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On the Development of Scholarly Communication. A Philosophical Approach to the Communication History

Abstract

The study considers a significant philosophical problem: what is the impact of means and forms of communication on social practices? Plato in the *Phaedrus* wrote that the art of writing (as a mean and form of communication) transforms our ability to remember. In this article, I demonstrate the importance of the problem and I investigate the transformations of scholarly communication in contemporary science. The idea of Open Science is known as a model for the scientific practices. In this study, I extend the existing approach and I define the idea as a set of rules (norms, instructions) for academic practices. I assume that scholarly communication is a foundation of Open Science. Furthermore, I present three domains of Open Science: the Open Access, the Open Data, and the Citizen Science. The main problem, however, is how to philosophically interpret the transformations of scholarly communication's practices. The value of this approach lies in a perspective of the philosophy of communication that can be very effective in characterizing the sociocultural transformation.

1. Introduction

The article presents how the transformations taking place in scholarly communication may be philosophically interpreted. The development of communication technologies and the changes in the views of scientific practices (including the ideas of how to do science, to disseminate knowledge, and how to communicate between disciplines) transformed the scientific practices themselves. I am interested in the transformation which began with the advent of the Internet's popularity in the early 90's of the twentieth century and led to the creation of the idea of "Open Science". This matter is used for a practical illustration of the philosophical problem of the search for the origins of cultural change and the related issue of communication's influence on social practices. Some related considerations can already be found in Plato's *Phaedrus* and *Seventh Letter*,[1] that describe the destructive con-

[1] Plato, *The Seventh and Eighth Letters*, transl. W. Hamilton. Middlesex 1973, 344C–344E.

sequences of the invention of writing.[2] I intend to demonstrate that the changes in contemporary science can also be analysed in such a manner – oriented to the transformations of communication practices.

The purpose of this article is to show how the practices and their principles which constitute "Open Science" may be the research subject within the philosophically oriented *communication history*. I will demonstrate that the foundation of Open Science is *scholarly communication* – which changes due to the transformation of its media and collective view aspects.

The history of scholarly communication is written primarily from the informatological, bibliometric or rhetorical perspective. Authors focus on the economic aspect of the changes brought about by the emergence of *digital information*.[3] I, on the other hand, propose studies within the framework of the philosophy of communication which focus on the cultural character of communication practices.

Since the emergence of modern science in the seventeenth century, the task of scholarly communication was primarily to publish. It can be said that at that time the scientific public sphere was born, as defined by Juergen Habermas. The space of that sphere not only allows for publication of the results of experiments and considerations, and for popularization of new solutions, but also enables verifications and discussions.[4] In order for scientists to be able to pursue this objective effectively, it is necessary to have the possibility of a unrestricted exchange of thoughts, ideas, concepts through scientific publications.

The beginning of the last century brought about rapid boom of science, universities, which entailed an increase in the number of researchers. That has resulted in an increase in the number of scientific publications[5] and the resulting information overload,[6] which causes numerous problems.[7] Scientists were no longer able to bring out their own publications; it was taken over by commercial publish-

[2] R. Burger, *Plato's Phaedrus*, Alabama 1980.

[3] R. Ekman, R.E. Quandt, *Technology and Scholarly Communication*, London 1999.

[4] J. Habermas, *The Structural Transformation of the Public Sphere. An Inquiry into a Category of Bourgeois Society,* transl. T. Burger, Cambridge 1991.

[5] Between 1650 and 1950 approximately 60 000 journals were founded. Currently there are about 24 000 active, reviewed scientific journals (see: P.O. Larsen, M. Ins, 'The Rate of Growth in Scientific Publication and the Decline in Coverage Provided by Science Citation Index', *Scientometrics* 84 [3] (2010), pp. 593–595). Of course, this figure is only an approximation, since it al depends on the definition of a journal and what the term "scientific" means. Yet another issue is how many of these journals actually have an impact on science (see: E. Garfield, 'Significant Journals of Science', *Nature* 264 [5587] (1976), pp. 609–615).

