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## Communications Revolution: from Civilizational Phenomenon to Science Communication Perspectives

### [Rewolucja komunikacyjna: od fenomenu cywilizacyjnego do naukowej perspektywy komunikacji]

**Streszczenie:** W opracowaniu dokonano przeglądu współczesnych teorii rewolucji komunikacyjnych i wykazano ich znaczenie w procesie przekształcania podstaw rozwoju architektury społecznej, instytucji społecznych, w tym również nauki. W tej analizie wykorzystano podejścia metodologiczne filozofii historii, filozofii komunikacyjnej, społecznej i politycznej oraz filozofii nauki. Jednocześnie rewolucyjna skala zmian i głębokość ich wpływu na społeczeństwo powodują, że ludzkość zmuszona jest porzucić naiwno-romantyczny stosunek do nauki (do racjonalizmu jako takiego), charakterystyczny dla świata początku XX w., kiedy wydawało się, że nauce udało się przezwyciężyć wszelkie kłopoty i błędy świata fizycznego i społecznego. Dlatego aktualnym zadaniem filozofii pozostaje badanie fenomenu nauki nowożytnej jako zjawiska komunikacyjnego w dynamicznym XXI w. Przemysł 4.0 to heurystyczne ramy metodologiczne służące zrozumieniu perspektywy zmian cywilizacyjnych i rekonfiguracji procesów komunikacyjnych w naukach o komunikacji z uwzględnieniem debaty technicznej i publicznej w tym zakresie. W związku z tym dążono do wykazania głębokiej polemicznej natury rozumienia rewolucyjnego charakteru zmian społecznych i istnienia szerokiej gamy typologii rewolucji (naukowej, przemysłowej, komunikacyjnej).

**Summary:** In the study, it was possible to carry out an overview of modern theories of communications revolutions and demonstrate their importance in transforming the foundations of the development of the corresponding social architecture, social institutions, including science, etc. In this analysis, we used the methodological approaches of the philosophy of history, communicative philosophy, social and political philosophy, and the philosophy of science. At the same time, the revolutionary scale of changes

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and the depth of their impact on society lead to the fact that humanity is forced to abandon the naive-romantic attitude to science (to rationalism as such), which was characteristic of the world at the beginning of the 20<sup>th</sup> century when it seemed that science was able to overcome all troubles and mistakes of both the physical and social world. That is why the current task of philosophy remains the study of the phenomenon of modern science as a communicative phenomenon of the dynamic 21<sup>st</sup> century. Industry 4.0 is a heuristic methodological framework for understanding the perspectives of civilizational shifts and re-configuration of communicative processes in science communication, taking into account the approaches of technical and public deliberation. We tended to demonstrate the profound polemical nature of the understanding of the revolutionary nature of social changes and the presence of a wide range of typologies of revolutions (scientific, industrial, communications ones).

**Słowa kluczowe:** rewolucja komunikacyjna; komunikacja; nauka; komunikacja naukowa; wiedza; filozofia nauki; przemysł 4.0.

**Keywords:** communication revolution; communication; science; science communication; knowledge; philosophy of science; industry 4.0.

## Introduction

The modern world is in a state of rapid changes, constant renewal of all spheres of life, growing opportunities, and the same growing risks and dangers. One of the sources of this situation is the modern communications revolution, which powerfully changes the way of life of countries and peoples, globalizes society, and globalizes problems that humanity must solve through joint efforts. Modern science, in turn, acts as a source and driver of communicative innovations that change the world and shape the expected future. All this makes it urgent to address the problems of analyzing the main features of the communications revolution and one's impact on modern science and science communication.

Revolutions are far-reaching, and their impact is felt for decades and centuries when it comes to political and technological revolutions. As for communications revolutions, they do not slow down and do not stop at all. Their effects are superimposed on each other (communicative interference) and form a synergistic effect that does not stop its influence. As we have it today, humanity was formed in many ways precisely by communications revolutions, which endowed man with language, writing, books, and all the means of communication known to us. The new type of culture, which has already appeared quite clearly at the beginning of the 21<sup>st</sup> century, is characterized by a change in communication methods, a change in approaches to storing and transmitting information, as well as a change in the actual codes and symbols with the help of which communication is carried out: "The changes that have happened since then have brought about new issues,

questions, challenges, and opportunities that need to be carefully and scholarly analyzed for the betterment of humanity. One category of these new issues is knowledge-related. Our knowledge has expanded significantly since the information revolution. Whether this expansion is just a quantitative change or if it points to a paradigmatic shift in our understanding of the universe and ourselves is an important question that needs to be answered. The other category is policy-related questions and challenges. With the introduction of the Internet, there are new ways of community building through social networks. Knowledge acquisition and dissemination are now accessible to all people in the world, at least potentially” (Demir, 2010, p. 1).

