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## **The Royal Academy of Sciences of Paris and the birth of historical epistemology.**

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### **Introduction : organize institutions, share knowledge.**

The history of the creation and reformation of the Royal Academy of Sciences of Paris is part of a complex set of political, scientific, economic and cultural issues that have been the subject of important studies. In 1666, Colbert, minister of Louis XIV, proposed the creation of a general Academy, became after the Academy of Sciences, in the tradition opened by various scholarly circles of the first half of the seventeenth century<sup>1</sup>. But the changes introduced by the ministry of Louvois, which considerably weaken the institution, lead his successor, Pontchartrain, to take over the Academy, which he entrusts to his nephew, abbot Jean-Paul Bignon, already a member of the French Academy since 1693<sup>2</sup>. Pontchartrain is also appointing new members, as the pace of recruitments had been considerably slowed down by Louvois. Among the new recruits, the botanist Joseph Pitton de Tournefort, the chemist Guillaume Homberg and the astronomer Giacomo Maraldi, scholars recognized and supported by members of the Academy, but also relatives of Pontchartrain and Bignon. The Marquis de l'Hôpital enters the institution in 1693, and Bernard Le Bovier de Fontenelle in 1697.

The institution is finally deeply reformed in 1699 and acquires the status of Royal Academy. The new regulation defines the different categories that will organize the work of the members of the Academy, now divided into four large families : the honorary members, the boarders, the associates and the students academicians. The rules also stipulates the official functions of the director and especially the perpetual secretary, who is responsible for keeping the records of the institution and for giving the public an annual report on the activities of the society, which will be published in at the same time that a selection of memoirs of academicians, in other words, the publications that we know today under the title

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<sup>1</sup> The Academy of Montmor, but not exclusively, as showed Simone Mazauric, which also mentions the cabinet of the brothers Dupuy, the conferences of the 'Bureau des adresses', organized by Théophraste Renaudot, the academy of Mersenne, that of Bourdelot, Jacques Rohault's lectures, among others. Cf. *Fontenelle et l'invention de l'histoire des sciences à l'aube des Lumières*, Paris, Fayard, 2007, p. 23-26. See also S. Mazauric « Aux origines du mouvement académique en France : proto-histoire des académies et genèse de la sociabilité savante (1617-1666) », in *Académies et sociétés savantes en Europe (1650-1800)*, Daniel Odon-Hurel et Gérard Laudin eds, Paris, Champion, 2001, p. 35-47.

<sup>2</sup> René Taton, *Les Origines de l'Académie des Sciences*, Paris, Palais de la Découverte, 1966 ; Roger Hahn, *L'Anatomie d'une institution scientifique. L'Académie des sciences de Paris, 1666-1803*, Paris, éd. des Archives contemporaines, 1993. Éric Brian and Christiane Demeulenaere-Doutère, eds., *Histoire et mémoire de l'Académie des sciences. Guide de recherche*, Londres — Paris — New York, Lavoisier, coll. Tec & Doc, 1996, 449 p.

of *Histoire et Mémoires de l'Académie Royale des Sciences*<sup>3</sup>, whose first volume appears in 1702 and which will continue to be published almost continuously throughout the eighteenth century.

The birth of the Academy of Sciences is therefore a strong political gesture (the assertion of royal power engaged in the production of new knowledge), but also a fundamentally modern act : following the Baconian ideal, which will dominate research for a large part of the eighteenth century, it aims to promote the progress of scientific knowledge, decides to edit an own journal that not only confirms the break with the culture of academic secrecy initiated by the *Journal des Sçavans*<sup>4</sup>, but which in addition escapes the circuit of the royal censorship, since it is the Academy which decides what it publishes<sup>5</sup>. Finally, the Academy adopts French as the only language of publication, breaking definitively with the erudite and elitist tradition of Latin.

The choice of the perpetual secretary is not trivial either. As David J. Sturdy remarks, it is difficult to know if Fontenelle was the scientist who best corresponded to Bignon's idea of being secretary of the Academy, with a view to reformation of the institution, or if the functions envisaged by the rules had been modeled on the personality of Fontenelle, whose numerous qualities appeared as providential for a modernization of the society. Actually, Fontenelle was at the same time a man of science, who mastered modern mathematics, author in 1727 of the *Éléments de la géométrie de l'infini*<sup>6</sup>, a work which imposes, as Michel Blay has shown, the notion of infinite as an epistemological presupposition indispensable to the new scientific thought<sup>7</sup>. He also knew how to be the wise interpreter of the different knowledge in construction, able of transmitting this knowledge according to the aesthetic and intellectual codes of the most demanding readers, as he had proved in his *Entretiens sur la pluralité des mondes*, whose success had gone well beyond the European francophone elites<sup>8</sup>.

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<sup>3</sup> The exact title is *Histoire de l'Académie royale des sciences, année [...] avec les Mémoires de Mathématique et de Physique pour la même année, tirés des registres de cette Académie*. We will refer to the different volumes of the collection through the acronym *HARS*, followed by the year. We will particularly mention any reference to Memoirs by the conventional *MARS* abbreviation, followed by the year.

