equipped with an MRI scanner to carry out this study, they recruited two groups of people. The first were experienced Internet users (net savvy group) and the other people, who had only recently started to use the network and do it relatively rarely (net naive group). Both categories of N=24 respondents were given the same tasks. The first task consisted of reading the book displayed on the specially designed to work in the MRI tunnel goggles. The second task was based on typical Internet user actions: navigation through the web, using useful links, typing keywords into search

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[1] MRI – Magnetic Resonance Imaging.
[2] ICT – Information and Communication Technologies.

engines etc. In the case of the first mode of activity, the image of the brain did not differ significantly in both groups. However significant differences were observed in undergoing second task, which related using the Internet. Experienced web-respondents in the course of the work of web navigating showed greater activation of left frontal brain (the dorsal lateral prefrontal cortex). In the group of people less experienced in Internet usage, part responsible for information processing and decision making of the cortex was completely inactive. The next step of the experiment consisted of a series of five-day exercises in which the inexperienced group was trained in navigation of the Internet. Repeated measurements showed that these few days of training were enough to activate those not used before areas of the brain. Importantly, repeated measurements showed that the obtained training results proved to be stable. This means that the use of the Internet leads to development of the specific and stable neural connections in the brain. These results of the research suggest that working with the Internet fosters greater activation of frontal areas of the temporal, parietal and frontal lobes (Small, et al., 2009), which are responsible for higher mental functions such as activities planning, developing strategies, decision making, reasoning, predicting and drawing conclusions. As emphasized by Small and Vorgan: "The current explosion of digital technology not only is changing the way we live and communicate but is rapidly and profoundly altering our brains" (Small and Vorgan, 2008:1). Surfing the internet, learning new tools such as Google browser, e-mail, learning the existing interfaces or finding the new ones for new web services require a range of cognitive abilities such as prediction, matching or planning. All these new skills according to Small's research team stimulate the brain development. But does the increased surface activity of the brain, creation of new, stable neural connections mean that it is better functioning? Results of described below research do not give an unequivocal answer to this question.

Basing on results of dozens of studies conducted by psychologists, neurobiologists, and educators an American journalist and researcher Nicholas Carr suggests that the Internet actually increases the activity of the brain, but our thinking becomes shallow and superficial. Author of a famous monograph,

"The Shallows: What the Internet Is Doing to Our Brains" (Carr, 2010a). Carr emphasizes that using the Internet, means entering the environment in which it is impossible to maintain a high level of concentration. The Internet network gives us easy access to the admittedly enormous amount of information, but its content and architecture favors superficial, quantitative approach to learning which loses all its qualitative values. Concentration of attention is not the only element of cognition, which we lose under the influence of this technology. Theoretical ease and speed of getting information makes users of new communications technologies deficient in development of the so-called long-term memory. Nicholas Carr citing Véronique Bohbot and Giuseppe Iaria working at McGill University in Montreal warns against the harmful effects of eliminating thought processes present in any personal route planning by GPS receivers. This is the clear evidence of "connection between the size of the hippocampus and the degree to which we employ our navigational skills. (…) Our hippocampi begin to atrophy from a lack of use in navigation; the result could be a loss of memory and a growing long-term risk of dementia" (Carr, 2010b). Quoted by Carr researches showed that the formation of topographic images of our closer and further environment do happen in two ways. The first involves the creation of the so-called "cognitive maps", i.e. the formation of general ideas about the place we want to reach. The second way is a strategy named "stimulus–response–stimulus", it consists in recalling a number of elements successively located in the space in which we were moving in the past (Bohbot, et al., 2004:418). And so i.e. to get to school we have to pass the green bank building and then having passed the lights we have to turn right, etc. As the research results show, both space navigations strategies are used with similar frequencies. Some people use two of them (ibidem). Using satellite navigation and applications such as Google maps only reinforces the second type of strategy orientation in space and thus impairs the ability to create cognitive maps. As studies by Bohbot and Iaria have shown, only the use of cognitive mapping strategy increases the volume of the hippocampus. According to many researchers described above, the impact of ICT on the functioning of the human brain is clearly overestimated.

