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► **To cite this version:**

Laurent Rollet, Philippe Nabonnand. An Answer to the Growth of Mathematical Knowledge? The Répertoire Bibliographique des Sciences Mathématiques. EMS Newsletter, 2003, 47, pp.9-14. <hal-01086766>

**HAL Id: hal-01086766**

**<https://hal.science/hal-01086766v1>**

Submitted on 24 Nov 2014

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# An Answer to the Growth of Mathematical Knowledge? The Répertoire Bibliographique des Sciences Mathématiques

Laurent Rollet & Philippe Nabonnand\*

In March 1885, the *Société Mathématique de France* (SMF) conceived the project of a bibliographical catalogue of 19<sup>th</sup> century mathematical sciences. Facing the constant increase of mathematical journals and the exponential growth of mathematical knowledge, the members of the SMF felt the lack of a bibliographical tool for advanced students and mathematicians. The *Répertoire Bibliographique des Sciences Mathématiques* was to be the answer of the SMF to the expansion of mathematics.

This long-term bibliographical enterprise - which was directed by Henri Poincaré – rapidly became an international endeavour: for almost 27 years, about 50 mathematicians from 16 different countries went through more than 300 mathematical journals. Between 1885 and 1912, more than 20,000 bibliographical references to mathematical works (articles, books, treatises, etc.) were identified, collected, and published, using a methodical and systematic classification.

This repertoire constitutes an important stage for the history of 19<sup>th</sup> century science. The reconstitution of its history represents an interpretative key for the study of the internationalisation of science. Moreover, it may be an essential source for investigations concerning the organisation of disciplinary frontiers within mathematical sciences.

The aim of this article is to set out the first elements of an investigation devoted to the history and the operation of the *Répertoire Bibliographique des Sciences Mathématiques*. First we will describe the scientific and intellectual context of its emergence. Secondly, we will relate the history of its creation. Thirdly, by using a few elements extracted from our computer database, we will try to give a general survey of the contribution of this bibliography to the history of mathematics.

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## *I - 19<sup>th</sup> Century Science: A Growing Concern for Bibliography*

During the second half of 19<sup>th</sup> century, a large number of disruptions affected European science: an unprecedented increase of research and a growing specialisation in every domain; the organisation of institutions in networks; an institutionalisation of research in most European countries via the creation of academies, learned societies and universities; an increase in the number of university students, notably in France after the 1880 and 1890 reforms; finally, the considerable acceleration of the internationalisation of science (for instance the organisation of the first international congresses).

Besides these disruptions, one should add an important phenomenon: the exponential growth of the number of scientific journals. At the end of 19<sup>th</sup> century many scholars perceived the constant increase of printed matter as a serious problem. Two simple figures can give some idea of this situation: in 1890, international statistics of printed matters estimated that 100,000 items a year were published. In 1900, one estimated the annual production at 20,000 books, 76,000 journals and approximately 600,000 articles<sup>1</sup>.

The first scientific journals appeared during 17<sup>th</sup> century. At that time, these journals were usually published by academies and learned societies and they didn't exclusively contain mathematical publications (one could find for instance articles devoted to botanical or zoological issues). The *Journal des savants* (1665) or the *Philosophical Transactions of the Royal Society of London* (1665) constitute two good examples of such publications.

The first issue of Gergonne's *Annales de mathématiques pures et appliquées* was published in 1810 and this journal was probably the first significant mathematical journal exclusively devoted to mathematics. It stopped in 1831 but several journals took over: the *Journal für die reine und angewandte Mathematik* (1826), the *Journal de mathématiques pures et appliqués* (1836) or the *Annali di scienze matematiche e fisiche* (1850). One should add that, during the second half of 19<sup>th</sup> century, the appearance of various learned societies was followed by the creation of several specialised journals<sup>2</sup>.

According to Neuenschwander, only 15 journals contained mathematical articles in 1700; in 1900, probably more than 600 journals published mathematical works<sup>3</sup>. Facing such an

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<sup>1</sup> [Goldstein 2001] and [Rasmussen 1995]. See also [Otlet 1900].

<sup>2</sup> For instance the SMF was created in 1872 and the first issue of its journal, the *Bulletin de la Société Mathématique de France*, was published in 1873.

<sup>3</sup> [Neuenschwander 1994], pp. 1534-1535; see also [Gispert 2000].

increase, many mathematicians were strongly in favour of the constitution of bibliographical catalogues. Thus, bibliography rapidly became a major part of scientific research.

Many bibliographical indexes were elaborated during 19<sup>th</sup> century. The most important national libraries in Europe started to publish their exhaustive catalogues. Moreover, apart from these ambitious projects, many scholars or members of learned societies tried to set up various bibliographic catalogues for specific fields of knowledge<sup>4</sup>: bibliographical catalogues on index cards; monthly, quarterly or annual bibliographical reviews; chronological, alphabetical or methodical bibliographies; bibliographies centred on a particular discipline (such as the mathematical repertoire), covering a larger field (i.e. the *International Catalogue of Scientific Literature*, with sections devoted to mathematics, zoology, etc.), or even universal repertoires (such as Paul Otlet's *Répertoire Bibliographique Universel*)<sup>5</sup>.