[6] M.J. Eppler, J. Mengis, 'The Concept of Information Overload. A Review of Literature from Organization Science, Accounting, Marketing, MIS, and Related Disciplines', *The Information Society* 20 [5], pp. 325–344.

[7] Julian Cribb and Tjempaka Sari Hartomo, writing about the development of scientific knowledge, stated: "Scientific knowledge is now said to double about every 5 years, but its distribution among the seven billion citizens of Planet Earth proceeds far less rapidly. While the number of scientific papers published grows dramatically with each passing year, the rate at which their essential knowledge is transmitted to ordinary people who might use it in their lives lags far behind. Indeed, it has been claimed that up to half the world's published scientific papers are never read by anyone other than their authors, editors and reviewers – and 90 percent are never cited." J. Cribb, S. Tjempaka, *Open Science. Sharing Knowledge in the Global Century*, Collingwood 2010, p. 1.

ing houses (later by large publishing groups such as Springer, Elsevier and Wiley). This contributed to a greater professionalism of scientific publishing and facilitated the work of the researchers, however, it also became the cause of "foreclosing" of publications. Researchers increasingly had to seek institutional access to scientific articles of their co-workers and colleagues. It is possible for academic libraries to purchase access to databases of publications, however, it limits their recipients to the staff affiliated at a given university or research institute. The free circulation of ideas and concepts was, thus, delayed.

However, the spread of the Internet at the end of the twentieth century facilitated the emergence of a number of initiatives aimed at improving scholarly communication, including creation of the movement for open access to scientific publications and the rapid development of Citizen Science. The Internet offered a chance to return to the practice of free communication based on scientific publications. This in turn contributed to a change in perception of what science is and how it should be practised, which resulted in discussions about its "openness" and in considerations on what *Open Science* can be like. In this article, I assume that Open Science is not so much a "new science" or an "opening of science", but it is primarily a restoration of its inherent feature of openness in scholarly communication.

The issue of Open Science will be analysed from the perspective of philosophy, which considers the historical transformations of communication practices. I assume after Karl-Otto Apel that analysing communication and understanding it as a key element of human activity is a very good starting point in philosophical analyses.[8] It could, therefore, be said that the considerations within this text are part of the *communication history* trend.[9]

Therefore, the subject of my considerations is the collection of scientific and communication practices, which constitutes what I call "Open Science". These practices can be reduced to three main areas: the Open Access, the Open Data, the Citizen Science. Each of these areas of Open Science operates efficiently due to *scholarly communication*, for that reason I call it a foundation of the Open Science. Thus, I see *scholarly communication* as a key element which not only enables science to function, but also allows it to be understood. In this perspective, communication is for me what language is for Ernst Cassirer – in relation to other symbolic forms (such as art, myth, religion or science) which can be understood because of it.[10]

This article consists of four sections. The second section defines what the Open Science is and characterizes its three main areas. Then, in the third section

[8] K.-O. Apel, *The Transcendental Conception of Language-Communication and the Idea of a First Philosophy*, [in:] H. Parret (ed.), *History of Linguistic Thought and Contemporary Linguistics*, New York 1976, pp. 32–61.

[9] For a discussion of what *communication history* and its research subject are, see my works: E. Kulczycki, 'Communication History and Its Research Subject', *Analele Universitatii Din Craiova, Seria Filosofie* 33 [1] (2014), pp. 132-155 and E. Kulczycki, 'On the Philosophical Status of the Transmission Metaphor', *Central European Journal of Communication* 7 (2014), pp.175-188.

[10] E. Cassirer, *The Philosophy of Symbolic Forms. Volume Two: Mythical Thought*, trans. R. Manheim, New Haven 1955.

scholarly communication is characterized and the meaning of the term is clarified. Section four contains a proposal to adopt scholarly communication as a subject of study of communication history. I demonstrate how the relationship between the collective view and the media aspect of scholarly communication can be described, and I indicate the consequences of such an approach and how it can be used in further studies.