<sup>4</sup> Founded by Denis de Sallo, under the protection of Colbert, the periodical was intended to make known the latest discoveries in science and the arts. Completely in French, it also responds to the desire to break with the tradition of secrecy that weighed on the work of scientists of the time. The first issue is published in January 1665 and will be very quickly followed by the publication of the first issue of *Philosophical transactions of the Royal Society* (March 1665).

<sup>5</sup> This is provided for in a letter of privilege from April 6, 1699. See Anne-Sylvie Guénoun, « Les publications de l'Académie des Sciences : le dix-huitième siècle », in Eric Brian and Christiane Demeulenaere-Doutère, ed., *Histoire et Mémoires de l'Académie des sciences, op. cit.*, p. 113.

<sup>6</sup> Fontenelle, *Éléments de la géométrie de l'infini*, Paris, Imprimerie Royale, 1727.

<sup>7</sup> Michel Blay, *La Naissance de la mécanique analytique. La Science du mouvement au tournant des XVII<sup>e</sup> et XVIII<sup>e</sup> siècles*. Paris, PUF, 1992, and *Les Raisons de l'infini. Du monde clos à l'univers infini*. Paris, Gallimard, 1993. Cf. *Éléments de la géométrie de l'Infini*, Michel Blay and Alain Niderst eds, Paris, Klincksieck, 1995.

<sup>8</sup> Fontenelle, *Entretiens sur la pluralité des mondes*, Paris, Veuve C. Blageart, 1686. The book is translated into English in 1687 by John Glanville, *A Discovery of New Worlds*, London, Bentley and Magnes, 1687.

But Fontenelle was also a true historian, able not only to record the progressive construction of the royal institution, but above all to draw from it the elements of a progression of the ‘esprit humain’ in a fundamentally modern dynamic<sup>9</sup>, as he had done it in the *Histoire des Oracles*<sup>10</sup> or in the *Digression sur les Anciens et les Modernes*<sup>11</sup>.

The Article XL of the regulation by which Louis XIV reforms the Company in 1699 imposed on the perpetual secretary the drafting of a « reasoned history » of the annual activities of the Academy, which constitutes the driving force for the publication of the volumes of *Histoire et Mémoires de l'Académie royale des sciences*. In addition, a letter of privilege grants the institution the right to print « the Daily Observations, and the annual relations of what has been done in the assemblies of the Academy and generally all that it wishes to make appear in his name, as well as the other works, Memoirs, Treaties or Books of the individuals who compose it [...] »<sup>12</sup>. The Academy thus had a great freedom of action, since it became its own editor, which enabled it to meet the dual requirement of communication with a specialized public (the *Mémoires*) and with other readers (the *Histoire*), without fear of censorship and without an external support, as it could have done with the *Journal des savants*.

This task is all the more complex because the perpetual secretary did not really have a generic model on which to build his own work. Some books of a historical nature were published during the first period of the Academy of Sciences, but they were essentially limited to a particular discipline, sometimes intersecting with research carried out within the Academy, but without systematically giving the complete history of the discoveries of the field of knowledge addressed<sup>13</sup>. For instance, Jean-Baptiste Du Hamel had published in 1698 the first volume of the *Regiae scientiarum Academiae historia*<sup>14</sup>, followed by a second volume,

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<sup>9</sup> About the commitment of Fontenelle Secretary of the Academy of Sciences in the Quarrel of the Ancients and the Moderns, voir Simone Mazauric, *Fontenelle et l'invention de l'histoire des sciences*, op. cit., p. 177-224.

<sup>10</sup> Fontenelle, *Histoire des Oracles*, Paris, G. de Luyne, 1686.

<sup>11</sup> Fontenelle, *Digression sur les Anciens et les Modernes*, Paris, 1687.

<sup>12</sup> Letter of April 6, 1699 quoted by Anne-Sylvie Guénoun, « Les publications de l'Académie des sciences : le XVIII<sup>e</sup> siècle », in Éric Brian et Christiane Demeulenaere-Doutère, dir., *Histoire et mémoire de l'Académie des sciences*, op. cit., p. 113.

<sup>13</sup> E.g. *Mémoires pour servir à l'histoire naturelle des animaux* by Claude Perrault, or *Mémoires pour servir à l'histoire des plantes*, by Dodart, published by the royal printing office in 1676. But most often the publications emanating from the first academy correspond to particular observations, or consist of a collection of some memoirs relating to a particular field, such as the *Divers ouvrages de mathématique et de physique. Par Messieurs de l'Académie des sciences* [Roberval, Frénicle, Huygens and Picard], Paris, Imprimerie royale, 1693. See Anne-Sylvie Guénoun, « Les publications de l'Académie des sciences : avant la réforme de 1699 », in Éric Brian et Christiane Demeulenaere-Doutère, eds., *Histoire et mémoire de l'Académie des sciences*, op. cit., p. 107-112.

<sup>14</sup> *Regiae scientiarum Academiae historia, in qua praeter ipsius Academiae originem et progressus, variasque dissertationes & observationes per triginta annos factas, quam plurima experimenta & inventa, cum Physica, tum Mathematica in certum ordinem digeruntur. Secundo editio priori longe auctior. Autore Joanne-Baptista Du Hammel, ejusdem Academiae Socio & Exsecretario*, Paris, E. Michallet, 1698.

published in 1701<sup>15</sup>. The book has the merit of telling the origins of the first Academy and outline the main activities of the company between 1666 and its reformation. But besides the fact that it is an extremely synthetic retrospective work (Du Hamel summarizes in the first volume a year of academic work in just a few pages), the generic model of the former secretary probably not served as a model in Fontenelle, it is rather the opposite that had to happen<sup>16</sup>.