The following table gives some indications concerning the most important catalogues for mathematics in the second half of 19<sup>th</sup> century:

Name of the repertoire	Information	Period
<i>Bulletino di bibliografia e di storia delle scienze matematiche e fisiche.</i>	Published by Boncompagni.	1868-1887
<i>Jahrbuch über die Fortschritte der Mathematik, Berlin.</i>	Successively edited by Carl Ohrtmann, Felix Müller, Albert Wangerin, E. Lampe, Leon Lichtenstein, Georg Feigl, etc.; this journal proposed annual bibliographies for mathematics. In 1932 it merged with the <i>Revue semestrielle des publications mathématiques</i> .	1868-1944
<i>Bulletin des sciences mathématiques.</i>	This journal was created by Darboux and Hoüel in 1870 as the <i>Bulletin des sciences mathématiques et astronomique</i> . In 1885, it became the <i>Bulletin des sciences mathématiques</i> .	1870-...
<i>Revue semestrielle des publications mathématiques.</i>	Published by the Amsterdam Mathematical Society (each volume recorded about 3000 bibliographical references).	1893-1934
<i>Catalogue of Scientific Papers.</i>	Published by the London Royal Society. It recorded about 40,000 publications (not exclusively devoted to mathematics).	1867-1925
<i>International Catalogue of Scientific Literature (section A, Mathématiques).</i>	This catalogue was the successor of the <i>Catalogue of Scientific Papers</i> . It collected about 25,000 bibliographical references.	1902-1921
<i>Bibliographie mathématique de Valentin.</i>	This was compiled by Georg Valentin in Berlin. It probably contained more than 150,000 references but was never published.	1885-1910

<sup>4</sup> Nevertheless, one can easily find such bibliographical endeavours before 19<sup>th</sup> century. For instance, in the case of mathematics, at least two bibliographies are significant: J. E. Scheibel's *Einleitung zur mathematischen Bücherkenntnis* published in Breslau from 1769 to 1798; F. W. A. Murhard's *Literatur der mathematischen Wissenschaften* published in Leipzig from 1797 to 1805 (both recording about 10,000 mathematical works).

<sup>5</sup> Concerning Otlet's bibliographical works, see [Rasmussen 1995], [Otlet 1906], [Otlet1908], [Otlet 1918] and [Rayward (Ed.) 1990].

### The most important mathematical bibliographies (1850-1900)<sup>6</sup>

All these bibliographical attempts constitute a sign for a general consensus regarding scientific research around 1900. Many mathematicians agreed that it was almost impossible to be certain that other scholars had not studied their ideas yet. Moreover, they were more and more upset by the time lag between the publication of an article and its registration in a mathematical bibliography (this discrepancy could reach 3 years in the *Jahrbuch über die Fortschritte der Mathematik*<sup>7</sup> or in the *Catalogue of Scientific Papers*). Consequently, many mathematical journals paid great attention to bibliographical issues in the 1880's and the 1890's: what would be the best bibliographical system for mathematical sciences? What kind of classification should be adopted? Who should do the bibliographical work? Should mathematicians adopt an alphabetical classification or should they elaborate, at an international level, a systematic and consensual classification?<sup>8</sup>

### *II - The first years: 1885-1894*

The SMF formulated the idea of a bibliographical repertoire for mathematics in 1885. Very rapidly the society diffused a preliminary project within the international mathematical community. One can find a first mention of the project in a *lettre circulaire* of March 1885 entitled “*Projet de répertoire bibliographique*”. This letter began with an acknowledgment of the incapacity of mathematicians regarding the increase of mathematical publications and went on with a presentation of the different steps of the project: (1) Compilation of bibliographical references on individual index cards, (2) ordering of the cards with the help of a suitable classification and (3) publication. According to Eneström this proposition was warmly welcomed; consequently, a month later, the SMF sent another circular that gave more precise instructions<sup>9</sup>.

Nevertheless, the project was defined and accepted four years later, in 1889. Moreover the first set of hundred printed index cards was not to be published before 1894. Such a time lag finds its main source in the complexity and the sophistication of the classification adopted.

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<sup>6</sup> For further information concerning the bibliographical repertoires devoted to various fields, see [Besterman 1949]. Of course, this table should be complemented by the different editions of Poggendorf's *Biographisch-literarisches Handwörterbuch der exakten Naturwissenschaften* and by the *Répertoire Bibliographique des Sciences Mathématiques*. It would be also essential to mention Houzeau's and Lancaster's bibliographies for astronomy, which had a strong influence on the commission of the mathematical repertoire: cf. [Houzeau 1878], [Houzeau / Lancaster 1882] and [Houzeau / Lancaster 1887].