2. Three areas of Open Science

I undestand science and communication as areas of symbolic culture, which is distinctively human activity. I adopt the concept of *culture* after Ward Goodenough, who defines it as everything that one should know or believe in order to function in a society in such a way as to be acceptable.[11] Science consists of social practices of scholars within which scientific knowledge is produced, e.g. through the use of scientific methods. The knowledge must be intersubjectively communicable and verifiable – both of these conditions can be met thanks to scholarly communication.

Under the concept of science, I mean the range of social practices, which started to be constituted in the seventeenth century and continues today. With the advent of modern science the first scientific journals appeared – with a model example of the *Philosophical Transactions of the Royal Society* started in 1665. The emergence of scientific periodicals is sometimes called "the first scientific revolution", which was made possible through the spread of printing.[12] Of course, Kuhn's concept of *scientific revolution* and the related understanding of the scientific *paradigm* must not mislead us: science in the seventeenth and eighteenth century not so much changed its paradigm, but rather created it.[13] Thus the *second scientific revolution* is a return to what made possible the first one: a universal dissemination of scientific knowledge. Bartling and Friesike describe the issue in the following manner:

> The first scientific revolution happened when the publishing of scientific papers became the prevailing means of disseminating scientific knowl-

[11] W. H. Goodenough, 'In Pursuit of Culturei', *Annual Review of Anthropology* 32 [1] (2003), p. 6.

[12] In this context, I use the terms "the first scientific revolution" and "the second scientific revolution" after Sönke Bartling and Sascha Friesike, who presented them in *Opening Science*. The book was publisher on 31 January 2014 published by Springer. However, it is not only the content of the book that is important here: this publication was created in on-line editors (Google Docs), and from the beginning the readers could see how it was created, they could propose amendments and changes (entered after editing by the authors). It is the realization of the postulates of Open Science in its entirety. Publication – in addition to the classic versions of the book (paper and ebook) – is licensed under Creative Commons (CC-BY-NC) on the project's website: <http://book.openingscience.org/> – therefore, the references to the publication in this article do not include page numbers, only the title and author. On a side note, the immutable pagination of scientific publications (e.g. PDF files) is one of the key formal determinants of scientific publications. However, in the context of mobile formats (EPUB, Mobi) it is an issue that science communication must deal with. The version of the book used here is from the September 15, 2013. The book was accessed on 3 January 2014.

[13] T.S. Kuhn, *The Structure of Scientific Revolutions*, Third Edition, Chicago 1996.

> edge. Our scientific culture developed around this. Today the Internet provides novel means of publishing and we are in the 'legacy gap' between the availability of these tools and their profound integration into the scientific culture (second scientific revolution).[14]

Therefore, it is reasonable to consider the formation of science in the seventeenth and eighteenth century and the Open Science of the twentieth and twenty-first centuries as stages of the same process. Martin Nielsen writes explicitly about "a second open science revolution extending and completing the first open science revolution, of the 17th and 18th centuries".[15] Therefore, the Open Science refers to all three main areas of scientific practice: research process, research data and scientific publications. I assume that Open Science can be defined as a set of rules (standards, instructions) referring to the scientific and academic practices.[16] The Open Science above all indicates standards and directives: what should be studied, published, communicated, and how it should be done. Recalling the three main elements of scientific practices, the following list presents what should be of interest to scientific practices: (1) the research process, (2) the data, and (3) the scientific publications. The condition of *openness* of these elements demonstrates how it should be studied, described and published. Thus, I assume that the three areas of the Open Science are: (1) the Citizen Science, (2) the Open Data and (3) the Open Access. Thus, the areas of the Open Science can be defined by three conceptual "What – How" pairs: (1) Research Process – Citizen Science; (2) Research Data – Open Data; (3) Publications – Open Access. Let us move on to their brief characterisation.

The first indicated area is the C i t i z e n S c i e n c e, in which there are three main trends of opening the research process. The first of these is associated with the inclusion of volunteers in the work of scientists. Originally the term meant the scientific involvement of "non-scientists", amateur-hobbyists, who had to collect data for scientists. The volunteers help with basic work or make the computing power of their computers available to researchers. In 1900, The Audubon Society began the Christmas Bird Count initiative. Nowadays, with the development of the Internet, the *Citizen Science* increased considerably. Users are involved in major projects such as *Galaxy Zoo*,[17] in which volunteers classify galaxies online, by recognizing the basic geometric figures. Projects carried out in the open research process use various methods to engage participants: from gaming mechanisms

[14] S. Bartling, S. Friesike, *Towards Another Scientific Revolution*, [in:] S. Bartlin, S. Friesike (eds.), *Openning Science*, Springer 2014, pp. 3–15.