The dominance of a rational way of thinking, the gap between the written way of expression, on the one hand, and the linguistic and figurative culture of perception led to the one-sided development of the Western European type of consciousness. As it were, the audiovisual layer was relegated to the background, manifested in the traditional contrast between scientific and artistic methods of cognition. Audiovisual product is traditionally perceived by scientists (and mostly all intellectuals) as somewhat secondary compared to the written tradition. Modern communicative reality in its everyday form accompanies a person’s whole life from time immemorial. This reality is generated by social life itself and is embodied in thoughts that circulate in society and are conveyed to people by various mass media (which includes oral culture, rumors, gossip, etc.).

Science is a specialized kind of communicative reality. It is not as easily accessible to the average person as everyday communication. Even its very existence is not a fact for an ordinary person. It requires an appropriate level of qualification and awareness of the scientist in the current problems of one or another direction. The communicative reality of science is the realm of everything that is generated by scientific research, that embodies everything new and valuable, on which the modern and future of society depend. We focus on the special axiological “charge” of the communicative reality created by the scientific community.

The purpose of the proposed article is a philosophical analysis of the essence of the communications revolutions in ones’ historical retrospect and ones’ main consequences, which are manifested in modern science communication.

## **Communications Revolution as Sociocultural Phenomenon and Theoretical Concept**

The communications revolution is a fundamental transformation of the foundations and forms of communication caused by systemic innovations in the creation, transmission, storage, and processing of information, achievements in the development of cognitive sciences, etc. The impact of the communications revolution on society is comprehensive. It forcibly draws individual consumers and large communities into its sphere of influence.

The concept of the “communications revolution” began to be widely used in Western social science since the middle of the 20<sup>th</sup> century. The most important inventions that provided human society with new forms of development, enrichment, and preservation of knowledge, and communication in time and space are considered communications revolutions. These are the emergence of language (the first communications revolution, which occurred at least in the Upper Paleolithic), the invention of writing (the second revolution, IV–III millennia BC), the invention of the means of remote Communication – the telegraph, telephone, radio, television (the third revolution, from the end of the 30s of the 19<sup>th</sup> century to the 30s of the 20<sup>th</sup> century), the appearance of computers, programming, etc. (the fourth revolution – from the time of the Second World War to the 60s and 70s), the beginning of space exploration, the Internet revolution, the development of artificial intelligence technologies, etc. (the fifth revolution – from the 60s to the 70s of the 20<sup>th</sup> century and until now) (Beringer, 2006). Here, it is one of the attempts to systematize the history of communications revolutions, but any systematization is still open for discussions and alternatives.

Our research tasks do not consider issues related to the definition of the chronological limits of each revolution and their qualitative differences. The one that has been unfolding since the middle of the 20<sup>th</sup> century should be considered as the real, most significant communications revolution. There is a point of view that arises from the need to consider three revolutions in the system that did not develop synchronously but in a common chronotope – these are the industrial, communications, and science revolutions (Beringer, 2006). There is no doubt that all these revolutions were mutually beneficial, interdependent, and, in many respects, resonated, reinforcing each other’s revolutionary effect.

The fact is that different stages (waves) of the communications revolution can be clearly distinguished only conditionally. All varieties and forms of revolutions interact with each other. Thus, new inventions in the field of industry and transport, technology and communication (to a certain extent

in education) at the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries led to a revolution in military affairs, revolutionary globalization of war (the phenomenon of world wars arises), the modern communications revolution (its the countdown can be started from the end of the Second World War) exerts its influence on all spheres of life and social institutions. Concerning science, this influence is particularly significant and profound, considering that this revolution itself is based on breakthrough scientific ideas embodied in the same breakthrough innovative technologies that are transforming the world before the eyes of one or two generations. We agree with Peter Barker, that revolution is a phenomenon that produces the paradigmatic changes in science and society architecture in general: “The end result is an incommensurable conceptual system but this does not spring into being fully formed while the unmodified original system still retains majority support. Talk of the sudden appearance of ‘new paradigms’ and or earthquake-like ‘paradigm shifts’ creates inappropriate historical expectations” (Barker, 2011, p. 448). According to this approach, important aspects of the communications revolution include, for example, the emergence of organized (state) mail, international postal structures, without which international relations (in particular, diplomacy), international economy, and cultural exchange on a modern global scale would be impossible. This circumstance is very important. After all, the communications revolution is not only some technical innovations, gadgets, inventions, etc. This is always a new level of social organization and management, which certainly affects the organization of communications, the regularity and regularity of communication, predictability and risk reduction, etc.