<sup>7</sup> [Neuenschwander 1994], p. 1836.

<sup>8</sup> It is possible to find some echoes of these discussions in [Eneström 1890].

<sup>9</sup> [Eneström 1890].

The intention of the SMF was to differentiate its project from other bibliographical endeavours by proposing a logical classification of items based on a thematic index. This index probably started to circulate in an informal way in 1887 (the letters of Poincaré, Perott, Mathieu, Schlegel, Brioschi, Eneström or Mittag-Leffler contain numerous discussions about the logical organisation of mathematical domains in the index). A *Projet de classification détaillée pour le Répertoire Bibliographique des Sciences Mathématiques* was published by Gauthier-Villars on June 1888 (67 pages). Finally, the first edition of the index was to be published in 1893<sup>10</sup>.

Taking occasion of the 1889 World Fair, the commission of the repertoire, which was chaired by Henri Poincaré, decided to organise the first *Congrès International de Bibliographie des Sciences Mathématiques*. The purpose of the organisers (Paul Appell, Gaston Darboux, Charles Rouché, Jules Tannery, Georges Humbert) was to gather in Paris all those involved in mathematical research and eager to contribute to the project at an international level.

During this congress - that was supported by the Ministry of Trade, Industry and Colonies - several decisions were taken:

- 1) It was decided that the bibliography would consist in an inventory of the titles of memoirs in pure and applied mathematics published from 1800 until 1889, as well as works concerning the history and the philosophy of mathematics from 1600 to 1889. In concrete words, the purpose was to establish a systematic list of all articles and memoirs published in the most important mathematical journals.
- 2) It was decided that the titles of memoirs would be classified, not by the authors' names, but according to the logical order of subjects.
- 3) The participants of the congress decided to exclude the publications on astronomy that had already been mentioned in the astronomical bibliography compiled by Houzeau and Lancaster in the 1880's.
- 4) The titles of the works written in languages other than French, Italian, German, Spanish or Latin were to be translated into French. Besides, the commission appealed to a generalized adoption of the classification index by mathematicians and mathematical journals.

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<sup>10</sup> Several edition of the index were printed. See [Commission permanente du Répertoire Bibliographique des Sciences Mathématiques 1893], [1898], [1908] and [1916].

Finally it was decided to establish a permanent commission that was based in Paris. Its composition was the following: Poincaré, Désiré André, Georges Humbert, Maurice d'Ocagne, Henry (France), E. Catalan (Belgium), D. Bierens de Haan (Holland), Glaisher (Great Britain), G. Gomes-Teixeira (Portugal), Holst (Norway), Georg Valentin (Germany), E. Weyr (Austria), Guccia (Italy), G. Eneström (Sweden), J. P. Gram (Denmark), Liguine (Russia) and C. Stephanos (Greece).

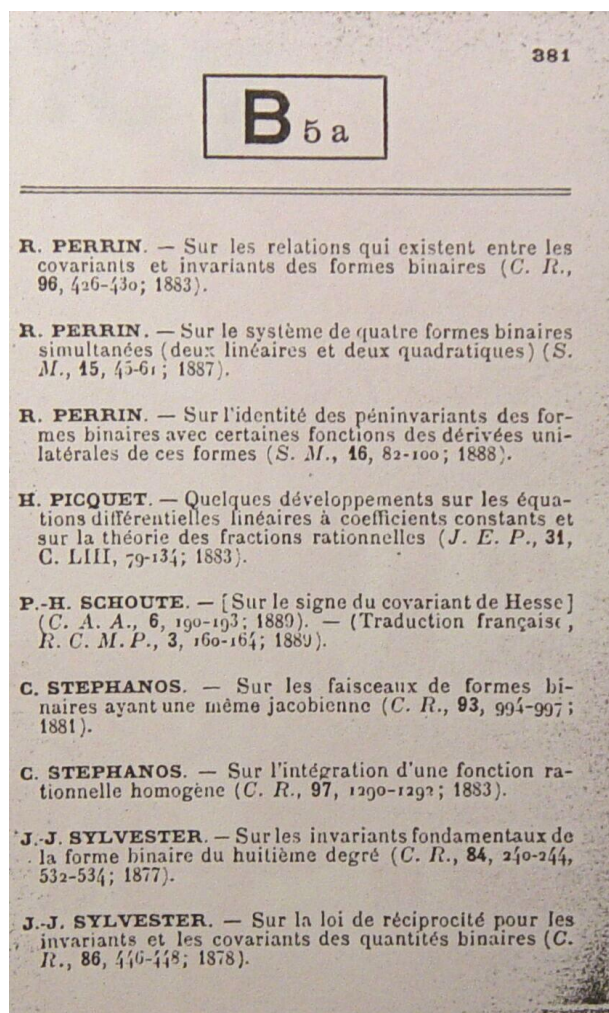
However, despite this strong international participation, one should not think that every country worked at the same level. It is indeed likely that several countries never sent any bibliographical reference to the Paris office: it is for instance the case for Great Britain and United States, partly because they were involved in other bibliographical projects. Moreover, the international dimension of the project was counterbalanced by the fact that the bibliography was created in Paris, directed from Paris, subsidized by French authorities and published in France. It is indeed very difficult to know whether it met with success or was distributed outside of France.