[15] M. Nielsen, *Reinventing Discovery. The New Era of Networked Science*, Princeton 2011, pp. 183–184.

[16] When writing about scientific practices, I mean practices that are constituted by the *scholarly communication* also in the *social sciences* and *humanities*, not only in *science*. Scientific knowledge is produced in the framework of *science*, but the reflection created within the humanities cannot be denied its value: both types of practices focus on different areas. We must also remember that the scientific results achieved in *science* are not always the result of the exclusive work of scientists but also increasingly of amateur volunteers (the section on Citizen Science elaborates more on the issue).

[17] The project can be found at <http://www.galaxyzoo.org>. Accessed on 11 January 2014.

(such games as *Mole Bridge*, *Fold It*) to quizzes (*Spectralgame*, *Annotathon*). However, the open research process is not only volunteers performing simple tasks. The second trend of entering into the research process is to conduct research within the *Open Notebook Science* – the researcher not only informs about the results of the scientific process, but also presents the entire ongoing process of data collection, processing and publishing. Each stage of the study is recorded (or written) and made accessible – mostly on a website, which is the "open notebook", on the blog or by means of tools based the wiki solution. Within this formula, the information which is presented is not only about the final data (successful results), but also about unsuccessful experiments, less significant results, false premises. The third way to enter into the research process is by collaborating with volunteers who themselves constitute the research material.[18] One such example might be the *Cancer Commons* project,[19] in which the patients with one of three types of cancers provide medical information about themselves, which is used to improve the treatment of the diseases.

The second area of the Open Science is the O p e n D a t a. This area is not uniform for all fields of science. In many disciplines the research data in a digital form have been available for years (e.g., since the '70s of the twentieth century in structural biology). The development of science disciplines increasingly enables the creation of great repositories of data which is the basis for the publication of research results. However, more and more often it is not enough to share an article at the time of publication, as the development of scholarly communication infrastructure has introduced technological conditions for the dissemination of unanalysed raw research data. In genomics, the "Fort Lauderdale agreement" is applied i.e., an agreement to share data, which provides the authors of the experiment with the priority to publish analyses of the genome).[20] While other researchers may use the data for detailed research without any restrictions. The research data are the basis for verifying the conducted experiments and the published results of research. Only with empirical data are we able to verify the correctness of procedures and inferences. It is also very important for another reason: when sources, which became the basis of "failed" experiments or the reason for not confirming hypotheses, are made available, we enable other researchers to learn from mistakes already made and to move to other directions.

The third area of Open Science is the O p e n A c c e s s. Scientific publications are the basis for interaction between scientists. Articles and books allow citizens to find out what research is funded with their taxes. The movement of the Open Access to scientific publications dates back to the 60s of the last century – it is related with the launch of the *Educational Resources Information Center* (ERIC) by the U.S. Department of Education's Office of Educational Research and the Improvement and the National Library of Education. Of course, other key intermediate events of the process can be identified, such as the ARPANET

[18] P. Szczęsny, *Otwarta Nauka, czyli dobre praktyki uczonych*, Toruń 2013, pp. 21–22.

[19] The project can be found at <http://www.cancercommons.org/>. Accessed on 11 January 2014.