So, we are dealing with a revolution as a series of irreversible radical, systemic, and transitive changes. They are synergistic, spontaneous, and self-development inherent in them and manageable only to a certain extent. The dynamics of revolutions in communication are characterized by fluctuations, waves, declines, and rises in intensity. Among other things, it is often proposed to consider three macro-revolutions in human history in general: the “green revolution” (the transition to productive agriculture – farming and cattle breeding – which took place in the Neolithic), the industrial revolution (which in the 16–18<sup>th</sup> centuries had a territorially limited character and covered Britain and Northern Europe, and later spread to the whole world) and, finally, the communications revolution, which begins to be traced almost from the beginning of the New Age. Many authors base communication revolutions on scientific revolutions. The theory of revolutions offered by Hilmi Demir has the key ones (Copernican, Darwinian, and Freudian revolutions): “Before Copernicus, humans, at least in the Western world, thought that our planet was special among all

other astronomical bodies; it was thought to be the center of the universe. The Copernican revolution changed that; the effect was the loss of the privileged position of our planet in the universe [...] This comforting thought continued until Darwin, and another disappointment was awaiting us. With Darwin, we lost our privileged position among other living creatures [...] Not long after Darwin, Freud made us realize that we did not even have that privilege of knowing and controlling our mental world” (Demir, 2010, p. 2).

All subsequent social innovations were closely related to industrial and political revolutions on a smaller scale (modern technologies of mass printing, telegraph, telephone, radio, television, etc.). The modern stage of the communications revolution is the relentless development of programming technologies, a network of artificial languages and codes, a variety of programs, the miniaturization of computers (lamp – transistor – chip – quantum technologies, etc.), the rapid rise of artificial intelligence, the widespread use of neuro structures (neuro-networks), etc. There are reasons to consider the current stage of the communications revolution as one of the key aspects of the fourth technical (industrial) revolution (Industry 4.0), destined to bring fundamental changes in life, work, and communication. Tectonic shifts await us in their complexity, depth, and scope. If the first industrial revolution used the power of water and steam; the second one used electricity; the third one automated production with the help of electronics and information technologies, then the fourth one, using the achievements of the third (first of all, the digital revolution), contributes to the integration of technologies, the removal of the boundaries that until now separated the material realm from digital and biological (Schwab, 2015).

Klaus Schwab (2015) points to three signs that today’s changes are not simply continuing the third revolution but are harbingers of the fourth one: speed, scale, and systemic consequences. Humanity has never seen such rapid technological progress. Compared to past linear industrial revolutions, the scale of the fourth one is increasing exponentially. The fourth revolution affects every industry in every country in the world. The depth and breadth of the changes caused by it require the transformation of entire production, management, and control systems. The possibilities of billions of people constantly connected with the help of mobile devices that have unprecedented power, and memory and give access to all the knowledge of humanity are truly limitless. Soon, these opportunities will increase many times over; new breakthroughs are taking place in hitherto unseen fields – artificial intelligence, robotics, the internet of things, autonomous transport, 3D printing, nanotechnology, materials science, new batteries, and quantum computers (Schwab, 2015).

Each communications revolution (if we still consider them as specific steps in communicative progress) changed the life of the human community, and this influence each time had its own scope and limitations. All communications revolutions defined new regimes and rhythms of existence for human culture and fundamentally new opportunities for creativity, for mastering, learning, and conquering the world. Being inside a current revolutionary process, it is impossible to make conclusions about the evaluation of the same process, to abstract from the fact that you are a part of this process, which may be exposed to considerable risks, etc. Therefore, the appropriate estimates of the course of events and their consequences will always be approximate, deformed, and inadequate in such a case. Therefore, there are reasons for researchers to refrain from categorical assessments and statements mostly. Regarding the communications revolution, as a rule, “moderate” and mostly positive assessments prevail. Emphasis is placed on the fact that the communications revolution brings new opportunities. This is another “revolution of opportunities”. Indeed, it is easy to find many new possibilities and aspects in this revolution. However, it is equally evident that this revolution cannot be reduced to the positive at all. Such an approach, pre-focused on the positive, is neither responsible nor genuinely scientific.