Thus, for Fontenelle, the setting up of this publication, which he wrote between 1699 and 1740, constitutes the founding gesture of a new form-meaning [**forme-sens**] that allows its inventor to write a modern history of sciences, by organizing knowledge according to a personal epistemological logic and proposing to its reader a new way to understand the phenomena and use his reason.

### **I. Organizing new knowledge :**

Each of the volumes of the *Histoire de l'Académie royale des sciences* is composed of two main parts, connected in a single volume, but recognizable by their distinct pagination. The first part is that designated by the title of « History » ; the second is that of the « Memoirs », where are gathered the works presented by the members of the institution or sent by the foreign correspondents and approved by the Academy. Their publication is placed under the responsibility of the perpetual secretary, whose name is never mentioned, and is, according to Fontenelle's own admission, a form of appendix to the historical part which opens the volumes<sup>17</sup>.

Placed in the first part of the volume, the « History » of the Academy of Sciences thus constitutes a kind of overall presentation of the activities of scientists during a calendar year, offering the reader a general overview of the main discoveries made during this period and proposing a reading of the memoirs themselves. Thus conceived, the book is addressed to two audiences : those « who have only a mediocre tint of Mathematics and Physics »<sup>18</sup>, and the

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<sup>15</sup> *Regiae scientiarum Academiae historia, in qua praeter ipsius Academiae originem et progressus, variasque dissertationes & observationes per triginta annos factas, quam plurima experimenta & inventa, cum Physica, tum Mathematica in certum ordinem digeruntur. Secundo editio priori longe auctior. Autore Joanne-Baptista Du Hammel, ejusdem Academiae Socio*, Paris, J.-B. Delepine, 1701. It is actually a second augmented edition, which covers the years 1699 and 1700.

<sup>16</sup> This is what the « Avertissement » of the *Histoire de l'académie royale des sciences depuis son établissement en 1666 jusqu'en 1686* says: « The Latin History of the years 1699 and 1700 that Mr. Du Hamel added in the last edition of his work, was made from the volumes of History for the same years, written in French by M. de Fontenelle [ ... ] ». *HARS depuis son établissement en 1666 jusqu'en 1686*, t. I, Paris, Martin-Coignard, 1733, « Avertissement ». This preliminary text is written by Louis Godin, assistant astronomer.

<sup>17</sup> « These Memoirs are about what are in an ordinary history the original Acts or Evidence sometimes printed at the end », *HARS 1699*, « Préface », p. ii.

<sup>18</sup> *Ibid.*

« deep scientists » [**savants profonds**]<sup>19</sup>. The first will be able to begin with the general presentation, even if they may complete their reading by the corresponding memory, when there is one<sup>20</sup>, the others being able to pass directly to the reading of the works of the scientists. The book thus invites us to go from the simplest to the most complex, but supposes not only some curiosity for the sciences, but also a minimum of knowledge in the matter, because, says Fontenelle, « for those who absolutely have none - he speaks of scientific knowledge - they would do better to take things a little higher, and it would have taken too much speech to go back to the first elements of science »<sup>21</sup>.

The historical section is, moreover, systematically divided into chapters corresponding to the scientific disciplines recognized by the Academy, organized into two large sections, Physics and Mathematics. Most of them are fixed chapters corresponding to the disciplinary fields addressed by the academicians : for physics, general physics, anatomy (human and animal), chemistry, botany ; for Mathematics, Algebra, Geometry, Astronomy, Optics, Acoustics and Mechanics<sup>22</sup>. Roger Hahn sees in this division between mathematics and physics the sources that had formed these disciplines in the seventeenth century, one from the *quadrivium*, the other, a legacy of the Baconian approach to nature based on observation and experience<sup>23</sup>. It may be added that the distribution of these chapters takes the reader from the empirical sciences (Physics) to the speculative sciences (Mathematics) through a growing form of intellectual abstraction which establishes a sort of hierarchy between disciplines, starting with by the most questionable subjects to finish with those which rest more on pure reason, or, as Fontenelle himself says : « we will begin with physics, because it is easier and less abstract »<sup>24</sup>. This classification corresponds as well to the overall organization of the volume and its dual destination (from the simplest to the most difficult), as to a hierarchy of knowledge on which Fontenelle bases a true theory of knowledge.

Actually, the historical part contains much more than just the summary of scholarly memories and the record of academic sessions. Fontenelle comments, discusses, rewrites the theories expounded in the memoirs, introduces reflections on the conditions of production of knowledge, and echoes, quite clearly, his personal work. Thus, the scientific discourse which

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<sup>19</sup> *Ibid.*, p. iii.

<sup>20</sup> Indeed, some articles of the *HARS* do not necessarily refer to a published memoir.

<sup>21</sup> *HARS* 1699, « Préface », p. ii.

