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Literature of Popular Science in North-America

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1. The Literature of Popular Science

The appearance of the first descriptions on the cost of the American continent and reports on voyages on the Atlantic archipelago inaugurated the age of literature of popular science. There is no doubt that the earlier notes came from European explorers[2]but in the eighteenth century even American sea captains gave numerous descriptions of what they saw.[3]These writings presented America as wholly imaginary land turning the descriptions into fictional stories. In most cases the result was a strange hybrid of geographical facts with an utterly irrelevant approach to the continent. However, these fantastic compound fragments were not very exact, and went but a very little way towards science and scientific facts, introduced a new horizon which corresponds a new way of reading and understanding the nature, which than led to the formation of the literature of popular science.

As the term suggests the literature of popular science is characterized by the aim to explain different, scientific contents simply, with artless words to offer a practical and appealing image of a scientific thesis or idea. It is this last quality that through a new approach shows how the writer becomes indeed a popular scientist and a guide. The logically organized texts fulfilled the hope to propagate the science, were addressed to a lay readership or those who were not provided by any intellectual foundation. Though the formation of this branch of the literature is mainly linked to writers and columnists, the appearance of the first texts of this kind was nowhere more evident than in almanacs, literary books and papers. Yet, in this eighteenth century context the liberty of journalism and writing of literature, luckily, was matched by the spread of advanced scientific ideas.

The main tradition of almanacs made early start in America with the yearbook of William Pierce in 1639.Although this calendar also includes scientific issues, there were the following almanacs which made a major effort to provide a scientific coverage. No doubt the difference also reflects changes in scientific sensibility in the eighteen hundreds. Almanacs don't mythologize science but include scientific poems and poems on scientific subjects. Yet it is true that readers who turned to this kind of literature faced a completely new horizon which includes features on science.

There was in fact much rejoicing when even the eighteenth century magazines made room for science. From the very first the magazines had attentive eye on science. Just think about the earliest American paper of the English emigrant, named Samuel Keimer, which opened up new possibilities for the form of sciences. The period of the American Enlightenment offered both challanges and opportunities for writers willing to describe and comment on science.

This study will survey those eighteenth century writings which did not ignore the new prospects of the scientific revolution and through a new approach wrote on science in simple and clear way. The paper will conclude with a brief outline of science coverage on the eighteenth century American magazines. The main aim of this script is to help the reader meet the evolution and development of popular science in the light of its close relation to the scientific literature.

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[2] cfr. Bakeless, John,*America as Seen by its First Explorers – The Eyes of Discovery,* Dover Publications, New York, 1989.
[3]cfr. for example, *New Discoveries in the Pacific Ocean,* in«The Massachusetts Magazine», 1789/IV., pp. 201-205., Travels of Capt. Waldo, in «The American Magazine» 1743/ Numb. 795. ecc.

2. Literary Forms of the Literature of Popular Science

2. a. The almanac

The almanac is a notable fruit of the Europe borned scientific revolution that gave birth to the literature of popular science which suggests a different avenue for the study of scientific matters. However almanacs are not of interest to literary critics primarily because don't demonstrate a systematic approach to science, in my opinion greatly influenced the development of the literature of popular science in America. Limiting their content to practical knowledge and everyday observations, more or less ignoring real scientific questions, the public was not expected to know anything about science. The almanac offered exciting ways of exploration, promoting the useful knowledge.

Beside Jacob Taylor and Nathaniel Ames, Abraham Weather wise is recognized as a master of almanac. His calendars consist of poems, short descriptions on scientific and related themes and even receipts. The almanac for the year of 1765 deserves notice because gave rise to the literature of popular science in America. Among the many things for which I consider this book the most important is the strong choice of a new genre, the «frontispiece» or else «antiporta»[4].For Father Abraham, antiporta means that the author densifies the content in a picture because art brings even those closer to the understanding of science who were not provided by any scientific formation. The frontispiece reveals itself in the balance of poetry and art but in this case neither art nor poetry oppose to science. On the contrary, one fuses into the other arriving to the harmonization of art and science. Generally speaking, pleasures of arts should be joined to a practical instruction and a scientific knowledge embodied in the work.