[20] P. Szczęsny, *Otwarta Nauka...*, p. 14.

project launched in 1969, or the foundation of the AGRICultural OnLine Access in 1970. However, the key turning point in the constitution of this area of Open Science are '90s of the last century and the advent of the Digital Age.[21] It is related to the huge growth of the Internet, launching first websites, email communications, electronic journals and repositories of scientific texts. The development of the medium has enabled a completely different way of thinking about publishing practices (therefore changed perceptions of scientific practices – how they could or even how they should be implemented). It transpired that the solution met with strong interest from researchers and the number of publications available in open access continues to grow.[22]

The term Open Access means technically unrestrained (i.e., free – without the necessity to create an account or log in to the site) access to articles published in scientific journals and books. Such access can be made possible in two different ways – it depends on who is to ensure that the condition of openness is fulfilled: the publisher or the author. Thus, the *Gold Open Access* and the *Green Open Access* are distinguished. Gold Open Access is such a form of the access provision, which is guaranteed by the publisher (of journals, books). This means that the publisher does not charge for access to the text (downloading, reading online) – the cost of publication of the text in such case is covered by the author (financed from a research grant, by the scientific institution, or the researchers themselves). *Green Open Access* is associated with self-archiving of work by the authors themselves: most often a pre-print version of the text which was sent to a publishing house, an institutional repository or to portals dedicated to research. Self-archiving does not require financial resources – authors do not pay for sharing their texts. The development of the Open Access initiative was accompanied by the spread of new legal possibilities fostering such solutions. One of the most interesting is the Creative Commons licences, which offers the possibility to publish articles and books so as to allow readers maximum freedom, i.e. with permission not only to read and download files, but also to create derivative works (such as translations or remixes).

It should be remembered that these three areas do not exist in a vacuum. Their existence and development opportunities are provided by *scholarly communication*. I have not market it as a separate area, as it permeates all scientific practices – each of the three areas of Open Science pursues its objectives through scholarly communication. Therefore, it should be rather viewed as an additional layer (foundation) of these practices, not as a separate area.

This is obviously not the only possible attempt to describe the debate on the openness in science. Benedikt Fecher and Sascha Friesike proposed a very interesting classification of discourses on the term Open Science. They described, in a convincing way, the ongoing debate in the model of "Five Open Science schools of thought". They distinguished the *Democratic* school that focuses on the production of knowledge available to everyone, the *Pragmatic* school that focuses

[21] P. Suber, *Open Access*, Cambridge 2012.

[22] M. Laakso, P. Welling, H. Bukvova, L. Nyman, B.-C. Björk, T. Hedlund, 'The Development of Open Access Journal Publishing From 1993 to 2009', *PLoS ONE* 6 [6] (2011), pp. 7–9.

on opening of the process of knowledge production and the use of the "wisdom of the crowds". The third school is the *Infrastructure*, for which it is crucial to produce tools and platforms that serve scientists to collaborate on the Internet. The fourth school – *Public* – recognizes the creation of science accessible to citizens as a decisive aspect of Open Science (Citizen Science, Science Blogging). Whereas the fifth school – *Measurement* – focuses on the production of new scientiometric tools (e.g., *Altmetrics*, open peer review). These various schools of thought focus on specific elements of scientific practices. I indicated three main areas and an "additional layer". When we look at both categorizations more closely, we notice that they are similar to each other and corresponding pairs of concepts (*ideas*) may be indicated:

1. *Democratic* school with the: Publications – Open Access pair.
2. *Pragmatic* school with the: Research Data – Open Data pair.
3. *Public* school with the: Research Process – Citizen Science pair.
4. *Infrastructure* and *Measurement* school with the focus on the *Scholarly Communication.*

Although both approaches to Open Science appear to be similar, they place different emphases on the key issue – from the perspective of considerations presented here – of scholarly communication. This will result in a different approach to communication practices, either as a foundation or just as an element of the Open Science. Therefore, let us discuss the scholarly communication itself.

3. The role of Scholarly Communication in Science

The understanding of communication adopted here comes from the constitutive (interactive) approaches. I acknowledge that communication is a kind of activity, and thus it is rational; it requires and is subject to interpretation and that at least two persons using signs participate in it. Thus, I assume that communication can be understood on the basis of a given culture. A set of communication activities on the social level is here referred to as communication practice by means of which a given culture is (re)produced.