Psychologist and cognitive scientist Steven Pinker believes that the process of human adaptation to the new digital media is similar to experience with adaptation to old media. "New forms of media have always caused moral panics: the printing press, newspapers, paperbacks and television were all once denounced as threats to their consumers' brainpower and moral fiber" – writes Pinker (Pinker, 2010). It is therefore necessary to consider the ongoing changes basing on model-based calculation of gains and losses. To rely solely on data showing an increase or decrease of the number of connections between neuronal might be a big mistake. Psychologist Patricia Greenfield analyzing different studies on the influence exerted by the ICT on our intelligence and cognitive ability observes that "some cognitive skills at the expense of others" (Greenfield, 2009:71). Dislodging of the written text by image and intensive use of screen technology led according to her to comprehensive and sophisticated development of visual-spatial skills. However, these gains are accompanied by reduced capacity for deep processing of stimuli, which underlies the "reflection, inductive analysis, critical thinking, mindful thought, and imagination" (ibidem). New technologies promote such skills as multi-tasking, perception and nonlinearity thinking. The ability to scan and browse is as important as the ability to read deeply and think attentively. "Skimming is becoming our dominant mode of thinking. Once a means to an end, a way to identify information for deeper study, scanning is becoming an end in itself – our preferred way of gathering and making sense of information of all sort" (Carr, 2010a:153). A similar opinion was expressed by Jan van Dijk, "the power of screens is the attraction of human attention. The biggest problem in mass communication nowadays is that attention is slackening fast" (van Dijk, 2006:196).

3. Social Consequences

Undoubtedly, the described above changes of human brain functioning and ways of perception are not without influence in determining how we deal

with the culture and how we organize our social life. Already nearly half century ago Marshall McLuhan warned that societies have always been shaped more by the nature of the media through which people are communicating, rather than by the content of that communication. "We become what we behold. We shape our tools and then our tools shape us" – he wrote in his great work (McLuhan, 1964).

However, before we consider the direction and nature of the ongoing information revolution, we should think about whom and to what extent it will strike. This question tries to answer – among others American media researcher – Mark Prensky. This author, describing the social impact of ICT, has proposed an interesting division of users of new technologies into "digital natives" and "digital immigrants" (Prensky, 2001). This dichotomy describes two different ways of communing with the wealth of networks. For persons born in the mid-80's digital world is their natural habitat. This is a category of people for whom the internet, mobile telephony is their primary medium and the time to devote to their use, strongly exceeds the time to commune with the old media (newspapers, radio, television). This generation is called by journalists also "Google generation", "generation Y" or the category of "linked-connected", which is characterized primarily by the fact that they satisfy much more of the life necessities through the digital media than those older than them. ICT for them is not only a source of knowledge and entertainment, but a kind of interface for the whole of social life. Persons older than them are "digital immigrants" who came to the new reality and must learn their "digital language" the rules of its application, the new cognitive skills for operation of multiple devices and applications. In this group of network users, Internet and mobile services are not their first-choice media. There still exists for them a clear commitment for regular and ritual reception of messages sent by press, radio and television. Gary Small and Gigi Vorgan pay attention to the fact that the digital natives through intensive contact with ICT are more creative, capable of effective and quick selectivity of needed information and have better spatial imagination. These features can be seen in increases in scores on tests of intelligence, which in the past 25 years in this category increased by over a dozen percent (the Flynn

effect[1]). Unfortunately, developing these skills happens at the expense of traits that characterized the ways of thinking and acting of digital immigrants. It turns out that the excessive use of the media monitors weakens many social competences. Researchers believe that the problem of young people is not only impaired concentration and attention skills, but first of all lower empathy. This means that the digital natives are worse at reading and interpreting the human emotions and feelings. As suggested by Small and Vorgan this is due to the fact that electronically mediated communication makes it difficult to mimic human observations, which in turn hinders the work of mirror neurons. Limiting the ability to recognize others emotions may hinder the process of adapting the individual to the surrounding community and his/her ability to produce and maintain social ties (Small and Vorgan, 2008:133-136). While new technologies definitely help in finding new contacts, but leave open the problem how those who make use of them should carry out their subsequent interactions. This could mean that the present technology-driven social change will be dominated by bonds of weak character (weak ties). As noted by Barry Wellman, "communities and societies have been changing towards "networked individualism where (...) boundaries are more permeable, interactions are with diverse others, linkages switch between multiple networks, and hierarchies are flatter and more recursive" (Wellman, et al., 2002, p.160). These differences constitute one of the sources of possible conflict between subsequent generations which significantly hinder communication and interaction between their representatives. Thus this problem is not conducive to cooperation between children and their parents. Also it constitutes an obstacle to school and university teachers in the effective transfer of knowledge.

