

# EVER TO EXCEL: SCIENTIFIC RESEARCH VISIBILITY 2014 AND BEYOND

Adam Sofronijevic<sup>1</sup>, Gheorghe Săvoiu<sup>2</sup>, Mladen Čudanov<sup>3</sup>,

<sup>1,3</sup>University of Belgrade, Faculty of Organizational Sciences

<sup>2</sup>University of Pitesti, Faculty of Economic Sciences

e-mail: <sup>1</sup>[sofronijevic@unilib.rs](mailto:sofronijevic@unilib.rs), <sup>2</sup>[gsavoiu@yahoo.com](mailto:gsavoiu@yahoo.com), <sup>3</sup>[cudanov.mladen@fon.bg.ac.rs](mailto:cudanov.mladen@fon.bg.ac.rs)

*Abstract. This paper is dedicated to the new trends in research visibility. The authors start from the history of science, to the importance of the scientific research visibility and finish in the future of this new aspect based on some anticipations of the contemporary tendencies and realities. Experiments with new way of conducting scientific research and publishing its results perhaps in a more open manner, might be a first step away from an object-oriented approach focused on a finalized scientific product, towards a system based more on constant, collaborative and simultaneous knowledge production that will have a firm ground and effective exposure in a digital world leading to a better visibility of individual and group scientific output.*

**Keywords:** *visibility, research, liquid or fluid text, nano-publication*

*“Hippolocus begat me. I claim to be his son, and he sent me to Troy with strict instructions: Ever to excel (αἰὲν ἀριστεύειν – aièn aristeúein), to do better than others...”*

Glaucus, Homer's Iliad, Book Six

## 1. INTRODUCTION

The similarity between the atom, as an indestructible element of reality, and its shadow, in the Platonic sense of the idea of the atom, generates the assimilation of science with a certain manner of thinking. *Science in antiquity began by looking for an answer to the question connected with a certain peculiarity of primordial element of nature, like earth, air, water or fire, which generated the alternation of the diurnal and the nocturnal, as well as the climatic variation, or the diversity of the times of the year* [1]. Two of the greatest philosophers in Miletus, Thales (624 - 546 B.C.) and Anaximenes (585-525 B.C.), developed their philosophical theories starting from elements they considered vital, respectively water and air, with Thales, water representing the origin of any form of life, but also its end as well, and so did air, or the breath of air, with Anaximenes; Moreover, Anaximenes reunited in air, all the four essential elements within a chain of successive transformations, and considered water to be condensed air, while rain water was, wrung by air, the earth was nothing else but strongly pressed water, and, fire rarefied water. Anaximenes believed that air, water, earth and fire exist to the

only end of enabling life to exist. Hence, the long philosophical journey of those who wanted to explain nature; it was continued via the writings of personalities placed at the extremities, defined as absolute contraries, namely). Parmenides (540-480 B.C. eternalized the world, and implicitly its essential elements (all that exists has existed, and nothing can be born out of nothing), while Heraclitus (540-475 B.C.) celebrated eternal movement and change (*everything flows*), or the transformation of an element into another. Empedocles (490-430 B.C.) was the man who would conclude the ancient attempt at finding an elementary structure for the world, including the field of science: he tried to explain all the changes in nature through the fact that the four original elements or matters, which he called “roots”, were combined in various proportions, and then they separate mutually, again and again... Those combinations were to be, later on, defined through the existence of some germs or seeds, by Anaxagoras (500-428 B.C.), and finally Democritus (460-370 B.C.) defined the atom – the very meaning of which term is, in fact, “indivisible”. With Democritus a whole cycle of philosophical investigation was actually wound up, a cycle that was critically illustrative of original matter and its primordial elements as well as the idea of change, while opening ever new questions.

*The four cardinal elements of nature, philosophy, mythology, later turned into the foundations of religion, can be by and large assimilated with the definition of science in general: the earth delimits that specific reality or object of study of science, air is virtually identified with the breathing specific to science or the method, water is superimposed on the clarity of scientific theory, which is generated by the eternally virginal seed of the present of knowledge, while fire symbolizes its model and creative impact, which can also be devastating if exerted on any theory, which it can reduce to ashes... The legend of Hermes mythologizes the concept of science as essence of the initiation into understanding the mysteries of the world and the dynamics of its constitutive elements. The world as a reality in itself is turning itself into a coherent entity, in a system or universe theory, whose every single part is connected with all the others in the universe, and so are the universes among themselves, within an unimaginable multiverse, which is why any action exerted on one of them is reflected on all the remaining entities, which have become inseparable: air, water, fire and earth being images of the same reality.*

Science emerges when at least four major elements are joined together: *a specific or a characteristic part of a dynamic reality, a method or a collection of methods for investigation, an original theory or an aggregation of theories and a special model for understanding, validation and projection* [2]. And thus scientific research derived from these four fundamental elements of the science and implies a part of reality, method, theory and model.