<sup>22</sup> Depending on the year, chapters on acoustics, optics, and mechanics may be missing from the *HARS*, just as there may be new chapters, such as catoptric, dioptric, and even geography (about the geographical measurements of the Ancients). The chapters in the « physics » section do not vary much.

<sup>23</sup> Roger Hahn, *L'Anatomie d'une institution scientifique. L'Académie des sciences de Paris, 1666-1803*, Paris, Éd. des Archives contemporaines, 1993, p. 77.

<sup>24</sup> *HARS depuis son établissement jusqu'en 1686*, t. I, p. 17.

concerns the sciences of the nature, is based on a double epistemological requirement : the observation and the experience, each of these stages corresponding to a degree of certainty of the scientific knowledge. In the first place, the meticulous and repeated observation of natural phenomena makes it possible to inscribe the discourse on nature in the register of the probable, conceived as a degree of truth that we can bring closer to the idea of probability. On many occasions Fontenelle insists on the necessity of repeating observations before drawing any general law. This is the case when he comments a memoir about the influence of the heart's fibers on the circulation of blood : « It is easy to judge how many observations would be needed to verify that thought. It is enough to propose it now, and to make glimpse some glimmer of verisimilitude »<sup>25</sup>. It is then that the experience takes place, conceived, not as a single phenomenon, but precisely as a perspective, or as a search for analogical relations between the various experiments and observations, explains Fontenelle. Only experience can definitely inscribe the discourse of nature in the register of truth, even if this process suggests a temporality sometimes very extensive. This is what he says, when he comments on a memoir about a « petrified oxen brain » : « Only experience can be allowed to attack a system as old, as natural, as necessary as he who establishes the brain for the principle of all animal movements », says Fontenelle at the opening of his commentary. And he concludes : « We propose here only conjectures that need to be confirmed by experience [...] It will only be by a large number of singular accidents of the brain, compared to others, that one will discover precisely the uses of this part, their extent and their limits, if however one goes never so far »<sup>26</sup>.

Mathematics presupposes, on the contrary, abstraction, the elevation of the mind and the use of speculative faculties, which are essentially based on hypothesis and logical verification, which places the mathematical discourse in a degree of veracity that is substantially different from that of science based on observation and experimentation. In other words, « in geometry every possibility is a fact, but it is not the same in physics<sup>27</sup> ». The reason for this difference lies in the very nature of the object studied, because « geometry is subject to nothing in its hypotheses, only to a pure and simple possibility which is infinite and infinitely infinite in comparison with what exists, and that is the object of physics<sup>28</sup> ». This does not mean that any mathematical system can be approved, « one realizes all too often in mathematics, that what is not demonstrated with rigor, is not proven at all, and that there is no certainty if it is not

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<sup>25</sup> *HARS* 1703, p. 14.

<sup>26</sup> « Sur un cerveau pétrifié », *Ibid.*, p. 26 et 27.

<sup>27</sup> « Sur le changement des acides en alkali », *HARS* 1717, p. 36.

<sup>28</sup> « Sur les rapports de densité de l'air », *HARS* 1716, p. 42.

complete »<sup>29</sup>, said Fontenelle. But the scientist has, in mathematics, an intellectual freedom that one could in certain points compare to the demiurgic dimension of artistic creation.

Thus, the object of scientific study and the methods of analysis that it implies subordinate the status of the resulting scientific discourse. The same goes for the organization of this knowledge, in other words, the chapter, when it comes to reporting to the public, as is the case in the *Histoire de l'Académie royale des sciences*.

Each chapter presents a complex and often heterogeneous structure : a variable number of articles, more or less short, exposing, without a clearly defined order, brief information, reviews of recently published works, scientific curiosities communicated by correspondents of the Academy in the provinces or abroad, reports of works presented to the members of the institution (published or not in the same volume), reports of the working sessions of the academicians around topics of current events scientist. Some of the texts mentioned in the volumes are not published, and, similarly, some of the memoirs that appear well in the second part of the volume, are not the subject of a comment from Fontenelle. So, if the division into chapters according to the two main categories of Physics is Mathematics imposes a form of order on the whole, the organization of the chapters themselves does not seem to respond to any predefined chronological plan nor thematic.

The difference between the « Mathematics » and « Physics » sections is not quantitative, it is mainly of a qualitative nature. Indeed, the « Physics » section contains a heading that is completely absent from the « Mathematics » section. While the latter is composed exclusively of reports of memoirs published in the volumes of the *Histoire de l'Académie royale des sciences*, problems discussed in session or books on topics of interest to the Academy, the various chapters that form the section « Physics » include a special section, called « Observations » : « Observations of general physics », « anatomical observations », « observations of chemistry », etc. Are gathered under this denomination often very pleasant presentations, noting brief information, of scientific curiosities communicated by the correspondents of the Academy in the province or abroad, accounting for exchanges of information between the academicians and their correspondents, summarizing works presented to the members of the institution (observations or experiments done in meetings), or commenting, in the informal tone of the conversation, the discussions of the academicians on topics of scientific news<sup>30</sup>. The observations also include examples of scientific anecdotes,

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<sup>29</sup> « Sur la construction des égalités », *HARS* 1708, p. 71.