One type of communication practices are practices of scholarly communication. Each practice is implemented at individual and social levels. The individual level is a specific action, the social level – that is, for example, various communication practices – allows an implementation of activities and at the same time maintains the social need which induced the specific action (individual level of practice). This can be illustrated as follows: at the level of an action (the communicative one) a specific scientist publishes a scientific article through which they contact scientists, promotes his work in the discipline, etc. While at the social level such communication practice maintains the functioning of science, which is a kind of social practice (based e.g., on the communication practices of publishing). Thus, communication research is a part of the scientific process, not a mere supplement to it.

Scholarly communication is constituted by practices of researchers and academics that consist in publishing and disseminating the results of research, criticism, polemics, by means of scientific publications (journals, articles, books, as

well as science blogs, microblogs). A key aspect of these publications is reviewing them before publication, although the model of reviews is also being transformed (from *double blind review* to *open peer review*).

The literature on the subject contains various terms, whose scope of meaning sometimes overlaps.[23] In this article, I am interested in *scholarly communication*, however, there is also the term *scientific communication*, which refers to explaining and popularizing science by columnists, journalists (but non-scientists), as well as the term *science communication*, which denotes the promotion and clarification of research results by scientists (therefore, *scholarly communication* could be considered a component of *science communication*). These distinctions result from a more primary division of communication practices related to science into two types: communication within the group of scientists (internal communication in science) and the communication for the purpose of explaining and popularizing of research (external communication in science). The first type includes such practices as publishing scientific papers, blogs, managing profiles on social networking sites for scientists, analysing and using scientometric indicators (e.g., Impact Factor or *Altmetrics*). The second type involves, among others, the creation of popular scientific texts, creating events and focuses primarily on the popularization of science in the society. Of course, these two types of communication practices complement and influence each other. The way how a communication practice functions and is implemented results from two aspects: (1) the media aspect and (2) the collective view one.

T h e M e d i a A s p e c t of a particular practice stems from the *media*, which are used to perform a particular communicative action (and consequently the communication practice itself). I assumed that we use signs to communicate – it is made possible by the *means of communication* (a given means is a *medium*). This may be e.g., language, pen, typewriter, computer, video camera. A particular medium is used for communication in certain forms: oral, written, audiovisual, graphic, etc. Thus, the shape of a particular practice is affected by the media aspect: a scientific conference proceeds differently (it is a typical scholarly communication practice) when a group of scientists meets in one place and discusses an issue (use of language and oral forms) from communication performed in the framework of a conference call – although the language signs are still used, the "perfection of the audiovisual form" is much more important (whether there is no delay in the transmission, whether the sound is clean and all the participants of the debate see each other at the same time).

T h e C o l l e c t i v e V i e w A s p e c t of communication practice is constituted by such content of the collective experience that allows (but also affects) the way of understanding, implementation and description of what a given communication is, what it is based on, how it should be "executed" to achieve success

[23] I. Mahmood, R. Hartley, J. Rowley, 'Scientific Communication in Libya in the Digital Age', *Journal of Information Science* 37 [4] (2011), pp. 379–390; H.A.J. Mulder, N. Longnecker, L.S Davis, 'The State of Science Communication Programs at Universities Around the World', *Science Communication* 30 [2] (2008), pp. 277–287; R. Vanderstraeten, 'Scientific Communication: Sociology Journals and Publication Practices', *Sociology* 44 [3] (2010), pp. 559–576.

(of course, if the aim of communication may be considered in terms of success). The collective views[24] on scholarly communication practices (shorter: views on scholarly communication) refer to, among other things, concepts related to communication processes (such as a community of communicating researchers, news, publication), beliefs ("the purpose of the article should be indicated", "the sources of quotations and borrowings need to specified", "access to scientific publications should be open") and values (e.g., "it is right that taxpayers receive messages about science financed by them", "good publication is used to present original results", "scientific reasoning is good, when it is clear and understandable"). It is the collective view aspect which bears the expression of the "need for openness in science." The views determine the way to implement scholarly communication itself, however, this realization is possible thanks to the media, i.e., thanks to the media aspect of the practice. These relations between the aspects themselves, but also between the aspects and the communication practice, are reciprocal. A change in the views on scholarly communication affects the media aspect (what are the means of communication and how they are used in scholarly communication), while the change in the media aspect (e.g., the emergence of the Internet) affects the views of the scholarly communication practice itself. Furthermore, if we perceive scholarly communication as a fundamental process for science, then it should be recognized that transformation of scholarly communication (resulting from changes in its aspects) will have an impact on science itself. Let us then consider how this mutually constitutive impact can be described and made into an object of research of communication history