It is important to understand the very nature of communications revolutions. Their basis should be seen first of all in the process of gradual condensation and diffusion of innovations (Rogers, 2003), which accumulate the previous revolutions’ “heritage” (causing a cumulative, synergistic effect that no one seems to have expected (the “black swan” effect (Taleb, 2010))). At the same time, some social institutions receive a push, an impulse in their development, deepening the revolutionary effect (in the case of the modern communications revolution, this certainly applies to science, which, together with innovators, is one of the leaders of communicative breakthroughs). Returning to the gradual accumulation of changes, let us pay tribute to innovators who successfully used the legacy of past stages of communicative development. Proponents of the theory of industrial revolutions as direct components of communications revolutions (among which the fourth revolution coincides with a fundamental revision of the communicative paradigm of human existence) rightly point out the following: “With the fourth revolution, we realize that human nature is intrinsically informational. And with respect to being informational entities, we are not much different than other entities, be it natural or artificial [...] The information revolution itself is radical, and it is only normal that such a radical revolution would lead to a very radical shift in our understanding of the universe” (Demir, 2010, p.2).

The metaphor of the communications revolution is heuristically fruitful for philosophical research aimed at clarifying the nature and content of sociocultural transformations. Viewing from this angle forces us to see the communicative component in all significant processes for the development of human civilization. At the same time, all revolutions have a communicative nature. Their maturation and their causes are primarily rooted in the organic, historically conditioned violation of the tradition of communications, and their imperfection (within the social architecture, between levels of government, between political and economic subjects, etc.). A revolution is a challenge to the status quo. This is an imperative: we must change to meet the demands of the times. The revolution brings a reality that no one was prepared for.

### **Communications Revolution vs. Science Communication: In Search of New Theoretical Framework for the 21<sup>st</sup> Century Development of Science**

In the focus of our research, the theory of communications revolutions acts as a methodological source for understanding its effects on science communication as a component of human civilization. The revolutionary influences of communication change the established parameters of social existence in general and, in particular, the everyday life and creativity of the scientific community. It is about both the speed of information exchange and its extreme saturation and intensity. The communications revolution has unprecedentedly increased the number of direct participants in communication, who previously had to write to, say, the journal editors to clarify some fact, and wait a particular time (sometimes several months) until the idea appears in some regular issue of a scientific journal. Accordingly, after a specific time, the author who circulated the disputed fact could express one's opinion and make it public.

As an example, in the 21<sup>st</sup> century, the scientific discussion goes beyond the communication of specific authorities of science, and takes on an open and dynamic form with the involvement of a wide range of communication participants: "In the context of contemporary knowledge society, however, the public communication of science is working its way upstream and becoming more *ex ante* than *ex post* in the chain of scientific endeavour. It is no longer something to be pursued firstly, *after* new knowledge has unavoidably placed science and the public further apart, but *before* it has been legitimately enabled to bring them closer together. It is no longer an activity for primarily responding to a natural lack of shared understanding



between science and the public, but one for building a new and necessary sense of common purpose” (Elam, 2004, p. 233).

Previously, a professional, scientific discussion could last for months, and the parties could search for sources and arguments in their favor for a long time, clarify their position, concede something, and reach a compromise. Now, the discussion can start and end within an hour. In social networks, competent researchers can directly exchange opinions, provide the latest facts regarding the discussed matter, reach an agreement on positions, etc. At the same time, science communication, thanks to advanced Internet technologies, opens up wider communication opportunities for discussions (platforms for the popularization of science, etc.). However, the participants in these discussions are often not professional scientists: “The potentially beautiful World Wide Web of forums, discussion boards, comment boxes and photo feeds we use to find and make science are overrun by petty, spiteful, and nonsensical talk [...] People are braver, bolder, and brasher in ways that transgress the bounds of decorum regarding more traditional venues of communication, raising special alarm regarding public understandings of science” (Coleman, 2015, p. 186).

The achieved power of computer technology (as well as the possibility of a network combination of their power) creates the basis for processing such large data sets that were considered inaccessible for processing and understanding even yesterday. The need to overcome the isolation between the spheres of science, between science and the spheres of social existence, where science can prevent the growth of crime, help overcome hunger, ensure people’s access to clean water, a healthy environment, etc., is increasingly being realized. Involvement of the civic community in research, observations, and surveys is becoming a common practice. On the other side, we can say that the 21st century brings some interesting trends in science communication, which are a matter for future academic discussion. The openness of science causes the tendencies of technical deliberation with wide civic engagement and communicative possibilities to get people involved in wide scientific discussions (Coleman, 2015, p. 189). Public deliberation tendencies catalyze the development of popular science communication channels when professional researchers and profanes have the same “strong voices” in public discussions (Coleman, 2015, p. 188–190).