<sup>30</sup> See for example a series of observations about the ability of some animals to survive without food, which reproduce a conversation in which intervene successively Jean Gallois, Jean-Baptiste Du Hamel and Maraldi. *HARS* 1706, « Diverses observations de physique », II et III, p. 5 et 6.



which are often accompanied by general considerations about the importance of observation, on the difficulties associated with knowledge of nature among other themes. The « observations » therefore appear as the part where Fontenelle is the most free to choose the subjects exposed, and the discursive modalities according to which these same subjects will be approached. The fact that Fontenelle favors the informal treatment of academic facts in « observations », or that he decides to summarize and comment on one or more memoirs in a report, therefore responds to strategic choices that should be studied as a structure, making sense in all volumes.

Among the other structural choices, the first and most obvious is the possibility of not reporting on the work of academicians, and leaving room for important work done outside the Academy. At first sight, Fontenelle respects what the preface of 1699 indicated :

When [...] a matter contained in the Memoirs was in itself so intelligible that it could not have been more so in history, we have spared the useless trouble of repeating it<sup>31</sup>.

According to this principle, many memoirs deserve only summary references. Like this « big collection of Mr. Mery's observations on hernias »:

It is given to the public, because it has been thought very useful for the practice ; but we do not make an excerpt from it in this history, because matter is of itself sufficiently intelligible, and because it would not be to the taste of those who seek only the brilliancy of theory, and systems.

For the same reasons, nothing is said here about observations on several dropsies, made by M. du Verney [**Du Verney le jeune**]<sup>32</sup>.

Most often, the references are even more succinct : « We refer entirely to the Memoirs, two writings of M. Winslow on the circulation of the blood in the fetus and the extract of various Memoirs of M. Sarrazin on the muskrat<sup>33</sup> ». A note, in margin, indicates each time the page of the Memoirs to which the editor returns. In the end, we see that the percentage of memoirs published by the Academy and subject to a true report is lower than expected. Fontenelle says himself, that these texts « do not contain anything difficult to understand, nor that gives new views for Systems », or that the subject does not seem worthy of mention as a major event in the history of the Academy, or in the history of discoveries of the human mind.

These purely formal observations show that, even if the Academy of Sciences as a institution decides on the publication of a dissertation, its perpetual secretary may well be

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<sup>31</sup> HARS 1699, « Préface », p. iii.

<sup>32</sup> HARS 1701, p. 56. The reference to the page of the Memoirs where these two works are always appears in the margin.

<sup>33</sup> HARS 1725, p. 28.

careful not to give an account of it in the historical part, thus ignoring one of his confreres' work. It is true that the « Preface » of 1699 had announced that,

When a matter could not be turned in another way, and treated less thoroughly than it was in the Memoirs, which sometimes happens in fact [...] of demonstrations of geometry and algebra. it has been reduced to silence, unless there has been a point in history that some progress has been made in this regard<sup>34</sup>.

But it is not precisely the clarity of the demonstration that explains the silence of Fontenelle with regard to certain works of his confreres ... This is the case of a memoir of Pierre Rolle<sup>35</sup> published in 1703<sup>36</sup>, and for which there is no extract or even mention in this year's *Histoire de l'Académie royale des sciences*. It is rather his engagement with Jean Gallois in the fight against the « infinitarians » **[infinitaires]** whom Rolle accuses in his memoir of obscuring geometry by errors unworthy of this noble discipline. He will not comment further on the other memoirs of Rolle or Gallois, to which he refers in a very summary way. It thus appears that Rolle's memoir against the geometry of the infinites clearly does not seem to him to « mark historically that any progress had been made » in Geometry ; it was therefore not necessary to « announce this news to those who are [...] happy to learn that the sciences or the arts are advancing »<sup>37</sup>. This dissertation is a work of the Academy, but it is not part of its history, let alone of the history of the mathematics. And to avoid any confusion, Fontenelle makes the precision in the volume of 1704, not by an article of his History, but by an « Avertissement », placed at the head of the volume and in a different typography (and therefore materially to the exterior of History), which explains the reasons for its silence by elliptical and impersonal formulations that do not hide the personal commitment of the secretary of the Academy :

*In the Memoirs of 1703, page 312, a writing by M. Rolle, entitled, New System of the Infinite, has been printed. The Reflections that various persons have made on this writing, on the principles advanced therein, and on the consequences that might be drawn from it, oblige us to state that, although it is among the other works intended for printing by the Academy, his intention has never been to adopt anything that can be found there<sup>38</sup>.*

The absence of comment remains exceptional. Certainly, Fontenelle fails to make some reports, but it is about some writings that we could described as minor work. On the whole, he

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<sup>34</sup> HARS 1699, « Préface », p. iii.

<sup>35</sup> Pierre Rolle (1652-1719), is a student academician in astronomy in 1685, then a boarder in geometry in 1699, the first holder appointed by Louis XIV. He becomes a veteran boarder a few months before his death.

<sup>36</sup> « Du nouveau système de l'infini. Par M. Rolle », MARS 1703, p. 312-344.

<sup>37</sup> HARS 1699, « Préface », p. iii.