## 2. ACADEMIC SCIENTIFIC RESEARCH VISIBILITY

The modern scientific researches, trying to understand the causes and the effects of the reality as specific phenomena, and the new tendencies, the original temporal and spatial projections have invited, and still invite us to adequate the instruments to make more visible the results. Using the same way in which *inter-*, *trans-*, and *multidisciplinary researches* have created new sciences, we try to understand the birth and growth of the way of thinking of the living modern sciences, and their new paradigms, new manner of research and contemporary results, all the time with an eye directed to the future visibility. Scientific research and almost equally important scientific communication that is laying foundation for the new ideas and implementation of the research results, is ongoing in a specific environment and the framework put forth by the Western Civilization – a home to inquisitive mind, critical thought and consequently scientific excellence. For better or for worse this environment is highly competitive and thus the pressing need for the best results. But also, and no less important, for the best ways to communicate these results to one's stakeholders if one is to succeed and obtain funding for the next research project. At the heart of a successful contemporary scientific communication lies the good visibility of research results. In the downpour of scientific information it is impossible to cover all publications, even in the very specific field one is priding him/herself to be an expert in. If an echo cardiographer decides to sit down today and read all the papers in the field it would take him/her 40 years and would lead straight to retirement without a chance to put to use such an extensive knowledge on peers' works [3]. And such a knowledge up until recently was a bare prerequisite for anyone to even dare calling himself an expert in the field. We see it is no more. So what is our echo cardiographer to do? Or, what are all of us to do in order to be, even in theoretical possibility, the best in such a flood of scientific papers and results and get the next project's funding based on scientific excellence and not combination of it and the pure luck? Because as of now the chance is a viable factor in determining what is a good science or what is the science at all because not all of the scientific results published will be ever read.

If scientific communication is to remain efficient and scientific visibility stay out of determining force of chance, scientific communication paradigm is to change and with it scientific publishing paradigm, authoring process and concept of scientific visibility as we know it today. There are a couple of phenomena visible today that may be helpful in predicting the way in which the solutions may appear. The first is the

automation of structured text production within the framework of general automation of some of the intellectual activities. This may have the profound effect both on the way scientists receive information and on authoring process. And the second one is emerging new forms of scientific publishing that also determine ways of production and consumption of publications of scientific research results.

The second machine age is dawning and bringing possibilities for automation of intellectual work [4]. Self-driving cars, super-computers that beat human champions in general knowledge quiz shows, robots that diagnose patients, are all reality as of now. More importantly for our subject matter, software that produces structured text that can not be distinguished from the one written by humans is also a reality. Topics addressed by these robot authors are economic and business reports, sport reports, yellow press reports. All of these are highly structured texts and the paradigm behind the phenomena lies in the conjunction of good meta-authors, even better data available and excellent algorithms to connect them. Early prognoses that mere existence of such technology will have immediate effect on scientific communication proved wrong or perhaps proved the timing within the concept of immediate wrong [5]. As of January 2014 no structured scientific texts have been written by robots although technology is out there. Literary reviews, abstracts, conclusions and forewords could all be massed produced if there was an economic incentive big enough as in the fields of reporting on company profits, minor league baseball matches and popular culture stars urban adventures. An expectation still exists that such an incentive will emerge and that in few years time we will have scientists relieved of the burden of writing such parts of papers that show readers, editors and peer reviewers that they are legitimate experts in the field or are part of the tradition in scientific writing. This may significantly foster production of scientific papers, but will also be a challenge to peer review system and already crumbling ethical standards in authoring community. On the other end of the scientific communication channel are effects that automation of consumption of scientific texts have on usage and they are available for some time now. A solution for efficient automation of interpretation of data in tables and graphs has been presented [6], as well as the proposition for extraction of relationships between factual statements in the text that can lead to more efficient search for the specific relationships [7]. Exciting advancements have been made in the fields of deep parsing of scientific texts [8], statistical analysis of general text [9] and finding of predominant senses words have in a text [10] which all allowed for further advancement in machine translation and machine speech recognition nowadays witnessed by general public using Google Translate and Apple Siri products. Anyone anticipating modes of scientific visibility in the near future should count in the effects of automation of intellectual work and pay special attention to specifics ups and downs in regards to existing frameworks such as peer review, Open Access movement and the publisher's paradigm.