The opening page of the calendar illustrates Abraham Weather wise's tendency to reproduce the principal theory of the book. The engraving is accompanied by a poem which contains the same elements as the picture:

Vast is the Power that forme'd this lovely Ball,
Immense the Being that presides o'er all
At his Command from *Chaos* order rose,
And Harmony on Nature he bestows.
Let universal Nature then proclaim
The beauteous Author of this Goodly Frame. [5]

This poem is a brief speculation on the godlike formation of the universe. Although the text exhibits the author's profound view on religion, it is integral part of the science-drivenantiporta. The whole text is filled with symbols which is scarcely more remarkable than in the figurative language. God, whose name is by periphrasis, which means that her name is never mentioned directly, is present as an ideal perfection who diffuses spirit of unity and brings every faculty to integrity and fulfillment. The „lovely Ball" in the first line should be identified and understood as the Earth itself, created by God. The aspiration of every living creature for order and unity, that compose the basis of the world, is best painted in and roused by the divine word in which the scattered materials harmonize.

Even though the poem was written in the age of Enlightenment, there is no doubt that the vision of its author was shaped by the medieval Christian theology and philosophy. The picture has a different meaning: it claims that a new era of business has dawned. It clearly shows that art is capable enough to engage knowledge or science to paintings. The engraving represents a wise, old man who is sitting markedly upright in an armchair. His right hand is resting upon the arms but his left hand is pointing to a globe. The naturalist, who, I strongly believe, looks so much the Italian physicist, Galileo Galilei, is being depicted in what appears to be his study with a huge window behind his back. He is appropriately dressed for a scientific lecture which is also verified by his actual scientific environment: the table is full of different instruments, mainly his inventions. And in the visual center of the picture, on the window sill, above the globe, there is the famous telescope of Galileo, used for scientific observations. Artists and poets regenerated literature becoming the sole depositories of all the knowledge of the eighteenth century by finding their materials in the science.

However it is important when reading almanacs to remember that these texts present a view of knowledge that treats science differently than do the essays of academic scholars and provide a generous sample of the pseudo-scientific literature of the time.

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[4] The Italian word means *outer door* or *vestibule* so an outside door which allows entrance in the building. The use of the Italian expression instead of the English word is a practical approach to literature as a real thing.
[5]cfr. Weatherwise, Abraham, *Father Abraham's Almanac,* Philadelphia 1765.

2.b. Between Dialogues and Lectures

The same demonstrative, populist intent is evident even in the dialogues and popular lectures of the seventeen hundreds. Pastime of attending lectures or reading informing dialogues probably increased as even untrained and incompetent people took up paying attention to scientific matters. These works which combined the scientific with the artistic and informal were justified by a claim to be useful supplementing the rigid academicism through stimulating curiosities with some everyday knowledge. The characteristic succinct and compact style of lectures and dialogues made the case for what was eventually became the nineteenth century propagatory or divulgative article.

The faith in the publication of practical and pragmatic knowledge in literary forms remarkably influenced the formation and evolution of dialogue in America. The major subject of the dialogue was tied to actual scientific issues. These works, directed at the field of science, in particular were tampered with to make simpler and easier which never lose their way. In the same time we have to notice that unlike the European literature of the century where much of the most enjoyable reading was to be found in semi-scientific or pseudo-scientific dialogues,[6]America is disappointing in this genre.

The only written dialogue which stands out from the age of the American Enlightenment is the text of Charles Christopher Reiche: *Fifteen Discourses on the Marvellous Works in Nature – Delivered by a Father to his Children*[7]*,* in which he is talking about the world and its inhabitants. Through an original plan, Reich fictionalizes the process of education pretending that the lessons are short talks of a father dedicated to his children. He believed it fundamental that children must be taught natural science. But it isn't that at all. The writer produced in all fifteen chapters which are preceded by a summary *Preface* a didactic text which surpasses the classical pedagogic books. Each chapter recounts the main features of the specific subject, indicated in the title, and expands it into the panoramic study of the whole universe. He is far from reduce the beauty of the universe under the domination of science: „As a matter of a very serious consequence, I would have you to contemplate, the globe, which we inhabit, the greatness of its extent, and especially its immense weight."[8]. Although Reich calls attention to the importance of science, he definitely ignored the scientific approach and replaced it with a very strong didactic method, treating natural science not as a branch of science but as an interesting story to tell: „From these my sentiments the judicious reader may learn by what rules to judge of these discourses, and to reflect, whether he can comply with, and promote the earnest wishes I entertain of seeing these pages in the hands of many, and particularly those of the youth."[9]

The impossibility of separating science from religion make this text existing at the limits of both religion and science. In the age of the American Enlightenment in which science was relatively new, not to mention its popularization, knowledge was passed on through religion. Which also means that science and every scientific attempt was seen with suspicion by the Church. It is therefore not surprising that even Reike's vision was shaped by a very strong religious conception, following the dominant European tradition. In the *Preface*he says:„Could one say: Lo! There is God! and man then visibly behold him in the deepest prostration he would adore his sublimes excellenciest […] [everyone] must live under an habitual sense of the presence of God, and act up to his pleasure and commandments even amidst his worldly occupation."[10]In order to explain the marvelous universe where we all live the writer turns to the existence of a transcendent force, called God.