<sup>38</sup> HARS 1704, « Avertissement ». Italics in the original.

fulfills his obligations to the institution, reporting on memoirs or works he cannot ignore. But the official character of the *Histoire de l'Académie royale des sciences* does not prohibit Fontenelle from having his opinion heard on certain delicate subjects, just like the fragmented nature of the composition of the volumes, subordinated in large part to the presence of the memoirs in the second part, does not prohibit certain construction strategies. Even if he cannot give a personal opinion, the secretary of the Academy uses the flexible structures that are the academic reports to propose his vision of the history of construction knowledge.

## II. Organization of knowledge and epistemological history.

Fontenelle gives only a few lines to a news unreliable, while he examines other information, including some memoirs, in very long commentaries. Thus, from a letter received from Cadiz in 1703, mentioning a strange phenomenon on the sea : « one would have seen for fifteen nights in a row all the brilliant sea of a clear light, almost like a liquid phosphorus ». The rumor even claimed that « the water of the sea carried in bottles, made the same light in the darkness, that some drops poured on the ground shone like sparks of fire »<sup>39</sup>. The conclusion of Fontenelle is brief and clear : everything is false. « The Academy believes to do as much in disabusing the public of the false marvels, as in announcing the true ones »<sup>40</sup>. If such information deserves only a small paragraph in the « observations », a memoir of Varignon on the « formation of spirals » inspires him a long report, in which Fontenelle praises « the great advantage of Modern geometers on the Ancients »<sup>41</sup>.

We also note that some topics come back regularly, not only from year to year but within the same volume, several reports or articles can address the same theme. This practice makes it possible to reconstruct real series within the chapters and in the duration of the volumes, and to follow the discussions around a particularly important or controversial issue for a given period. In such cases, Fontenelle is accustomed to mention in the opening of his account the state of the question in the preceding volumes, and to refer, in a footnote<sup>42</sup>, to the different articles of History or to the memoirs having already analyzed the question. Thus, one can follow the different opinions concerning the circulation of the blood in the fetus<sup>43</sup>, the

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<sup>39</sup> *HARS* 1703, « Diverses observations de physique générale », X, p. 22.

<sup>40</sup> *Ibid.*

<sup>41</sup> « Sur les spirales à l'infini », *HARS* 1704, p. 47-57, specially p. 53. Also « Nouvelle formation de spirales », *MARS* 1704, p. 69-131.

<sup>42</sup> Both in opening and in the body of the article.

<sup>43</sup> « Sur la circulation du sang dans le fœtus », *HARS* 1739, p. 4-14. Fontenelle reviews the memoirs published on the subject since the reformation of the Academy, in 1699, 1701, 1703, 1717, 1725 and finally in 1738.

nature of the fossil shells and the origin of the mountains<sup>44</sup>, or the discussions around the origin of the monsters<sup>45</sup>, to retain only a few examples of thematic series on « physics ».

We know the importance that Fontenelle attaches to the history of the various scientific disciplines in that they allow to better perceive the evolutions of the human spirit, as he affirms in the *Éloge* of Montmort :

He had been working for a while on a *Histoire de la Géométrie*. Every Science, every Art should have its own. It is very agreeable, and this pleasure contains a great deal of instruction, to see the road which the human mind has held, and to speak geometrically, that kind of progression, the intervals of which are at first extremely great, and then are naturally tightening more and more<sup>46</sup>.

The *Histoire de l'Académie royale des sciences* gives the author the opportunity to contribute to this work as shown by the existence of these thematic series. Certainly, it is at most only chapters within the history of a given discipline, and not a history of every discipline. But Fontenelle is aware of the limits that are hers, and does not pretend to propose a historical synthesis on physics, anatomy, or mathematics. The *Préface sur l'utilité des mathématiques* was already perfectly clear in this sense :

Until now the Academy of Sciences takes Nature only by small parcels. No general system, for fear of falling into the inconvenience of precipitous systems, of which the impatience of the human spirit is too well suited [...]<sup>47</sup>

This famous statement of Fontenelle has always been interpreted as an epistemological principle governing the elaboration of a general knowledge of nature, and that can not be called into question. Now, the elaboration of this general knowledge is inseparable from the production of a historical discourse on nature, of which the *Histoire de l'Académie royale des sciences* is, in the end, one of the first examples. The rejection of a general system of nature does not forbid the collection of the scattered elements which necessarily constitute this knowledge and which will make it possible, step after step, to constitute the memory of the discoveries of which the human mind is capable, and with which we will one day be able to write the history of the different scientific disciplines :

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<sup>44</sup> « Diverses observations de physique générale », *HARS* 1703, XI, p. 22-24 ; « Diverses observations de physique générale », *HARS* 1706, X, p. 9-11 ; « Sur l'origine des montagnes », *HARS* 1708, p. 30-33, « Sur le cristal », *HARS* 1708, p. 33-34, and p. 34-35 ; « Sur l'origine des pierres », *HARS* 1716, p. 8-16 ; « Sur des empreintes de plantes dans des pierres », *HARS* 1718, p. 3-6 ; « Sur des coquilles fossiles de Touraine », *HARS* 1720, p. 5-9.

<sup>45</sup> Fontenelle refers to the numerous memoirs and reports published on the subject in the article « Sur les monstres », *HARS* 1740, p. 37-50.

<sup>46</sup> *Éloge de Montmort* *HARS* 1719, p. 92.