More visible in the line of scientific communication are the formats that are used to present scientific research results. The paradigm of codex printed book in Latin has been replaced by the paradigm of the digital journal paper in English and this starts to give way to a needle in a haystack metaphor. If there is enough reading material in journal papers only for a full life time of reading just in a specific field, not to mention the broader discipline, how do we cope? One viable solution has been presented in the form of a structured triplet, and it's most sophisticated spin-off so far has been the nano-publication concept. A nano-publication allows for machine power to weigh in and help human researcher pinpoint exact relationships of interest [11]. A nano-publication is a very short declaration connecting two concepts by means of a third and providing metadata about this relation (conditions under which the relation is viable, author, timestamp, etc.). Originating in life sciences, nano-publications seem to be envisioned and increasingly shaped as a tool for the efficient publishing of datasets. The abundance of datasets is a relatively novel development in science. Not long ago, quality datasets were strictly guarded and unavailable to outside researchers. Nowadays the gap between available datasets and the resources to even curate them let alone analyze them is widening each day. Therefore nano-publication format is addressing one important issue of contemporary scientific research and research funding. The nano-publication concept has the potential to successfully face the challenge of providing a novel method of evaluating datasets and scientific work based on them, while at the same time preserving the values of the traditional means of scientific communication [12]. Nano-publication concept also has the potential to foster scientific research in developing and transitional countries by providing incentives for looking into datasets in open access, curate and do other preparatory work for nano-publications to be machine readable [13]. How a nano-publication does achieve all this? It is based on XML technology and open standards that allow for wide machine readability. Triplet concept that is in its foundations allow for extraction of database relations and curator of concepts is needed and viable role in this framework, concepts being all objects that may be a part of a triplet, name entity, relation, scientific concept, gene, species etc. By maintaining a wiki of concepts that contain millions of concepts both high skill and not so high skill intellectual human labor is needed. On one side of the equation is researcher who envision the new relationships, manages the research project that lead to data base creation and is responsible for overall scientific communication and research result visibility and on the other side there is a low level skill technician whose work is needed in order to make all the necessary preparations so that data may be machine readable, if one is to look falsely on him/her a servant to the machine. This plays well in the ideas about changing the shape of skills-education vs. market need for labour curve, which tended to be linear and now is more U shaped, with low labour and high skilled labour being needed while the mid field is occupied by machine labour [14]. In this we find another proof for the thesis presented by these authors who claim that new digital

technologies emanating also in such concepts as the nano-publication are destructive for existing frameworks, in this case framework of scientific communication and at the same time creative. They create new kinds of need for low level skill intellectual labour that will feed the machines with data prepared in a specific way and also by freeing more sophisticated skilled researchers from repetitive/structured work tasks will create new possibilities for this kind of labour to be employed.

So far we have examined how researchers may collaborate with machines in order to make their research more visible and their communication more efficient both by examining new technologies available and new format of scientific publishing. Now we will look at yet another new format of scientific publishing that allows for researcher to collaborate more closely and in this manner approach the challenges of higher productivity and higher quality demand in another fashion. Fluid or liquid text or a book is a piece of writing created by collaboration of two or more authors that add changes to it with such a frequency that a reader or rather the one observing the creative process has a feeling that the text is flowing, it is not being transformed in increments, from one version to another, but is in constant change. In order to present such a work to a reader the liquid/fluid text needs to be frozen for an edition and the work continued until another point in time when another version for readers is required. One immediately thinks of a scholarly textbook that nowadays have a lot of authors, fast paced changes and the need for editions in regular time intervals. An example of a practical experiment that focuses on the benefits of fluidity for scholarly communication is the LiquidPub project at <http://www.iiia.csic.es/en/project/liquidpub>.

The deconstruction of the idea of a final document such as in Wikipedia where the validity of a document is now marked only by a temporal stability rise questions beyond scholarly communications [15]. The concept of modular data sets that can be recombined, as proposed by [16] offers a way to look beyond static knowledge objects, and presents a view on how not only to structure and control, but also to analyze overwhelming flow of information. With the help of this software-based concept we can examine how to remix and thus take an active stance to shape science and the culture in the future and to deal with knowledge objects in a digital environment. Liquid or fluid text, the concept of the remix and reuse can be all paths to a new way of critical thinking about the possibilities of the scientific text and scientific communication, opening up new venues both in time and in space for visibility of scientific research results. If we think about research results beyond the concept of a stable object, but as a grounding basis to explore strategy of further scientific inquiry and the challenge to established notions like stability, identity and materiality that are all bound up within the existing paradigm of scientific communication and presentation of scientific research results, it will enable us to argue for and pay more attention to otherness, difference and another knowledge system based more upon fluidity.

### 3. A FINAL REMARK

Experiments with new way of conducting scientific research and publishing it's results perhaps in a more open manner, like for instance via liquid texts or wiki pages, might be a first step away from an object-oriented approach focused on a finalized scientific product, towards a system based more on constant, collaborative and simultaneous knowledge production that will have a firm ground and effective exposure in a digital world leading to a better visibility of individual and group scientific output.

Modern scientific research has not abandoned the tendency towards maximum integration or unification, the doctrine of unified research and unique law or of the unity of science (an

expansion of logical positivism over the scientific method, theory and model, turned into the “physicalism” of the Vienna school, that of Rudolf Carnap, but also find the example of the sciences of complexity, that is only one in a rich series, which could be listed he from Econophysics through Sociophysics to quantum economics and so on), and scientific research has thus accepted the new course of original products of the research visibility in approaching expanding reality with big enthusiasm and creativity.

The modern scientific research based on an extended mixture of inter-, trans-, cross and multidisciplinary research team and research products is unifying [2], while classical science isolates all the time...

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