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[6]In the European literature, where there had been a strong tradition of writing dialogues, there are lots of works which claim a place in the literature of popular science. These texts combined the scientific background with imagination promoting science, and more generally, its benefits in the everyday life. An early example is Francesco Algarotti's *Newtonianism for the Ladies, or Dialogues on Light and Colours* (1737). With an increasing desire to science in the seventeen hundreds even those liberal intellectuals and journalists were to tackle scientific topics and problems who didn't have any previous experience to draw on. The *Dell'elettricismo* (1746) of Eusebio Sguario, *Del Baco da Seta* (1756)of Zaccaria Betti, *Della Coltivazione del riso* (1758) of Gian Battista Spolverini and *Della Coltivazione de'monti* (1778) of Bartolomeo Lorenzi are all dialogues where at the at the heart of the discussion are on physics, biology and geology.

[7]cfr. Charles Christopher Reiche, *Fifteen Discourses on the Marvellous Works in Nature – Delivered by a Father to his Children,* Philadelphia, James&Johnson, 1791

[8]ivi., p. 7.

[9] ivi., pp. iv-v.

[10] ivi., pp. iii-iv.

For Reike the only way to understand the universe is the search for God: that is, through religion. In other words: the author used the religion to frame his scientific topic, locating reality in a transcendental realm that gives meaning to the visible world. On that basis it has to be clear that the scientific aspect of this dialogue in several times contrast with its spiritual thickness, treating science very differently than do the later talks.

Bridging the gap between literature and scientific literature, lectures are an advance justification of the literature of popular science. Lecturers explored every scientific problem, celebrating science as a repository of facts, directed to new ends. The finest example of this genre is the series of lectures of Charles Willson Peale, housed by his American Museum. Rather than seeing their scientific features, these discourses open for consideration their affective and public dimensions as forms of literature of popular science. Peale regenerated the genre of the lecture organized outside the universities by introducing an informal style, and developed a very popular line in turning the science into useful knowledge. Now, we have to well understand that for him science which in his age was associated with natural history was very different: it meant a popular form to satisfy people's appetite for scientific issues.

In his opinion lectures should leave university halls and find place in museums, libraries and in salons. He claims that this kind of literature subordinates science to story-telling, facts to anecdotes and reality to fiction, giving space to explore, to inform and to entertain. His proclamation of popular forms grew from clear awareness of the European situation where from the seventeenth century, lectures given in coffee houses were already common events.[11]His cogent, lucid and impressive lectures are not abstract speculations and rigid adherence to the taxonomy of Carl Linnaeus, who at the time of the Enlightenment was considered the only valid point of reference, but aim to show through their didactic tone that the key to life is the knowledge of natural science. Peale' stress on clarity, transparency and simplicity is evident in his *Introductory Lecture* of the relation between utility and the knowledge of natural science: „In my introductory Lecture […] I endeavoured to show how important is the knowledge of natural history to every class of Citizens. […] And again I repeat the comfort, happiness, support of all ranks depend on their knowledge of nature".[12]He underlines that the main role of popular science is to accomodate people to the society where they live.

Comparison between the seventeenth century lectures and the university lectures of the same period serves to illustrate their difference in science coverage. To say no more than popular lectures overlook the science because of their practical aim and unusual approach: this is a special form of education with a practical end with the main goal of capturing the popular imagination. In his lectures Peale touches the limits of scientific freedom, finding inspiration in naturalness and spontaneity. In his third lecture, *Mongoose, Bats, Mammoths, Elephant and Sloth,* Peale after giving a short, general description of the elephant, in which he draws attention to all of its main features, covering size and shape, behavior and habitat, goes on with what we might call „amazing animal stories" in the sense that Peale attempts to describe original and true stories about elephants.