In the beginning, the SMF had planned to publish the bibliography as a book. Such a choice would have implied a very slow publication process since it would have been necessary to wait for the end of the perusal process before printing anything. Consequently Maurice d'Ocagne and Roland Bonaparte proposed to publish the mathematical bibliography as a collection of printed index cards. This option offered the possibility to start the publication as soon as a sufficient number of bibliographical items had been collected. Despite this arrangement, the publication lasted for almost 20 years: the first set of cards was published in 1894 and the last one, the 20<sup>th</sup>, in 1912).

The perusal of mathematical periodicals probably began in 1888 but it acquired its cruising speed after the 1889 congress. The following procedure was adopted for the preparation and the publication of the series: (1) All the memoirs and periodicals of a given country were placed under the responsibility of a member of the permanent commission living and working in the country. (2) This representative directed the perusal and the redaction of individual bibliographical index cards for each memoir and article that had been identified. For each memoir or article one index card containing its bibliographical references was made. (3) Each individual index card contained the common bibliographical information (title, name of the review, date, etc.) as well as a classification code corresponding to a specific domain of research (this code was furnished by the *Index du Répertoire Bibliographique des Sciences Mathématiques*). (5) Individual index cards were then regularly sent to Paris. They were

centralized and prepared for publication. (6) The Paris secretariat directed the process of publication, which was very slow: he had to gather together individual cards according to their classification. Nevertheless the index cards concerning a specific division were not published before they contained a sufficient number of bibliographical references. For instance, if there weren't enough references for the code A1, no card was published and one had to wait for the sending of other bibliographical references concerning this classification code.

Each printed card contained approximately ten references. Each set of 100 index cards contained about 1000 bibliographic items. The illustration below is a reproduction of a standard index card: the figure in the upper right corner indicates the number of the card and the framed code indicates the classification code according to the index.



**Reproduction of a printed index card**

Three main mathematical domains were distinguished in the classification of the index: (1) Mathematical Analysis; (2) Geometry; (3) Applied Mathematics. Within these domains,

several classes were identified and designated by a capital letter (see table below). For instance, the class A contained works devoted to elementary algebra, theory of algebraic and transcendent equations, Galois groups, rational fractions and interpolation. Each class (A to X) was generally divided into subclasses, divisions, sections and, even, subsections. For instance, the code L<sup>1</sup>4c $\alpha$  was used to designate the **class** of conics and surfaces of second degree (L), the **subclass** of conics (<sup>1</sup>), the **division** corresponding to tangents (4), the **section** dealing with tangents satisfying specific conditions (c) and the **subsection** corresponding to the case of right angles ( $\alpha$ ).

Mathematical domain	Classes
Mathematical Analysis	A-J
Geometry	K-Q
Applied Mathematics	R-X

**Repartition of the classes in each mathematical domain**

The repertoire was published from 1894 until 1912. During these 18 years, 20 series of 100 index cards were published. Each series contained about 1000 bibliographical references and one can therefore estimate that these series represent a list of 20,000 mathematical works. More precisely, one can distinguish three moments in the publication of the series; they correspond to the three attempts to cover the whole classification, as shown in the following table:

Period	Number of series published	Covered classes
1894-1895	3	A1 to X7
1896-1905	12	A1 to V9
1906-1912	5	B12 to X8

**The three periods of publication**

### *III - Is the mathematical repertoire a new tool for historians of mathematics?*

The intention of the SMF was to create a bibliographical tool for scholars in mathematics. Some journals adopted the classification of the index (for instance the *Bulletin de la Société Mathématique de France*). Nevertheless, it is quite difficult to determine whether the mathematical community really used it. We are in possession of various documents concerning the creation and the publication of this bibliography, but there remain many points about which our information is still fragmentary. How many copies did the *commission*

*permanente* print (and sell)? Was the bibliography largely distributed outside France? Why is it so difficult to find copies of the index cards in French or foreign libraries?<sup>11</sup>

Moreover, one should add some other questions concerning the general context of its creation: it would be important to determine the relationships between this project and universalistic and internationalist trends at the turn of 19<sup>th</sup> century. The mathematical repertoire constitutes a modest project compared to similar attempts in Germany, Belgium and Great Britain and one can consider that it had three major challengers:

(1) *The mathematical bibliography compiled by Hermann Georg Valentin*. Valentin was a chief librarian at the Berlin Library and he started the compilation of a mathematical bibliography in 1885, at the same time as the SMF. His aim was to collect *all mathematical publications since the invention of typography*. After several years of strained relations with the representatives of the French bibliography, Valentin finally became a member of the permanent commission<sup>12</sup>. His bibliography was probably never published, partly because of the First World War.

