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# American mathematical journals and the transmission of French textbooks to the USA

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## Abstract

*In the nineteenth century, American journals became an important vehicle for the dissemination of the scientific knowledge, including the French mathematics exposed in famous textbooks in particular written for École Polytechnique teaching and admission by the leading mathematics scholars of the period 1785-1825. Specialized United States mathematical journals frequently and accurately referred to passages of these works published in France. This article discusses the forms of this circulation (articles, questions, and courses), the origin of the borrowings (textbooks, treatises) and the evolution of the contents during the first half of the century while translations of French textbooks were published in America. It also examines the identity of the journals contributors who introduced theorems, exercises or proofs initially written by French professors or textbook authors. Considering the thematic network of contributors in term of common uses and references, this work shows that the diffusion of French mathematics in American papers relied on specific educational needs.*

## Introduction

In the United States, science and mathematics practice, education and diffusion experienced deep transformations in the first half of the 19<sup>th</sup> century<sup>1</sup>. The creation of specialized journals, learned societies and autonomous mathematical chairs in colleges witnessed the beginnings of the mutations the country was experiencing in the acceleration of the scientific knowledge diffusion and in the structuration of education. Textbooks, that used to be imported or reprinted from English works in the colonies, started to be written by American authors and participated to the growth of the education publishing market (Karpinski,

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<sup>1</sup> For an overview on American mathematics between 1800 and 1875, before the “emergence of the American mathematical research community”, see chapter one of (Parshall & Rowe, 1994, pp. 1-49).

1940). American mathematical publications of the very early nineteenth century were still influenced by English methods in arithmetic (Michalowicz & Howard, 2003), algebra (Pycior, 1989, pp. 126-128) or geometry (Ackerberg-Hastings, 2002, p. 69). At the beginning of the 1820s, *curricula* of a few colleges were reformed, introducing French more analytic textbooks. In the two following decades, more than twenty French textbooks translations were published<sup>2</sup>. French mathematics education, this is to say mathematical work done within the French institutional framework as defined in (Crosland, 1992, p. 12) and designed for the use of instruction by or for teachers and students, was not only imported in the United States through textbooks translations. It was also displayed and diffused in articles or questions references in American mathematical journals.

This study intersects two fields on the history of mathematics in the United States. The first deals with the consideration of the scientific journal as a specific way to transmit and diffuse knowledge in the nineteenth century. Works as (Hogan, 1985), (Timmons, 2003) and (Kent, 2008) especially showed how the constitution of a publication community and the introduction of education and research-oriented contents built up attempts to initiate the professionalization of mathematics. The other concerns foreign - notably French - influences mathematics education in America was exposed to, right after the War of Independence. A very large study was made on the subject in (Cajori, 1890) in which a bibliography of nineteenth century colleges' *curricula* and textbooks was compiled. Lao G. Simons (Simons, 1931) gave a list of French textbooks translations American scholars produced between 1818 and 1850. More recent works draw very general overviews (Parshall & Rowe, 1994), or focused on specific topics, specific textbooks or very short time periods as (Pycior, 1989) did for algebra textbooks.

Examining the two approaches, this article describes the transmission to America of French mathematics education through American mathematical journals<sup>3</sup>. It relies on a systematic analysis of contents that were diffused and their original French vehicles (were textbooks only concerned?). It also questions uses the American mathematical journals' contributors made of the references in their writings. The paper leans also on a prosopographical study of these contributors in order to evaluate the correlation between needs in term of mathematical education in America and circulations of French contents through journals.

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<sup>2</sup> The corpus of the American translations of French mathematical textbooks is described and analyzed in (Preveraud, 2014, Chapter 4).

<sup>3</sup> The case of general-interest journals that essentially reviewed translations of French mathematics textbooks is mentioned in (Preveraud, 2014, pp. 130-134).

## Corpus and methodology

The sources of this study were four American mathematical journals published in the period 1818-1878<sup>4</sup>, starting after the first ever French textbook translation<sup>5</sup> and ending before the publication in 1878 of the *American Journal of Mathematics* considered as the first research-oriented journal in that country (Parshall & Rowe, 1994, p. 49). It was a period of specialization and professionalization of mathematics in the United States. *The Mathematical Diary*, *The Mathematical Miscellany*, *The Cambridge Miscellany of mathematics, physics and astronomy* and *The Mathematical Monthly* were all mixed-level mathematics journals, introducing problems, articles sometimes but not always research-oriented, or offering courses notes. These journals had a short time life, but their successive publication shows significant mathematical editorial activity during the antebellum period.