<sup>47</sup> *HARS* 1699, p. xix.

The time may come that we will join in a regular body these scattered limbs; and if they are as we desire it, they will assemble in a way of themselves. Several separate truths, as soon as they are in sufficient number, offer so strongly to our mind their relations and their mutual dependence, that it seems that after having been detached by a kind of violence from one another, they naturally seek to assemble<sup>48</sup>.

Fontenelle manifests the same conviction in the volumes of the *Histoire de l'Académie royale des sciences*, and takes the measure of his work, as a historian of scientific everyday life. Each account, each disciplinary chapter can be seen as one of those « separate truths » which, though interesting in themselves, do not build a sure knowledge. But, on the other hand, a sufficiently long series of articles may offer to the mind another form of knowledge, based on constants, on relations between isolated facts, in other words, based on laws.

When placed in the context of serial writing, this principle makes it possible to explain Fontenelle's historical practice in a different way and to see the processing of accounts as something other than the construction of the memory of the institution. The paratexts (notes and marginalia) that characterizes the different articles of the *Histoire de l'Académie royale des sciences* written by Fontenelle weave the relations between the different « separated truths », until these truths appear in number sufficient to be able to propose a new certain knowledge. It is besides Fontenelle himself who gives us this key to reading the volumes of his History, when, at the end of his term, he proposes some articles of synthesis on the big questions which crossed the series. We can mention the account entitled « Sur les monstres » that Fontenelle proposes in 1740, and which, besides the historical review on the question, analyzes several new memoirs: thus, fontenelle says, « that all together could be more easily seen at a glance »<sup>49</sup>. He proceeds in the same way on the question of the circulation of blood in the fetus, in a synthesis that he publishes in 1739, taking up two memories of Louis Lemery published in the same volume<sup>50</sup>. The opening of the article defines the intellectual project :

This question has occupied the Academy since its reformation in 1699\*. It was continued in 1701\*, in 1703\*, in 1717\*, and finally in 1725\*, and although often and longtime agitated, it remained rather indecisive, not by the obstinacy of a vanquished party which would not yet not surrender, but because the weakest party indeed was not entirely defeated. [...] It would be good to put them back in front of us, as well as all the others that we have just indicated, because we believe we must spare the reader a long and tiring repetition of a hundred things already said, and most of them more once<sup>51</sup>.

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<sup>48</sup> *Ibid.*

<sup>49</sup> *HARS* 1740, p. 35.

<sup>50</sup> « Sur le trou ovale. Premier mémoire », *HARS* 1739, p. 31-50 ; « Sur le trou ovale. Second mémoire », *Ibid.*, p. 97-118.

<sup>51</sup> « Sur la circulation du sang dans le fœtus », *HARS* 1739, p. 4. Asterisks refer, in the margin, to memoirs and accounts dealing with the issue for each of the years mentioned.

The report then extends over a dozen pages, most of which is reserved for the history of the controversy, and, above all, the presentation of the hypotheses defended by the two camps in confrontation : Lemery's theory and Méry's one (and after, Winslow's), punctuated by many references, on the sidelines, to reports published in the various volumes of the *Histoire*. The presentation that Fontenelle makes of the memoir which serves as his point of departure is thus distributed throughout the article, as if it were the most likely answers to the difficulties raised over the years by the defenders of both theories. Then, after showing what is now acquired in the matter, he concludes :

If the light that we have just shed on the question of the circulation of the blood in the fetus could finally close it, this example would help to prove that the protests of the philosophers are not never ending, and that instead of reproaching them with their uncertainties, we should praise them for the wise patience with which they expect the necessary clarity<sup>52</sup>.

Thus, an episode in the great history of human anatomy, offers several lessons to the reader : first, more and more precise knowledge of how maternal blood passes into the body of a child, which is an achievement of Science. But equally important, if not more, a methodological and epistemological teaching : there is no absolute knowledge in itself, especially in physics ; science is built only in time, by « chapters » never completely closed, and requires the patient work of the historian, able to establish a relationship between the « separated truths » which, through their meticulous confrontation, allows to build a truth more and more sure. The *Histoire de l'Académie royale des sciences*, which Fontenelle writes, pretends to participate, through patient discursive work, in the progressive construction of these truths.

The form taken by the *Histoire de l'Académie royale des sciences* perfectly corresponds to the principles on which Fontenelle bases the very possibility of scientific knowledge, particularly as regards physics. The knowledge of nature is based on the possibility to discover relationship between of singular natural phenomena. This work, put into practice in everyday writing, can be appreciated only in time, so that the construction of the scientific discourse is confused with the (literary) writing of the *Histoire* and with this « history of the human mind » which the author wants to produce<sup>53</sup>, and where great discoveries count as much as errors in which even great scholars can fall.

Indeed, the elaboration of the scientific discourse benefits from the chapter practice and the serial treatment adopted by Fontenelle. Admittedly, the serial approach results from a generic

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<sup>52</sup> *Ibid.*, p. 13.