(2) *The Universal Bibliographical Repertoire*. The Belgians Paul Otlet and Henri Lafontaine created this repertoire around 1895. It was conceived as a universal bibliography of human thought. This repertoire had some success for some years but French mathematicians had some serious reservations.

(3) *The International Catalogue of Scientific Literature*. The London Royal Society created this project in the 1890's. Its aim was to publish, at an international level, regular bibliographies on every field of scientific research. Although the French scientific community was involved in this project, professional mathematicians (especially in France) also expressed strong reservations<sup>13</sup>.

From a scientific point of view, the mathematical repertoire raises the problem of the internal structure of 19<sup>th</sup> century mathematics. At first glance, this bibliography can constitute an interesting tool for the study of mathematical production over a large period; its 20,000 bibliographical references constitute a valuable source of investigation for historians of

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<sup>11</sup> As far as we know it is impossible to find a complete set of the 20 series of the repertoire in any library in France (even in the *Bibliothèque Nationale de France*). We had the opportunity to work on a complete set thanks to Jean-Luc Verley.

<sup>12</sup> Concerning this special case, cf. [Eneström 1911], [Valentin 1885], [Valentin 1900] and [Valentin 1910].

<sup>13</sup> Concerning the universal repertoire and the International Catalogue of Scientific Literature, see [Rasmussen 1995].

mathematics. However, this is probably not the main point. Indeed, with its specific and complex classification, the mathematical repertoire gives an outline of a specific conception of mathematics. It does not only give access to mathematics but also to the conception of mathematics that was constructed by the mathematical community at that time. Does it give an adequate description of 19<sup>th</sup> century mathematics? In the light of recent works in history of science, can its classification be considered as conservative or should it be seen as modern? Did the classification really take into account all the existing mathematical domains of 19<sup>th</sup> century mathematics? Did the classification contain gaps and if so, what were they?

The creators of the project didn't only propose a thematic ordering of mathematical fields; they also elaborated a personal definition of the mathematical corpus that the repertoire should take into account: they were for instance convinced that most of the works concerning pure and applied mathematics published since 1800 would be of interest for scholars. On the other hand, they excluded from their corpus classical works that didn't contain general results, notably those intended for students and for the preparation of examinations; in a similar way, they decided that the works in applied mathematics would be mentioned only in the case they implied a progress in pure mathematics. The introduction of such a separation between pure and applied mathematics is quite astonishing, particularly in the context of the development of engineer training in all European countries.

What can historians of mathematics learn from such a bibliographical endeavour? In order to study precisely the structure of the catalogue, we created a computer database. Although we are quite far from the end of the data entry process<sup>14</sup>, we are in a position to give an outlook of the information that may be extracted from such a database.

A general investigation covering 1700 index files (17 series) provides a piece of information concerning the repartition of bibliographical references within the 3 main mathematical domains: Mathematical Analysis (A to J) represents 50% of the references, Applied Mathematics (R to X) 33% and Geometry (K to Q) 17%. For Mathematical Analysis, the most important classes are those devoted to Algebra (A), Theory of Functions (D), Differential Equations (H) and Arithmetic (I). For Applied Mathematics, one can distinguish 3 significant classes: Mathematical Physics (T), General Mechanics (R) and Fluid Mechanics

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<sup>14</sup> At the present time, this database contain 3692 bibliographical items. This corresponds to the first 4 series of the repertoire, that is 400 index files over 2000. This database is accessible online thanks to Laurent Guillopé at the Cellule MathDoc: <http://math-sahel.ujf-grenoble.fr/RBSM/>.

(S). Finally, the main classes in Geometry are those devoted to Elementary Trigonometry (K), Algebraic Curves and Surfaces (M) and Conics (L).

Apart from these general figures, we are in a position to give some precise descriptive information concerning the first 300 index files (3 series) of the repertoire<sup>15</sup>. Very significantly, the figures of the repartition of items within the 3 mathematical fields is quite similar to the previous ones, which concerned 17 series: Mathematical Analysis represents 53%, Geometry 13% and Applied Mathematics 34%.

The number of mathematicians listed in the first three series of the repertoire is 850. Although impressive, this figure requires further analysis: in fact, the most important part of these authors have between 1 and 5 bibliographical references and one can only find 120 mathematicians with more than 5 references. The prominent authors of the 3 series (20 items or more) are the following: A. Cauchy (101), N. H. Abel (55), L. Gegenbauer (49), C.-G.-J. Jacobi (42), M. Chasles (37), A. L. Crelle (31), Sophus Lie (29), F.-J. Studnicka (23), C. Duhamel (23), J. Liouville (22), P. Tannery (21), Th. Clausen (21), A. Cayley (21), E. Heine (20) and S. D. Poisson (20).

