

Intelligence and Technology: the Problem of Interaction

Inteligencia y tecnología: Un problema de interacción

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Contents

- 1. Introduction
- 2. Research methods
- 3. Research results
- 4. Discussion
- 5. Conclusion
- References

ABSTRACT:

The paper analyses the transformation of the concept "intelligence" in relation to the development of modern information technologies. Information technologies are considered as leading factors of sociocultural changes, as well as of changes in the sphere of human consciousness interaction with information systems. To consider this problem, the authors turn to cognitive developments in the field of intelligence. The paper uses such methods as comparative analysis, historical-philosophical and systemic methods. These methods allow us to consider the interaction of intelligence and information technologies (illustrated with modern educational technologies), as well as to develop an integrative approach to intelligence understanding.

Keywords: intelligence, consciousness, information technologies, educational technologies, informational environment.

RESUMEN:

El documento analiza la transformación del concepto "inteligencia" en relación con el desarrollo de las tecnologías de la información modernas. Las tecnologías de la información se consideran factores principales de los cambios socioculturales, así como de los cambios en la esfera de la interacción de la conciencia humana con los sistemas de información. Para considerar este problema, los autores recurren a desarrollos cognitivos en el campo de la inteligencia. El documento utiliza métodos como el análisis comparativo, los métodos histórico-filosóficos y sistémicos. Estos métodos nos permiten considerar la interacción de la inteligencia y las tecnologías de la información (ilustradas con tecnologías educativas modernas), así como desarrollar un enfoque integrador para la comprensión de la inteligencia.

Palabras clave: inteligencia, conciencia, tecnologías de la información, tecnologías educativas, entorno informativo.

1. Introduction

Today, the society informatization has significantly changed the human environment. It has led to changes in the structure of professions, changes in vocational education, the emergence of new means of information distribution, to "digitizing" of all human activity spheres.

Intensification of informational processes, which occurred in the 60-80-ies of the last century, had a global impact on the culture as a whole. Many scientists designated this period as a transition to a new stage in the society development. The understanding of its features has led to the emergence of various concepts known as the theory of the informational society, in which the main value and the structure-forming basis is information, in which information technologies set the vector of social development. It is impossible to talk about theoretical approaches to the development of the information society concept without such scientists as D. Bell (1999), E. Toffler (2010), P. Drucker (1995), etc.

Informatization of society raised the acute question of the possibilities and prospects of human intellect development. On the one hand, the society informatization has opened up broad prospects for interaction between humans and information, has created conditions for the optimization of mental and production processes with the help of computer systems. Today, however, it is clear that information technologies take on not only the mediator role between the "individual" and the "world", but become an independent "informational subject", functioning on an equal footing with the human consciousness and mentality. There are quite a lot of studies devoted to the "digital subject" as an independent information system (Gardner 1999; Negroponte 1995; Slouka 1995).

Informatization of the society raises a natural question: if society informatization can not be changed, then how human intelligence would adapt to a new information environment, in global information systems? What is intelligence today in terms of information technology development? It is this problem that needs to be resolved today. To study this problem, it is necessary to determine the content of the "intelligence" concept and consider the sphere of intelligence interacting with information and educational technologies. Educational technologies, in our opinion, constitute a separate area of interaction of intelligence with the informational environment filled with educational resources.

2. Research methods

The theoretical and methodological basis of the study was the historical and philosophical sources devoted to the study of the specifics of the digital society and the network space, the Internet, various information systems. The authors are familiar with the works of foreign researchers, among which in this respect the most authoritative are the works of D. Bell, R. Darendorf, M. McLuhan, O. Toffler, A. Touraine.