<sup>53</sup> Jean Dagen, *L'Histoire de l'esprit humain dans la pensée française de Fontenelle à Condorcet*, Paris, Klincksieck, 1977.

constraint (the historical model), as well as the scientific policy of the Academy, eager to build the history of its discoveries as a story of its conquests. But the choice in the presentation of the reports, the system of references by which Fontenelle weaves the threads of this story, confirm the epistemological attitude that characterizes the whole of Fontenelle's work : scientific knowledge is a historical production, built on the denunciation of errors, in search of the principles that ground truth. The discursive nature of knowledge about Nature seems to reflect the influence of Gassendi's thought, for whom the human understanding is essentially discursive, and especially in the field of physics :

Our concepts are not essences : they are human works, as is the human thought that shapes them ; they contain nothing but what experience and reasoning have led us to put into it, that is to say, the more or less definite and more or less rich series of attributes and accidents of the thing which we seek to know; as such, they never represent but one step in the process of knowledge, and their content is a function of the degree that we have reached in an indefinite progress<sup>54</sup>.

To Fontenelle, the discourse on nature does not appear as a self-sufficient structure (capable of grasping and fully interpreting the reality in question, as is the case with mathematics), but as a necessary step in the elaboration of conceptual instruments allowing the interpretation of Nature, the ultimate goal of scientific discourse. The discursive organization of knowledge thus becomes an analytical structure essential to the elaboration of a discourse of authority, and the observation of the nature that the historical narrative elaborates then acts as a tool for the mind in its effort to get knowledge : « Every subject exactly considered becomes infinite, and attention is a sort of microscope, which magnifies and multiplies it always, in proportion as it is more perfect »<sup>55</sup>.

Fontenelle thus operates a reversal of epistemological perspective that distances it from its Cartesian label: in the discourse on the nature proper to scientific knowledge, it is impossible « to dismiss the facts ». As in Gassendi's work, it is not the principles that make possible the construction of knowledge, it is knowledge in construction by discourse that reveals the laws. The epistemological, rhetorical, aesthetic, even stylistic attitude of the *Histoire* make sense : the choice of observation, the use of the principle of analogy as a form of experience of thought, build a discourse that is not univocal, but a metadiscourse<sup>56</sup>.

## **Conclusion:**

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<sup>54</sup> Olivier Bloch, *La Philosophie de Gassendi. Nominalisme, matérialisme et métaphysique*, La Haye, M. Nijhoff, 1971, p. 113-115.

<sup>55</sup> HARS 1706, « Sur la formation de la voix », p. 15.

<sup>56</sup> M.S. Seguin, « Le statut discursif de la Lune entre fictions et mathématiques dans les écrits de l'Académie des Sciences », dans *La Lune au XVII<sup>e</sup> siècle*, sous la direction de Chantal Grell, Turnhout, Brepols, 2014, p. 185-202.

Fontenelle inscribes nature and discourse on nature in a constant dynamic tension, opening widely the perspectives of the progress of knowledge, and makes of this movement the object of an aesthetic but also an intellectual pleasure totally breaking with the Christian vision of the world<sup>57</sup>. As in the *Digression sur les Anciens et les Modernes*, the history of human mind represented by the history of sciences, is never ending.

In other words, in the volumes of the *Histoire de l'Académie royale des sciences*, Fontenelle praises the libido sciendi : pleasure of Nature, whose multiple forms perpetually launch new challenges to the spirit of man ; the philosopher's pleasure, constantly trying to apprehend him, even if he knows that she will always escape him a little. Finally, behind his worldly mask and his official duties, Fontenelle shows a radical freedom of spirit, which makes him one of the most daring libertines of the late seventeenth century and, already, one of the most bold spirits of the Enlightenment<sup>58</sup>.

Fontenelle's work, organizing and interpreting knowledge between the seventeenth and eighteenth centuries constitutes an essential articulation in the diffusion of new ideas and the illustration of a transformation of the strategy of diffusion of philosophical conceptions often not very conform to Christian dogmas. Intended for a wide audience, cultivated but not always erudite, written in a spiritual language, but apparently devoid of the brilliant and polemical effects of some of its contemporaries, the volumes of the *Histoire de l'Académie royale des sciences* written by Fontenelle from 1699 to 1740 contributed undoubtedly more than others works to impose in a subtle and conciliatory way a certain vision of nature and knowledge on French public opinion but also, because of the prestige of the author, the nature and the diffusion of some of his writings, to an audience of European dimension. The perpetual secretary of the French Royal Academy of Sciences is therefore the illustrious ancestor of Enlightenment encyclopaedists.

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<sup>57</sup> M.S. Seguin, « Des idées matérialistes dans le discours officiel sur les sciences : Fontenelle à l'Académie des sciences », in *Matérialisme(s) en France au XVIII<sup>e</sup> siècle. Entre littérature et philosophie*. Adrien Paschoud/ Barbara Selmecci, eds., Berlin, Franck et Timme, 2019, p. 51-79.

<sup>58</sup> M.S. Seguin, « Fontenelle, au tournant des XVII<sup>e</sup> et XVIII<sup>e</sup> siècles », in *Philosophie et libre pensée. Philosophy and Free Thought. XVII<sup>e</sup> et XVIII<sup>e</sup> siècles*. Textes réunis par Lorenzo Bianchi, Nicole Gengoux et Gianni Paganini. Paris, Honoré Champion, 2017, p. 347-361.