4. Scholarly Communication as a Research Subject of Communication History

I treat social practices which constitute *scholarly communication* as a research subject of communication history. Communication history is interdisciplinary. The research is carried out from different research perspectives – by media experts, philosophers, communication researchers, communicologists, literature specialists or historians. I am interested in the philosophical reflection on how the object of research is constructed in the context of communication history, i.e., study of which ideas, phenomena or practices helps to better understand and describe communicative actions.

I also assume that a particular research object, which *scholarly communication* is, should be examined in the diachronic perspective. Since I assumed that a specific communicative action acquires its cultural meaning by being a part of cultural practice, while the practice depends on the state of the culture (resulting from, e.g., historical changes), it should be recognized that communication itself

[24] In this article, I use the term "collective views", although the literature on the subject offers also other terms, such as: "collective representations", "collective ideas", "collective attitudes" or "mental equipment". I do so in order to avoid various erroneous connotations and to emphasize that the ways of organizing the collective unconscious (*mentalité*) consist of e.g., representations or concealments, which express the collective concepts of the world, images, myths and values recognized by the community, or those which had an influence on it.

is also formed in a historical process. This means that the study of the *scholarly communication* history should include an analysis of historical change of the relationship between the practice itself and its collective view and medial aspects. I assume that in order to understand how scholarly communication was transforming throughout history an analysis of these practices in a broader cultural dimension is required. This means that there is a need to examine not only the development of the media enabling implementation of communication, but also of the views on scholarly communication and of the transformations of the science itself resulting from changes. The key issue here is the study of the collective views, since the development of the media is analysed more frequently – however, such analyses of the Open Science are "one-dimensional". They emphasize the key role of the medium by which to approach the heavily *technological determinism* in its simplest form – criticized very often and correctly.[25]

Opening the scientific process, access to publications and empirical data is enabled through the increasingly effective media. There is no doubt about it. However, not only the impact of the media on the practice of scholars should be examined, but also the impact of the collective views – on the media (their capabilities and limitations) and on the practices (which science is intended to do) – on the media aspect of the practices themselves. Such perception of *scholarly communication* transformation will make a more holistic look at scientific practice possible. The application of this method obviously requires further theoretical research, however, a heuristic description may be attempted, to stipulate how specific practices in the field of scholarly communication could be analysed in the framework of historical communication research. Let us then consider a canonical practice – the publication of research results in scientific journals.

Publication of scientific articles began in the seventeenth century, with the development of modern science and the emergence of the first periodicals. The first scientific papers emerged from the transformation of earlier forms of writing: letters and essays.

Since that time the number of people involved in science has increased dramatically and and around 1850 it reached a million scientists, increasing 1.5 century later to almost 100 million – the current estimate of the number of people involved in science.[26] While studying the history of communication practice, it can be concluded that scientific journals appeared in the seventeenth century, as – owing to the spread of the printing press – there was such a possibility).[27] Of course, the form of journals and articles evolved, with time footnotes and endnotes appeared, guidelines for creating bibliographies were created and attaching abstracts to articles became a standard. The journals also started to be published in an electronic form, and now very commonly they indeed appear only in the digital form. The study of these changes: analyses of changes in the style of scientific articles, of the

[25] E. Kulczycki, 'Transformation of Science Communication in the Age of Social Media', *Teorie Vědy / Theory of Science* 35 [1] (2013), pp. 7–9.