The first one tells a story about a drunkard soldier who after an ecstatic night, woke up under the belly of an enormous elephant. The animal not only left the man untouched, but treated him as a friend: „The elephant however eased his fears [the man's fears] by carrying with his trunk and dismissing him in the most friendly manner."[13] This anecdote is followed by another most touching story which illustrates the death of a poor man, killed by a furious elephant, in revenge for his violation. Peale focuses not on the death itself but rather on the personal emotions which is demonstrated even at the level of language: „The poor man's wife witnessed the scene. Wild with despair for the loss of her husband she shrew her two children at this feet of the furious animal crying «Why spare me or my children since you have slain my husband? The elephant became constantly calm, took the eldest boy on his trunk placed him on his neck and adopted him for hiscormack, would never obey any other conductor»"[14] The woman, torn between the grief for her lost husband and the duty for the children, seems to be struck down by a fever for her troubled mind. But sometimes later her distress of mind decreased when she noticed that the animal provides support to her children. The pacified elephant encouraged her and at the end of the story, on the basis of the previous experience, it is associated with good and wisdom. Here Peale shows that the understanding of an animal basically lies beyond of the

[11] About the coffee house, called also «penny university» see also: Cowan, Brian, *The Social Life of Coffee – The Emergence of British Coffeehouse,* Yale University Press, New Haven&London 2005; Tolles B. Frederich, *Meeting House – Counting House. The Quaker Merchants of Colonial Philadelphia 1682-1783,* The North Varolina Press, 1984.
[12] Peale, Charles Willson, *Lectures*. The manuscript can be found at the American Philosophical Society
[13]ibid.,*Third lecture (Mongoose, Bats, Mammoths, Elephant and Sloth),* p. 20.
[14]ibid., pp. 20-21.

power of human reason. It follows that Peale's lessons has a double aim: on the one hand he makes the didactic function primary, on the other, his lectures mean to be a presentation for popular entertainment.

It can't be doubted whether the genre of the popular lecture, which in America had become widely known and is enduringly linked to the name of Charles Willson Peale, the most famous American scientist, naturalist and inventor, contributed to the development of the literature of popular science. Although its formation is mainly linked to amateur biologists, astronomers and natural historians, the great expansion in this branch of the literature was witnessed by eighteenth-century papers. Though in the age of the Enlightenment the need of information and the thirst for knowledge even in the American continent was reflected in the best way through journalism.

2.c. The American magazines

In the seventeen hundreds the appearance of the first astronomical almanacs and semi-scientific dialogues were followed by well organized papers and magazines which could promptly respond to the great demand of the borning intellectual climate for new scientific information. It was of the gravest urgency because although safe topics like news, foreign affairs or agriculture were flourishing, the amount of science related articles was restricted and little of semi-scientific issues could found their way into the pages of newspapers. Among the first American papers[15] which drew plain line between science and its popularization there are several journals such as the Bostonian magazine of Isaiah Thomas «The American Royal Magazine», the «Columbian Magazine» of Thomas Seddon and William Spotwood in Philadelphia orthe «American Museum or Repository of Ancient and Modern Fugitive Pieces» of Mathew Carey.The main objective of these magazines which marked a great step forward in scientific divulgation, was to show how could be science disseminated to readers who had no special interest in theoretical debates or technical matters.

Magazines both in Europe and in America became the most important vehicle of scientific theories, inventions and innovations.[16]European journals provided perfect example of the American newspaper writing. The English «The Spectator» of Joseph Addison, the Italian «Il Caffè» of Pietro and Alessandro Verri and the French «Journal des Sçavans» of Denis de Sallo were those which marked a new way of writing with their brief abstracts, summaries or plain comments on the scientific life.[17]The period, like never before, exhibited a fascination with articles which offered considerable insight into the progress of science. In a short time periodicals became the most important means of providing the reading public with information and guidance on curious new state of science, philosophy and literature. Indeed many of the age's great intellectuals used journalism as a vehicle for the popularization of their ideas.

Few papers have had such large impact as the «The American Royal Magazine», whether in the semi-scientific accounts, or in the botanical and geographical engravings. The monthly periodical, published in Boston between 1774 and 1775, was one of those papers which were not aimed especially to the intellectuals creating a fashion for the popularization of science in America. However the debut was not easy. In order to make science easy to digest, the paper indirectly turned to the scientific life. The approach of the magazine to science was dominated by brief rezumes based on prepared studies. These were broad comments written by members of the intellectual comunity expressing the subject in an inspiring language. This means that among the many didactic and entertaining stories for which eighteenth-century magazines are most famous, there already emerged semi-scientific columns. Although in the first number, published at the beginning of 1774,it is not easy to find any form of popularization, four months later, in the number of April, the ratio of semi-scientific and non-semi-scientific articles is four to eighteen.[18]

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[15] The earliest American paper was the periodical of an English emigrant, named Samuel Keimer. The «Universal Instructor in all Arts and Sciences» was the first to use journalism to popularize science and arts through the publication of one or two entries of the *Cyclopedia, or Universal Dictionary of Arts and Science* in each copy. Although it didn't last long, it was followed by other periodicals which covered a wide range of materials.