Table 1. Four mathematical journals in the United States (1825-1861)

Title of the publication	Dates	Place of publication	Editor	Editorial contents	Issues
<i>The Mathematical Diary</i>	1825-1832	New York, NY	Robert Adrain (1825-1826), James Ryan (1826-1832)	Questions	13 (2 vol.)
<i>The Mathematical Miscellany</i>	1836-1839	Flushing, NY	Charles Gill	Questions and articles	8
<i>The Cambridge Miscellany of Mathematics, Physics and Astronomy</i>	1842-1843	Cambridge, Ma	Benjamin Peirce, Joseph Lovering	Questions and articles	4
<i>The Mathematical Monthly</i>	1858-1861	New York, NY	John D. Runkle	Questions, notes and articles	36 (3 vol.)

In every issue, each of the four publications proposed several questions to be answered by readers, whose solutions were published in the following issues. In *The Mathematical Diary* and *The Mathematical Miscellany*, questions and solutions comprised almost the entirety of the scientific contents. This model of journal where mathematics were exposed through problems rather than research articles found a breeding ground in America as it did previously in England with *The Ladies' Diary* (Albree & Brown, 2009). The role of problems/solutions in these first American journals was predominant in the edification of a mathematical community because readers, issue by issue, were encouraged to answer, criticize, and improve others' mathematical contents in their submitted communications. Regarding education, the importance of problems/solutions was brought out by editors. "It is well known to mathematicians, that nothing contributes more to the development of mathematical Genius, than the efforts

<sup>4</sup> The first American mathematical journals, *The Correspondent* and *The Analyst*, showed no significant reference to French mathematical works. Between 1818 and 1878, only one publication could not be analyzed: *The Mathematical Companion* (1828-1831) could not be located.

<sup>5</sup> Sylvestre-François Lacroix's *Elements of Arithmetic* by Harvard Professor John Farrar in 1818.

made by the student to discover the solutions of new and interesting questions” remarked Adrain (Adrain, 1825, p. iii).

Progressively, editors added a new type of contents, specially intended for students: transcripts of courses in *The Cambridge Miscellany* or courses notes in *The Mathematical Monthly*. In their journal, Gill, Peirce and Lovering, as well as Runkle made explicit their desire to target a young readership by creating a “Junior department” at the beginning of each issue. This dedicated section contained questions, articles and courses adapted for a student’ audience. Education concerns were made clear by editors in chief. A common point of the four journals was the large range of readership they intended to catch as *Mathematical Monthly’s* editor in chief explained: “[the journal] should embrace students in one extreme and professed mathematicians in the other” (Runkle, 1858-1859, pp. i-ii).

In these four publications, references in problem solving, articles and courses that were related to French mathematics contents were exhaustively looked for in each issue. The attention was focused on quotations of famous French textbooks written in the period 1785-1825, when many French mathematicians were asked to write for the/their teaching at new *École polytechnique* (opening in 1794) and within the frame of secondary education institutions named as *lycées* (created in 1802)<sup>6</sup>. During that period, fewer than ten authors shared almost the total print-run. Gaspard Monge’s *Géométrie descriptive* for both *École polytechnique* and *École normale*, or Augustin Louis Cauchy and his *Cours d’analyse* for *École polytechnique* were rather designed for higher education and almost entirely used in that framework. Sylvestre-François Lacroix and his series for *École centrale des quatre-nations* as well as Étienne Bézout reprints of his series for *les gardes du pavillon et de la marine* were used in secondary schools and some of their texts read by *École polytechnique* admission candidates. Prints of Adrien-Marie Legendre’s *Éléments de géométrie* and Pierre Louis Marie Bourdon’s *Éléments d’algèbre* were also widely used within the *lycées*.

It is also important to highlight the case of recapitulative treatises, as for example *Mécanique céleste* by Pierre Simon de Laplace, *Mécanique analytique* by Joseph Louis Lagrange or *Traité des propriétés projectives des figures* by Jean-Victor Poncelet. Those books did have an ambiguous position towards education: they were usually not meant to be taught, and rather designed to compile and expose the whole knowledge about a specific mathematical subject. Nevertheless, since Laplace, Lagrange and Poncelet were employed for teaching in French higher education institutions respectively at *École normale de l’an III*, *École polytechnique* and *École d’artillerie et du génie de Metz*, they used their own treatises with their students. Even though treatises did not pertain entirely to education matter<sup>7</sup>, they did participate to the circulation of French mathematics education between France and the United States.