The 2723 items listed come from 83 mathematical journals. This figure should be compared with the list of 227 journals of the *Index du repertoire*. Moreover, 62 of the 83 journals contain less than 20 bibliographical references. Only 8 periodicals contain more than 50 references and represent 71% of total number of items: *Journal für die reine und angewandte Mathematik* (712), *Comptes Rendus des Séances de l'Académie des Sciences* (500), *Sitzungsberichte der Königl. Akademie der Wissenschaften in Wien* (299), *Journal de l'École Polytechnique* (134), *Bulletin de la Société Mathématique de France* (117), *Casopis pro pěstování matematiky a fysiky*<sup>16</sup> (80), *Annales Scientifique de l'École Normale Supérieure* (78), *Journal de mathématiques pures et appliqués* (58)<sup>17</sup>.

Obviously, these 8 journals were published in Germany, Austria or France. Such a phenomenon can be explained by the strong mathematical domination of France and Germany

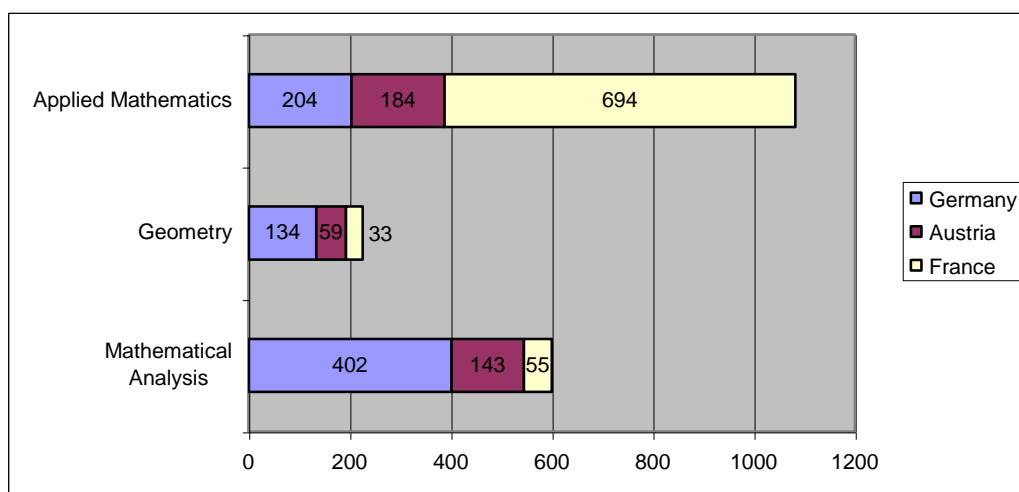
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<sup>15</sup> These figures only concern 2723 bibliographical references and it would be quite hazardous to consider that they provide an adequate account of the whole repertoire. Nevertheless, these items correspond to the first attempt to cover the whole classification (from A to X) and may be interesting, for two reasons: first, they furnish some indications about the complexity of this bibliography. Secondly, they give some idea of the richness of the classification and of the extent of the work that had been done in 1895.

<sup>16</sup> This journal was published in Prague, a city that was part of the Austrian territory.

<sup>17</sup> The repertoire also took mathematical monographs (books, treatises, etc.) into account. The first 3 series contain around 50 items of this type.

during 19<sup>th</sup> century; as we will see, the presence of Austria finds probably its origin in the strong activity of Emil Weyr's crew at the beginning of the perusal work. As an illustration, when, for each class of the index, we only take into account the most important journals listed (more than 20 references for each periodical), the only remaining ones are those that were edited in France, Germany and Austria. It is then possible to give an overview of the repartition of these countries according to the three mathematical fields (graph below).



**Repartition of the mathematical domains according to the place of edition of the most important journals<sup>18</sup>**

The perusal of memoirs and periodicals of a given country was placed under the responsibility of one or several mathematicians living and working in the country. Nevertheless, it is quite clear that, in the beginning of the project, very few countries put a lot of effort into the constitution of the bibliography. Apart from France, Germany and Austria<sup>19</sup>, only four countries sent more than 15 bibliographical references to the Paris office: Portugal (100 items, 3 journals perused), Russia (95 items, 4 journals), Italy (59 items, 1 journal) and Norway (52 items, 1 journal).

In a 1900 report concerning the progress of the repertoire, Charles Laisant gave some information about the number of bibliographical references submitted by each country. At that time, only the half of the bibliography (ten series) had been printed and the most important

<sup>18</sup> Of course, these data are still fragmentary and must be confirmed by a more precise investigation of the whole set of 20 series.