The authors used such research methods as:

- historical and philosophical method that allows to distinguish the philosophical aspects of the study of intelligence;
 - comparative method, which allows to carry out theoretical analysis of philosophical and scientific approaches to the problem of intelligence, the problem of intelligence interacting with information and educational technologies;
 - systematic method, which determined the general logic and principles of the study.
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3. Research results

Currently, the problem of intelligence lies in the field of a whole complex of social, humanitarian and technical sciences (philosophy, psychology, cognitive sciences, neurosciences, artificial intelligence sciences). However, despite such a variety of scientific approaches to the study of intelligence, there is no single concept of intelligence. In psychology, intellect is considered to be a set of personal thinking abilities which opposes sensual and intuitive cognition. The development of technical sciences has filled the concept of "intelligence" with a qualitatively new content. Intelligence is now considered as the ability of the information system to learn and process information. In other words, intelligence has been understood as a "collective intelligence", a special "digital subject" in a particular information system, capable of purposeful information collection and of self-learning (Finn).

From the philosophical point of view, intelligence is understood, first of all, as an individual cognitive activity, the activity of his/her thinking. Therefore, the study of intelligence inevitably refers us to the problem of consciousness.

Attempts to understand and explain the nature of human thinking were made by ancient Greeks. The concepts of Plato and Aristotle are widely known. R. Descartes formulated the problem of psychophysical dualism, in which consciousness was a thinking substance that determines the existence of man, on an equal basis with the bodily substance. Since the XIX century, the problem of the study of consciousness changed for the sphere of psychological science. Behaviorism acquired a dominant role in this area of research. It negated consciousness as an independent phenomenon giving it the role of a behavioral response to the observed environmental stimuli (Watson 1998).

The study of memory phenomenon, the characteristics of the cognitive procedures of encoding and decoding information and speech led American researchers busy with cognitive science in the 1950-ies of XX century to the development of computational models of consciousness. It turned out that human consciousness is not just a reflection of the objective reality and the brain work is only a part of what we call consciousness.

Consciousness is the result of human interaction with the outside world, which carries the imprints and memory not only of individual mental processes and acts of behavior but also of various cultural matrices. Cultural anthropology played an important role in identifying this in the United States in the second half of the twentieth century.

As a result of the interaction of psychology, cultural anthropology, linguistics, neuroscience, there is a fairly broad interdisciplinary field of research – cognitive sciences. Of course, this area of research was not theoretical, but rather a systematic empirical, experimental research, specific computational models of consciousness and intelligence. The central hypothesis of cognitive science is that consciousness is best understood as a set of representative structures or mental acts. Most of the works devoted to cognitive science suggest that consciousness is a set of mental representations, like similar structures of computer data (Dennett 2004; Searle 1983).

Cognitive theorists believe that consciousness contains mental representations such as logical judgments, rules, concepts, images, and analogies. Consciousness uses computational procedures such as deduction, induction, matching, analysis, which the computer uses to find, encode, and display information. In a narrow sense, the activity of consciousness was reduced to the activity of the brain. It was also revealed that cognitive sciences were trying to present human consciousness, by analogy with computational models in the framework of the bionic approach. Deep Mind project from IBM can serve as an example of this model.

Thus, from the standpoint of cognitive science consciousness, similar to intelligence, can be considered as a complex cognitive computational model – an informational system that creates and constructs informational space (informational environment) on the mental principle. We will distinguish these concepts.

Global communication, building up the informational society is accompanied by the creation of global and local informational systems. Space and time are ways of structuring them. Therefore, today the concept of information space is associated with new informational technologies, with the processes of informatization in the society. What is the "informational space"? Before defining this concept, we shall define "informational systems". According to the foreign researcher D. Bourgeois, informational systems should be understood as "computer systems and software that are used to collect, store, process, generate and distribute data" (Bourgeois). In the education system, for example, the information system can act as a studying system that allows you to manage the content and the learning process: "Technically, the individual educational space is an integrated system of different WEB2 technologies, such as blogs, wikis, social networks, news feeds, etc., in the center of which there is a student with his personal interests. This is not just an educational system, but a real teaching environment" (Desyatova 2011).

In a global informational (network) environment, informational space is a form of matter existence, and matter is understood as information (data). Information systems are way to

structure information; they are the location of the informational space. In this sense, the informational space should be understood as the space of information transmission and interaction of information elements in informational systems of various types.