Cognitive strategies of digital natives are characterized by the specific ways of selecting information. Human brains when analyzing the usefulness of information may use many different heuristics. Generations of digital natives consider given information as valuable only when finding subjectively convincing argument testifying their relevance. Conversely the digital immigrants were

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[1] The Flynn effect – long-sustained increase in intelligence test scores; these continued year-after-year increase of IQ scores was documented, for the first time, by James R. Flynn.

raised in respect of authorities to guarantee the quality of the piece of received knowledge. For this generation not only the subjectively perceived value of information were important and also the source of its origin. These differences manifest themselves in the assessment of material from places like Wikipedia, with that produced for example by Britannica professionals. Digital natives are the generation of prosumers[1] accepting the coexistence of two systems of cultural production: an expert system and a distributed knowledge system. Expert model, is a model in which the media communications are created or selected only by – endowed with the institutional authority – sender. This type predominates in the old media (radio, press, television), where information messages are one-directional: from the elites to the masses. Here the sources of information consist of the opinions of leaders trained for this purpose (journalists, researchers, specialists). In the model of distributed knowledge information production is often anonymous. Creators of information often operate in a decentralized manner outside recognized institutions and knowledge produced by them is often fragmented and uneven (where common truths coexist with highly specialized production). The digital natives are more likely than the digital immigrants to accept a situation in which everyone can be at the same time: an author, editor, reviewer, commentator and the recipient of the information. The latter may be relieved to see that the world of culture is divided into producers and consumers, creators and audiences. According to Jan van Dijk "The current replacement of reading printed texts by watching television or looking at images in other media (...) have been judged far too easily by intellectuals and culture pessimists as signs of blunted culture and losses of creativity and imagination" (van Dijk, 2006:194). One of the louder critics of such social changes dictated by the development of ICT is Andrew Keen. In his opinion, the sources of knowledge based solely on non-market production, which so much enjoy so many of digital natives, like for example Wikipedia, YouTube, MySpace and others contribute to shallow our culture. He fears that if we destroy the professional media – with their rich ecosystem of

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[1] prosumer – "proactive consumer", consumers who are active to help personally improve or design the goods and services they bay; first used in 1980 in book "The Third Wave" by Alvin Toffler.

writers, journalists, musicians, and actors – we will never be able to rebuild it. The young people should use technology in a way "that encourages innovation, open communication and progress, while simultaneously preserving professional standards of truth, decency and creativity" (Keen, 2007:205).

4. Conclusion

As pointed out by sociologist Kazimierz Krzysztofek the contemporary social world is a very "(...) complex system that drives the game between the three powerful elements: technology (hardware), logical (software) and culture (content) (...). The stunning industrial development has multiplied the strength of our muscles and senses through the use of machine, now a digital breakthrough extends some powers of the brain functions" (Krzysztofek, 2008:8 and 10). Extension of the brain is reaching for new, previously unknown powers. What we observe is, in a metaphorical sense, a reversal of the early trajectory of civilization: "we are evolving from cultivators of personal knowledge into hunters and gatherers in the electronic data forest" (Carr, 2010a:138). However, according to the cultural lag[1] hypothesis, the changes in the expressive, cognitive, normative sphere will occur with some delay in relation to changes in the instrumental (technological) layer. This means that before we are all dominated by the kind of knowledge specific to the digital natives a little more time will elapse. With this given time, we can use it to make changes in social policies aimed at pedagogy, education and participation in culture. "Bridging the brain gap will require two major interventions: we need to help the digital natives learn to advance their interpersonal skills and the digital immigrants to teach their hone technology skills" (Small and Vorgan, 2008, p.46). Only such actions will allow the consequences of the ongoing technological, social and cultural change to result in cooperation and creative coexistence of different models of communication and different ways of creating and sharing knowledge.

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[1] Cultural lag – term described by sociologist William Ogburn in "Social change with respect to culture and original nature" (1922).

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МОЗОКОТ, ИКТ И СОЦИЈАЛНИТЕ ПРОМЕНИ

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Апстракт

Студијата се обидува да ги опише социјалните последици од промените во когнитивните стратегии што се одвиваат под влијание на дифузијата на информатичките и комуникациските технохлогии. Авторот ги разгледува најновите социолошки и психолошки истражувања во развитокот на човечкиот мозок предизвикани од експлозијата на дигиталната технологија. Прегледот на доминантните научни пристапи и правењето сметка на профит и загуба во основните човечки когнитивни процеси, овозможува да се одговори прашањето во врска со промените во формите на социјални релации и моделите на културна партиципација. Социјалниот аспект упатува кон проблемот на атрофија кај социјалните врски базирана на недостаток на емпатија во електронската комуникација. Културниот аспект на проблемот се базира на коегзистенцијата на два система на знаење: експертен систем и систем на дисперзирано знаење. Овие прашања се опишани во контекстот на генерациската празнина што постои помеѓу луѓето, за кои дигиталниот свет е единствената позната средина (дигитални домородци) и оние кои се ангажирале со него во возрасниот живот (дигитални имигранти).

Клучни зборови: знаење, когниција, информатичко општество, интернет, нови медиуми, дигитални домородци, дигитални имигранти