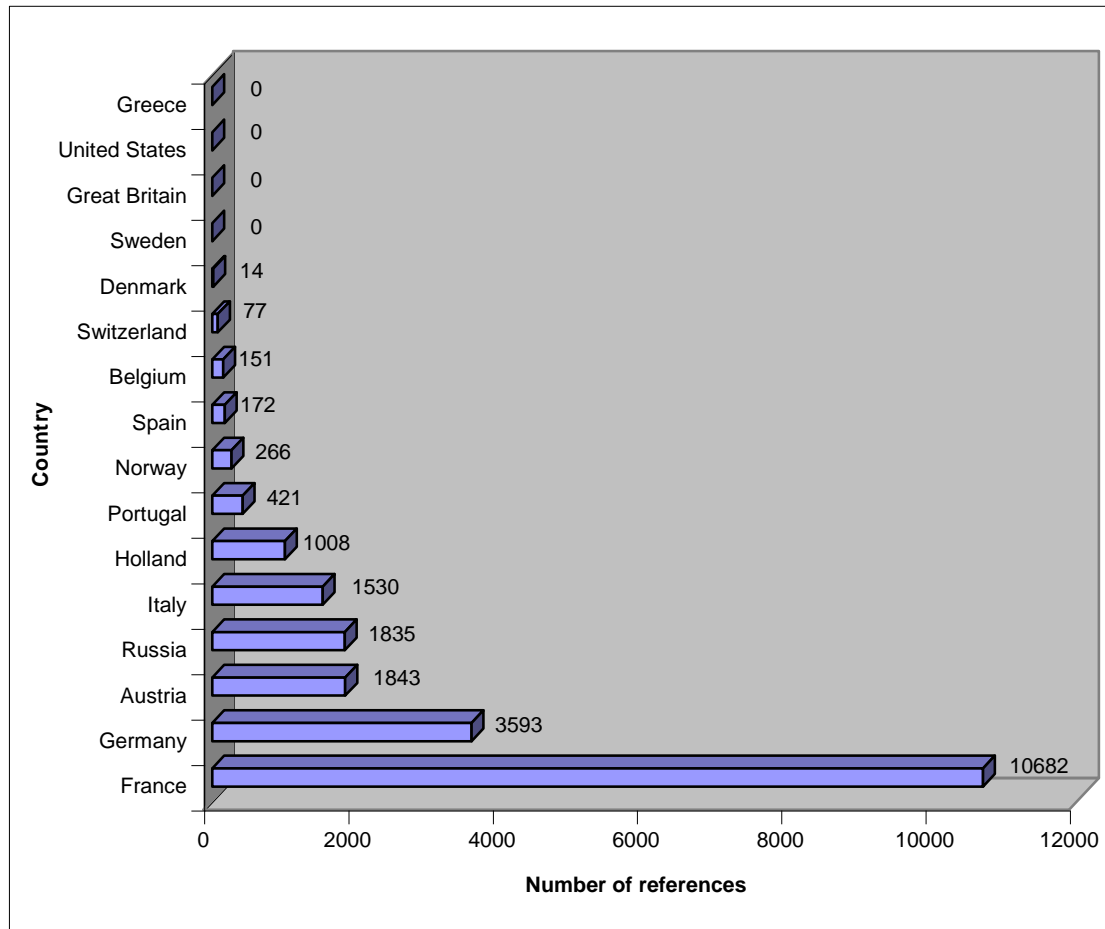
<sup>19</sup> 920 bibliographical references concerned French mathematical journals, 783 were published in German journals and 539 in Austrian periodicals. Of course, these figures don't furnish any information about the authors' nationality!

suppliers were still France (10,682 items, 6 journals)<sup>20</sup>, Germany (3593 items, 7 journals) and Austria (1843 items, 8 journals). The graph below provides an overview of the participation of each country: Russia, Italy, Holland, Portugal, Belgium and Spain are the most significant suppliers. Although paradoxical, the absence of Great-Britain and United-States is not surprising since the two countries were engaged in a competing project, i. e. the International Catalogue of Scientific Literature.<sup>21</sup> To a great extent, the references sent by Holland, Russia and Spain correspond to the heading “*Mémoires ou ouvrages séparés*”. These nations were taking part in the broadening of mathematical production and it is likely that they used the repertoire in order to gain some recognition at an international level. Moreover, one can assume that the mathematicians of these countries judged that their national periodicals weren’t important enough and that monographs and books constituted the best illustration of their national production.

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<sup>20</sup> 7200 references come from the *Comptes rendus de l’Académie des Sciences*.

<sup>21</sup> The case of Sweden is also quite paradoxical. Eneström was the representative of the country within the *Commission Permanente* and he had written several articles in favour of the constitution of a mathematical bibliography during the 1880’s. Nevertheless, he rapidly showed some serious reservations about the French project, partly because of its system of classification. His growing inertia towards the French repertoire is a plausible explanation for the absence of Sweden.



**Number of bibliographical references submitted by each country in 1900<sup>22</sup>**

Only 157 classification codes were used for the ordering of the first three series, although the *Index du Répertoire Bibliographique des Sciences Mathématiques* proposed around 2000 possible codes<sup>23</sup>. Concerning these 300 index files, it is important to notice that 113 of these 157 codes refer to bibliographical items that were just as well published before 1840 as after 1870. One can therefore conclude that the most part of the mathematical domains designated by these codes were active over a large period of 19<sup>th</sup> century. Furthermore, 11 classification codes are exclusively devoted to mathematical works published after 1860; 8 of these codes concern mathematical domains that are emergent in the second half of 19<sup>th</sup> century<sup>24</sup>. The presence of two other domains – one concerning the properties of general involutions

<sup>22</sup> These figures come from Charles Laisant's report in 1900 [Laisant 1900].