[16] However we have to still remember that in America of this age, which roughly coincides with the period of the American War of Independence, science was relatively poor. Nevertheless, besides politics, even articles on medicine, astronomy, math, physics or biology enjoyed great popularity.

[17] cfr.,Beáta Tombi, *Tudomány és ismeretterjesztés a XVII-XVIII. századi Itáliában* [Science and Popular Science in the Eighteenth century Italy], L'Harmattan, Budapest, 2018., pp. 79-86.

[18]The *Essay on Fevers, On the Cultivation of Madder, Thoughts on the Culture of Silk, Mathematical Observations*were the first texts which provided major reformulation of semi-scientific literature, and turned the attention of the public to scientific matters.

In these texts which cover a wide range of materials writers experimented with several techniques to turn difficult scientific contents into plain, clear language. The simple and artless words in all cases offered a practical and appealing image of a scientific problem or idea.:

"Haller, Whytt and others, have demonstrated that the Nervo-muscular parts of all animals are less or more irritable - that this irritability is increased or diminished by many circumstances that it is naturally greater in young subjects than old, in females than males; and that it is vastly augmented by inflammation. Acrid substances are universally known to affect irritable parts; nor has glassy phlegm and accumulated mucus, been unnoticed in the disturbance they have given to the first passages. Galen had nearlydied from a collection of this sort in the large intestines. All humors wherein salt, water and oil have a share, being retained in a warm place, tend to a rancid or acrid state."[19]

The journalist's attention to new modes of writing is performed by an innovative approach that science exists exclusively as a form of evidence. The loose structure of the text accomodates anything from technical terms (cfr. „nervo-muscular part"; „substance"; „phlegm" ecc.) to everyday expressions („glassy"; „mucus" ecc.). The author begins his discussion with the characteristics of fever, extensively documented through citations from the history of medicine. It follows that on the surface, the paper might seem a medical discourse. However the column addresses the scientific terms more generally, as the first sentence announces. The hard and unclear expressions which are difficult to comprehend turn out to be usual, ordinary words, used in the everyday communication. Proceeding in the text scientific expressions are gradually abandoned and are substituted instead by a form of dialogue between journalist and reader. Stylistically the text replaces the scientific approach with organized expositions of the subject, more in the form of novels, while methodically operates through analysis and examines objects by keeping in mind the terms of simplicity, clarity and precision. Indeed, it is clear that the columnist is not writing a scientific report, but a reflective-informative treatise, inaugurating a special branch of the literature of popular science. This method thus brought philosophy and science at tea-tables offering bright description of scientific progress in different fields.[20]

3. Conclusion

One of the most outstanding result of the eighteenth century was the discovery of natural sciences and, as a consequence, the formation of the literature of popular science. Although in the period of the American Enlightenment science didn't attract too much attention, there had been formed a new group of writers who even without any scientific training were provided the main locus for a different, very advanced discussion of science. Related tothe everyday life but showing great interest in scientific problems they could comment perceptively on scientific issues, making visible new ways in the literature.

The technical term of the literature of popular science is controversial from the beginning because it has been largely ignored in the literary history. Even today there is a great number of historians of science who seem very critical the existence of this branch of literature.[21]Despite their strict arguing, the evidence of writings which allow a straighter and more direct communication with the expanding middle classes begun to suggest that the term describes semi-scientific works which involve elements of science in an informal way: original style and forms in the structure of the language are constant and immutable elements of this kind of written prose which has created a fashion for science.

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[19] in «The American Royal Magazine», 1774., No. 4., p. 129.
[20]In the eighteenthcentury Europe the rising middle class felt desperate necessity for a place where besides a hot beverage could also exchange news or got to know about the latest cultural events and literary publications. This place had been found in the fast-breaking coffeehouses. Since their first appearance coffee houses have been serving as a center of cultural interaction dominating the taste of the rising middle class. However in Europe these centers set down social and cultural values shaping the public opinion,in the America of this age, due theirscarce presence, those were the first periodicals to undertake similar duties. cfr. Cowan, Brian, op. cit.
[21]cfr. for example Bernard Cohen, John Gribbin, Edward Grant

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