Informational space is necessary for accumulation, preservation and transfer of information. Among the qualitative characteristics of the informational space there are:

1. Length – the distance at which informational objects are available to the consumer of information;
2. Volume – the number of information resources included in the informational space of a particular length;
3. Density – saturation of an information space with information resources in relation to the creators of information or consumers.

Thus, the informational space includes:

- a set of banks and databases;
- technologies of their maintenance and use;
- informational telecommunication systems functioning and interacting in a certain duration (digital time).

An example of an informational space can be an information environment with structured data, in which digital data acts as physical components of an information space, for example, an educational environment.

4. Discussion

The problem of existence and functioning of digital intelligence is particularly indicative if illustrated with the global educational environment. Let us consider the problem of interaction between digital intelligence and the educational environment looking at such a technology as distance learning.

A few years ago, many teachers of higher education expressed doubts about the success of the introduction of distance education and its use in the educational process. The main argument of such skepticism, especially among teachers of humanitarian education, was that distance education, in their opinion, distorted and even destroyed the real process of education. There were concerns that this was the destruction of the classical academic education system.

Skeptics also pointed to the technical difficulties of the introduction of this element in the educational process, the preparation of training programs, large time costs for maintenance. Today, however, we can safely say that distance education is a mandatory element of any higher education institution. On the one hand, the active introduction of distance education is connected with the development of the technological environment of human existence, and on the other – with a high degree of educational processes' integration in all the world countries in connection with globalization and informatization.

So, if we look at foreign organizations, we will see quite a large number of organizations in which distance education technologies are developed and successfully implemented. Moreover, no university in Europe can do without this element. If we look at various organizations, colleges and councils for distance education, we can see a fairly stable system in which distance education is an actively functioning element, having both its advantages and disadvantages. A foreign subsystem of distance education has the following elements:

1. Distance education institutions:
 - International centre for distance learning (headquarters in England);
 - European distance learning and e-learning network (headquarters in Hungary);
 - European centre for distance learning (headquarters in the Netherlands);
 - The Commonwealth of education (headquarters in Canada);
 - Council for distance education and training (headquarters in the United States);

- Integrators of distance learning (headquarters in the United States);
 - Association of distance learning of the United States (headquarters in the United States);
2. Virtual colleges, universities and consortia:
- Argosy University Online (online component of "national" university);
 - Breyer University (online degrees, certificates and courses);
 - California University of Southern University (a regionally accredited online university);
 - California virtual campus (distance learning in California);
 - Canadian virtual university (consortium of accredited universities);
 - Kentucky virtual campus (partnership with Kentucky universities);
 - Remington College ('national' college with online education);
 - Online education Tunxis (from Community College, Tunxis College);
 - UMassOnline (online courses and accredited degrees).
3. On-line platforms making introduction and training in a distance regime:
- GetEducated.com (course, rating and comparison of online programs);
 - University of the humane society (online degrees and certificates);
 - Australian correspondence schools (offer hundreds of courses);
 - North American Council for online learning (K-12 focus);
 - Webcast courses (from Californian University — Berkeley);
 - eCollege.com.

Even on the basis of the data on these elements of foreign distance education only, today we can talk about the emerging informational system in the sphere of education, where people and informational resources are the key factors. According to Simond Meedgly, one of distance learning coordinators, University of Birmingham, "distance learning is a method of training which is outside of the regular contact between people" (Meedgly).

Of course, distance learning is a way of learning that allows a student to study most of the subjects of the chosen specialty without full - time participation in the educational process. Distance learning provides access not only to learning, but also to sources of information. It forms a specific learning environment, both on the part of the student and of the institution itself, since distance learning programs often include a computer-based learning system and the creation of a virtual classroom. The cost of distance learning depends on the country and on the chosen educational institution. Distance learning acts as a self-learning information environment: through the institution's multimedia educational portal, students can watch lectures, download additional audio lessons to listen through their own devices, interact with group mates through an online forum, and communicate directly with teachers. For example, at Franklin Institute of Health, distance learning includes online video lessons, downloadable mp3 lectures, downloadable worksheets, formulas, applied research, textbook assignments, online testing and project evaluation, an interactive environment for fellow students and teachers.