<sup>23</sup> Moreover, in a 1900 report, Charles Laisant confirmed that the first ten series that had been printed at that time didn't use more than 300 classification codes of the index [Laisant 1900].

<sup>24</sup> Some new results about determinants (2 codes), Dedekind's and Kronecker's arithmetical theory of algebraic functions (2 codes), properties of  $\varphi(n)$  functions, Lie's theory of continuous groups, Gylden's theory and nomography

according to Chasles and the other one devoted to axonometric or isometric perspective – reveals the active role of Emil Weyr at the beginning of the perusal work since most of the bibliographical references come from the *Sitzungsberichte der Königliche Akademie der Wissenschaften in Wien*. The last domain (descriptive geometry on curves and surfaces) gives an illustration of the vitality of this old theory. This vivacity can be explained by the importance of descriptive geometry training in Engineer Schools and Faculties of Science.

Who was in charge of the perusal process and how was it done? The most part of the German and Austrian contributions corresponds to the perusal of the *Journal für die reine und angewandte Mathematik* and of the *Sitzungsberichte der Königliche Akademie der Wissenschaften in Wien*. Emil Weyr essentially did this work<sup>25</sup>. He was certainly the most dynamic foreign contributor and his work ensured the international representation of the repertoire for the first three series. On the other hand, it seems that his work was not exhaustive at all. For instance, according to his collected works, Jacobi published 104 articles in the *Journal für die reine und angewandte Mathematik*; however, one can only find 36 references to Jacobis's works in the first three series of the repertoire. Judging from this example (and from several others), it appears that considerations concerning the mathematical domains, the length or the theoretical importance of publications were not automatically seen as relevant criteria.

The essential part of the French contribution corresponds to the perusal of the *Comptes rendus de l'Académie des sciences*. This was made by Henri Brocard, who was the director of the Alger Meteorology Institute and one of the French representatives of the commission. His work only concerned publications in applied mathematics (classes R, S, T, U, V, X<sup>26</sup>) but it was exhaustive (in his 1900 report, Laisant noticed that the *Comptes rendus* had been completely perused: “Il n’y a cependant peut-être que les *Comptes rendus de l'Académie des Sciences de Paris* qui soient tout à fait au courant, grâce au dévouement de M. le Commandant Brocard ; c’est lui qui a pris cette si lourde tâche, et il s’en est acquitté avec une exactitude et une régularité véritablement admirable”<sup>27</sup>).

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<sup>25</sup> He was the Austrian representative in the *Commission permanente* and the leader of a small crew. In a letter to Henri Poincaré (25/04/1892), Weyr wrote: “J’ai l’honneur de vous signaler qu’il nous sera possible de remplir votre demande au moins quant aux principaux recueils allemands. M. Le baron de Lichtenfels, professeur de mathématiques à l’École Polytechnique de Graz s’est chargé de dépouiller avec moi le *Journal de Crelle*. [...] Cette collection de fiches déjà finie, concernant les *Sitzungsbericht et les Denkschriften* de Vienne et de Prague, les publications polonaises et quelques autres publications, vous parviendra en quelques jours par la poste”.

<sup>26</sup> This point would require further analysis since the situation is similar for other French journals.

<sup>27</sup> [Laisant 1900], p. 248.

To conclude, it might be interesting to notice that two major mathematical journals seem to be absent from the whole repertoire: the *Mathematische Annalen* and the *Nouvelles annales de mathématiques*. The case of the *Mathematische Annalen* is astonishing since Weyr announced the beginning of the perusal of this journal to Poincaré in 1892<sup>28</sup>. The case of the *Nouvelles annales de mathématiques* is quite different: it probably reveals the (intentional?) choice made by French mathematicians for a specific style of mathematical: i. e. ‘official’, academic and professional mathematics to the detriment of mathematics for education, a domain that was not very much recognized.

According to us, this mathematical bibliography can constitute a valuable source for historians of mathematics; in particular, it gives access to the conception of mathematics that was constructed by 19<sup>th</sup> century mathematical community. Our analyses will be of course completed at the end of the data entry process. Moreover, a possible development of this research could consist in a comparison between this bibliography and some others repertoires, like the Belgian *Répertoire Bibliographique Universel* or the *Jahrbuch über die Fortschritte der Mathematik*. Finally, the understanding of the expectations, difficulties, illusions, etc. raised by this first attempt to organize mathematical activity at an international level might be helpful for contemporary mathematicians, at a time when many international projects are devoted to the numerisation of past or present mathematical works.

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