Each communications revolution has a more profound and radical impact than the previous ones. Each subsequent one uses all previous ones and transforms their capabilities to strengthen its influence. At the same time, the rapid rise of new means of communication can, in some ways, nullify the gains of previous revolutions (the crisis of bookkeeping under the influence of electronic media). Paper publications continue to exist

inertially, but the future lies in digital publications with open access to the Internet.

The modern communications revolution challenges the existing academic hierarchies, which in many respects are forced to give way to horizontal connections between equal partners and subjects. The communications revolution puts new dimensions of equality on the agenda, at least, such as equality of access to information resources, to the Internet. On the other hand, these circumstances give rise to new forms and manifestations of inequality. When we realize the imperious, authoritarian character of the revolutionizing influences, we must admit that the communications revolution not only shapes but also deforms. It destroys many things, devalues them, and causes deflation and inflation of knowledge and education. Authors often focus on trends of unpredictability, excess information “at the entrance”, when decision-making subjects are physically unable to process masses of significant information correctly and are forced to ignore some data – or rely on cooperation with artificial intelligence.

Therefore, the communications revolution creates and deepens the “age of risk” (Beck, 1992). Revolution is a natural way out of the crisis. However, the revolution sometimes causes a crisis, a test for the social organism. No social organism is entirely ready for such a test. Revolution can deepen social contradictions and revolutionary “means of salvation” may not be adequate or even harmful. Regarding the communications revolution, both in society and in science, there was a demand, and there were prerequisites, but it must be stated that science was unable to overcome the crisis of new opportunities fully.

There are many dangers for science communication, generated precisely by the modern communications revolution, which is in progress. For example, with the help of neural networks today, it is possible to generate texts of various complexity (articles, news, etc.) that will not contain any reliable information at all (deep-fake technology). That is, the latest communication resources can (and do) serve to scale, and spread fakes, falsifications, forgeries, etc. Such expansion is carried out in the realm of science. The most quoted articles are often disavowed after a short time, the facts and assessments given in them are recognized as erroneous, etc.

## Conclusions

In the study, it was possible to carry out an overview of modern theories of communications revolutions and demonstrate their importance in transforming the foundations of the development of the corresponding social

architecture, social institutions, etc. In this analysis, we used the methodological approaches of the philosophy of history, communicative philosophy, social and political philosophy, and the philosophy of science. We tended to demonstrate the profound polemical nature of the understanding of the revolutionary nature of social changes and the presence of a wide range of typologies of revolutions (scientific, industrial, communications ones).

Detailed attention was paid to reviewing the theories of communications revolutions based on the stated purpose of the research. We have demonstrated that regardless of how we define the stages, typologies, and chronological boundaries of the communications revolution, it is evident that the communicative drivers shape modernity with a comprehensive acceleration and re-configuration of all socio-cultural processes. Because science has a communicative nature, it is shown that communications revolutions fundamentally transform scientific communication's principles, intensity, and social significance. The heart of the communications revolution is breakthrough scientific developments embodied in innovations. The communications revolution caused far-reaching changes in the structure, organization, and principles of the scientific community's work. Accordingly, in the historical process, science revises its socio-cultural status – from “the ivory tower” metaphor to the socially responsible partner of contemporary society with a high level of openness and public involvement (civic engagement). We agree the new roadmap for science communication is formed within technical and public deliberation tendencies.

Science is one of the determining factors that shape and personify modernity. The achievements of modern science and related technologies give impetus to systemic and far-reaching innovations that create an image of the world and its future. At the same time, the revolutionary scale of changes and the depth of their impact on society lead to the fact that humanity is forced to abandon the naive-romantic attitude to science (to rationalism as such), which was characteristic of the world at the beginning of the 20<sup>th</sup> century when it seemed that science was able to overcome all troubles and mistakes of both the physical and social world. That is why the current task of philosophy remains the study of the phenomenon of modern science as a communicative phenomenon of the dynamic 21<sup>st</sup> century. Industry 4.0 is a heuristic methodological framework for understanding the perspectives of civilizational shifts and re-configuration of communicative processes in science.

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