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<sup>6</sup> See (Dhombres, 1985).

<sup>7</sup> The status of *Mécanique céleste* was studied in (Hahn, 2005).

The systematic study of French textbooks and treatises references in American journals was conducted under the following methodology. An initial investigation enabled to identify occurrences of the authors' names that have just been listed. In most cases, when a quotation of a patronymic was found, it was immediately followed by a title of a book. Less frequently, contributors to American journals used French publications without quoting the author but only the title of their work. A second inquiry was then pursued in order to seek keywords occurrences as "géométrie", "algèbre", "calcul", "traité", "éléments", etc. Some other French works were found but were discarded from the study because they were not directly addressed to education: articles in Gergonne's *Annales de mathématiques pures et appliquées* or Liouville's *Journal de mathématiques pures et appliquées*, memoirs of Académie des sciences and research-oriented books as Legendre's *Théorie des nombres* or Laplace's *Théorie analytique des probabilités*.

## Textbook references supporting problem solving

Famous French textbooks were quoted by contributors to American journals. The most commonly cited authors were Lacroix and Legendre who wrote *Traité élémentaire de calcul différentiel et de calcul intégral* and *Éléments de géométrie*. These two publications were quoted during the whole period, a reason why this article will focus on their use in the four journals. The exhaustive corpus of French textbooks quoted and used in American mathematical journals is gathered in the following table.

Table 2. French mathematical textbooks quoted or used in American mathematical journals (1818-1878)

Title	Author	First edition	Number of references
<i>Éléments de géométrie</i>	Legendre	1794	7
<i>Traité élémentaire de calcul différentiel et de calcul intégral</i>	Lacroix	1802	7
<i>Cours d'analyse</i>	Cauchy	1821	2
<i>Éléments de géométrie</i>	Lacroix	1799	1
<i>Compléments aux éléments d'algèbre</i>	Lacroix	1800	1
<i>Éléments d'algèbre</i>	Bourdon	1817	1
<i>Cours de mathématiques à l'usage des écoles militaires</i>	Allaize, Billy, Puissant, Boudrot	1813	1

*Éléments de géométrie* by Adrien Marie Legendre, first published in 1794, was widely used in schools of France during the whole 19th century. Its presentation of Euclidian geometry, using algebraic symbolism and a new arrangement of properties, was perceived by American scholars as a good compromise for their teaching between classicism and modernity (Preveraud, 2013, pp. 46-47). The textbook was even twice translated in the 1820s (Schubring, 2007, pp. 46-50), and twice again in the 1840s, not including the reprints. In American journals of mathematics, it was quoted mainly for

highlighting the solutions to geometrical questions. Because contributors needed to write succinctly and have their solution edited, they often referred to a property statement as ellipses length relations between axes and chords (Runkle, 1860, p. 269), or used formula as the one that gives the volume of a tetrahedron (Ryan, 1827-1832, p. 76) and specifically referred to Legendre if the reader wanted to find complete statements and proofs. For example, in a question published in the *Mathematical Miscellany*, one asked to determine the number of diagonals of a polyhedron. In one of the answers, New-York teacher Marcus Catlin used the relation  $s = E - v + 2$  between the number of faces ( $v$ ), edges ( $E$ ) and angles ( $s$ ) of a polyhedron and quoted its exact location in the second textbook edition of Legendre: “See Livre VII, Prop. 25, Leg. Geom, 2nd Ed. Paris” (Gill, 1836-1839, p. 160).

Another French bestseller frequently quoted in American journals was Lacroix’s *Traité élémentaire de calcul différentiel et de calcul intégral*. Unlike Legendre’s *Geometry*, this book had not been translated in the United States<sup>8</sup>. In American journals, the main use of *Traité élémentaire de calcul différentiel et de calcul intégral* was to help contributors in elaborated mechanical questions where analytical methods gave complicated differential equations to integrate. In *The Mathematical Miscellany*, for example, Charles Avery, professor at Hamilton College needed to solve the following equation: “ $\frac{d^2\varphi}{dt^2} + g\varphi + F(t) = 0$ ” (Gill, 1836-1839, p. 230). Instead of explicitly exposing a long reasoning, he gave credit to Lacroix’s solving methods of this kind of differential equations (“La Croix, page 407”) and furnished almost directly the integrated solution.

The quotation of those two French textbooks helped contributors in their solutions, but also enabled them to avoid consuming too much space in the journal. Nothing is more relevant at a time when journal existence was precarious and relied, in particular, on the cost of paper.