[26] S. Bartling, S. Friesike, *Towards Another Scientific Revolution...*

[27] D. Raven, 'Elizabeth Eisenstein and the Impact of Printing, *European Review of History. Revue Europeenne d'histoire* 6 [2] (1999), pp. 223–234.

language used, the rhetorical figures, the methods of referring to literature, attaching additional items (abstracts, keywords, etc.), have been successfully carried out in many studies.[28] Alan G. Gross, Joseph E. Harmon and Michael Reidy – the authors of an very interesting monograph *Communicating Science: The Scientific Article from the 17th Century to the Present* – presented the history of research on scientific articles and distinguished three dominant perspectives: the rhetorical, the philosophical and the literary.[29] Each of them focuses on the transformation of what I referred to as the media aspect of communication practice. However, the authors of the *Communication Science*... realize that such research can be extended in order to get a better understanding of the history of communication practices. When presenting the objective of their research, they write:

We hope to give the reader a sense of what it was like to be a scientific communicator, say, a German chemist in the early 18th century or a British physiologist in the late 19th century. In each case, we have a man trying to convey an experimental result, in the first by means of a vocabulary of the five senses, in the second by means of a highly developed technical vocabulary. We want readers to see how different were the communicative horizons of these two men, both fully committed to the same task of conveying knowledge of the natural world. We believe that only by a careful analysis of such texts as these will readers develop a sense, albeit a second order sense, of being *there*.[30]

In the above quotation, there are two key elements. First of all, an indication that research on the media aspect or a rhetorical analysis is not enough. One should also take into account the research on what these authors call *communicative horizons*, which I define with the term the *collective view aspect* of communication practices. Secondly, we must not forget that the historical sources themselves are a kind of "vehicle" for this aspect: texts which are available to us through a *medium*.

A fuller understanding of these phenomena is possible when we keep the collective view aspect in mind: what do certain actions result from, the use of particular media, why trust those and not other media? It should be noted that with the increase in the number of researchers the level of professionalism of scientific practices rose and the importance of groups of scientists grew as well. This resulted in a need to develop a system of publishing which allowed the acknowledgement of: the contribution of many authors and their co-authorship of an invention, discovery, analysis; and at the same time helped inform the widest possible number of scientists. The researchers saw discoveries and publications as "their own" – not anonymous, but created by particular researchers. Taking into account other phenomena of the time, such as emerging modern form of copyright (the period of national laws in the eighteenth century and the internationalization of copyright law in the nineteenth century), and it becomes clear that the development of the publishing practice was not only correlated with the development of the media.

[28] See: M. Pera, *The Discourses of Science*, transl. C. Botsford, Chicago 1994.

[29] A.G. Gross, J.E. Harmon, M. Reidy, *Communicating Science. The Scientific Article from the 17th Century to the Present*, Oxford 2002.

[30] *Ibidem*, p. 11.

Of course the media support it, but they too are shaped by the collective views on scientific practices or even the media themselves. For example, it is a rather popular belief that the printed book is more important than the one available only in a digital form – this collective view, shared by researchers in the twenty-first century, not only affects the assessment of the book, but also the development and use of the medium (print, electronic publications). This in turn can lead to various changes within science itself (e.g., a printed publication will not – due to limitations of circulation – reach a potentially great number of interested scientists).

Therefore, *scholarly communication* may be studied not only by informatologists, book historians, but also by communicologists and communication philosophers who want, in their research, to emphasize the collective view aspect of the practice. An indication of the methods of testing the relationships between thus defined collective views and the media of scholarly communication requires further discussion and elaboration. The philosophical perspective in the study of communication practices should focus primarily on the cultural nature of these activities – not on the quantitative aspect (e.g., journals' circulation, article structure), but on the qualitative element of the research objects: the circulation of journals should be seen not only as demand and printing capacity, but also as interest in a particular field of science. Because of this reason – not because of media development – scientific journals crash after two centuries. The structure of an article should be seen not only in the light of editorial requirements and ways of reducing costs (e.g., the size of the article), but above all from the perspective of how scholarly communication should be practised: the emergence of abstracts is not a result of the transformation of the media aspect, but of the collective view one – the editors have simply come to the conclusion that it saves time for both readers and Investigators.[31] Transformations taking place in scholarly communication at the beginning of the twenty-first century can be better understood when observed in the context of historical changes of communication practices.

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[31] *Ibidem*, p. 13.