Of course, distance education is not free from shortcomings. Among significant problem there are the level of technical and software remote courses; technical training of the student (computer or tablet device, high-speed Internet access, basic skills of working with the Internet (for example, the ability to view online video, download and print files and go to websites), a printer for printed files and a device for playing mp3-lectures (it can be your computer with speakers); determination of the optimal percentage of the number of students per teacher.

In addition, distance education involves self-study. There is a threat of phenomenon of "lonely individuals" deprived of real contacts with classmates and teachers. To solve this problem, many foreign universities organize frequent online contacts with teachers and participation in virtual forums, virtual help groups and discussion rooms. It is also quite obvious that there are areas that cannot be studied remotely, such as medicine. In this case,

many European universities conduct laboratory and on-site seminars (e.g. medical universities suggest seminars in chemistry at weekends, clinical practices at local medical practices, long-term European educational tours to learn from international experts in the field of medicine).

A significant problem of distance education from the philosophical and anthropological point of view is the threat of direct communication between the teacher and the student being substituted with virtual relationships. In this case, the problem acquires a broad humanitarian component, since it points to the specifics of human – technology interrelation. So, even the German philosopher of the twentieth century, K. Jaspers, expressed the idea that mastery of technology changes the person in the era of technical development “the Spirit boils down to the ability to learn and perform useful functions” (Jaspers). A Spanish philosopher H. Ortega y Gasset believed that “A modern man — I mean not an individual, but humanity as a whole — is no longer free to choose between life in nature and the use of the super-natural. He is irrevocably and finally assigned to the latter, included in it as firmly as the primitive savage into the natural environment. And this conceals, among other things, such a threat: barely realizing his own existence, a person discovers a fabulous number of objects around him. There are various means created by technology and forming a certain artificial landscape located in the foreground in front of him that obscures the pristine nature from his eyes” (Ortega y Gasset).

Of course, many philosophers were right in believing that the technical environment is the artificial replacement of the natural human existence. This is the environment, which actively affects his consciousness and behavior. The technique meant a special technical environment, which we call *information* today. This is an environment in which the main element is not information, no matter how paradoxically it might sound, but the knowledge that is being designed, built by the person from the informational flows. Therefore, the problem of human intelligence, the boundaries between natural and artificial, individual and collective, is now the subject of fierce philosophical debates.

5. Conclusion

This study showed a significant transformation of the concept of “intelligence” in view of the information technologies development. Nevertheless, it is essential to define not only the areas of interaction between intelligence and information systems, the scope of its application in education, but also to develop an interdisciplinary concept of understanding intelligence. This concept can serve as a necessary ideological framework in the study of the principles of any systems’ organization and functioning, including informational ones. It can determine the prospects, opportunities and boundaries of the information technology introduction in the field of human activity and thinking.

In the information space, the intellect itself acts as a special collective system, a “digital subject”, which includes a set of interacting information systems. Moreover, it becomes an indicator of the computer technology development, the content of which is made up by media resources, which are characterized by convergence, digitalization, interactivity. After all, the information space itself is a means of ordering the objects of the informational environment, which is determined by the sets of information resources, technologies, means of their support and transformation.

Thus, the information environment forms a global area of informational interactions, structured and related in a certain way. These interactions are based on the network principle, and any network is a self-constructed and self-learning system. In this respect, informational environment forms an independent collective system for the processing, analysis, and purposeful creation of information, which is possible to understand as “digital intelligence”. And the intelligence itself acts only as a means of adaptation to the informational environment. In this regard, it is necessary, in our opinion, to distinguish the concept of intelligence from the concept of consciousness, since human consciousness is always the carrier of individual intelligence. The use of historical and philosophical, comparative and systematic methods of analysis of intelligence and information systems’ interaction has shown the lack of interdisciplinary study of information technology practical

use in their interaction with human intelligence. This study is an attempt to define the process of transformation of the intelligence concept in the history of philosophy and modern science based on modern cognitive research in order to apply this concept to study the principles of informational systems.

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[Index]

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