Despite the common use for these textbooks, others were used in a very different way. This was the case of Augustin Louis Cauchy’s *Cours d’analyse*, published in 1821 for his teaching at *École polytechnique*. This high-level mathematics textbook was not reported in American journals for its complex and elaborated results and presentation of analysis, nor its help in problem solving. What interested American contributors were the elementary<sup>9</sup> notes Cauchy wrote at the end of his treatise. Contributors translated some of them in the junior sections of *The Mathematical Miscellany* or *The Mathematical Monthly*, with pedagogical goals.

For example, Editor Charles Gill gave a translation for young students of a note on the theory of positive and negative quantities. It was, said Gill, to “assist the students in mastering the first principles of the use of symbols in algebra”, a science where “great care should be taken to obtain a correct and

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<sup>8</sup> West Point Professor Charles Davies widely used Lacroix’s book for the writing of *Elements of Differential and Integral Calculus* (1836) (See Preveraud, 2014, pp. 245-247).

<sup>9</sup> Referring to the foundations of mathematics as defined in (Gérini & Otero, 1993, p. 51).

precise idea of the symbols used in the science, and the operations performed upon them” (Gill, 1836-1839, p. 204). In this note, Cauchy made a distinction between the number, associated with the idea of magnitude measurement, and the quantity that emerges when “one considers every magnitude of a set specie as serving for increasing or decreasing of another set magnitude of the same species” (Cauchy, 1821, p. 403). For Cauchy, the quantity could only be endowed with a sign placed in front of a number. In other words, if  $A$  points out a number,  $+A$  indicates a positive quantity and  $-A$  a negative one. Cauchy proposed a definition of a negative quantity, similar to what English textbooks used to give: a negative quantity refers to a diminution and has to be subtracted.

This pedagogical approach established a breaking with the analytical methods of Lacroix or Bourdon’s algebras where negative quantities were never defined but late introduced as absurd solutions of first degree problems (Lacroix, 1815, pp. 80-91). In the United States, both approaches were used in textbooks publishing (Pycior, 1989). But after the first translations of Lacroix (1818) and Bourdon (1830, 1831), there was a shift in the way negative quantities were introduced in translations of French algebras. For example, Charles Davies’s translation of Bourdon’s *Éléments d’algèbre* (1835) proposed a mixed solution: an early definition of the negative quantity followed by the interpretation of negative solutions to first degree problems. The analytical, radical and original French approach was progressively given up or softened by a so-called rigor of definitions more appropriate to methods of American and British algebras previously in use. Thus, Lacroix and Bourdon’s algebras were only quoted once in American journals. In that context, 1836 translation of Cauchy’s note by Gill in his journal, aimed at transmitting to beginners in algebra a frame about the theory of negative quantities, participated in the change of American mathematical algebra textbooks. Gill’s note was indubitably well adapted to the mid-1830s educational needs and tendencies for algebra instruction.

## Treatise references diffused new mathematical contents

Regarding to French mathematics education transmitted to the United States through American mathematical journals, this article discusses now the case of treatises whose references are gathered in the following table.

Table 3. French mathematical treatises quoted or used in American mathematical journals (1818-1878)

Title	Author	First edition	Number of references
<i>Mécanique céleste</i>	Laplace	1799-1825	13
<i>Mécanique analytique</i>	Lagrange	1788	10
<i>Traité des fonctions elliptiques</i>	Legendre	1826	9
<i>Traité des fonctions projectives des figures</i>	Poncelet	1822	4
<i>Traité de géométrie supérieure</i>	Chasles	1852	2
<i>Géométrie de position</i>	Carnot	1803	1



The two most cited books dealt with mathematical mechanics. In *Mécanique céleste* and *Mécanique analytique*, Laplace and Lagrange wrote physics treatises where rules of nature were displayed under the domination of mathematics. Lagrange's work wasn't given any English version. Laplace wasn't translated in America until 1829 with *Mécanique celeste by Marquis de Laplace* written by Salem mathematician Nathaniel Bowditch, and very partial English translations produced in England and Ireland weakly circulated within the United States during the first part of the century (Preveraud, 2014, pp. 412-413). As Lagrange and Laplace's books both gave differential equations governing movements of bodies and the way to solve it, they were widely-used by American contributors facing applied mechanical problems to solve, essentially in *The Mathematical Diary*, before the publication of Bowditch's translation. An example of use was given in Rutgers Professor Theodore Strong's solution. He had to "investigate the nature of the curve described by a body projected obliquely along a given inclined plan, the resisting arising from friction being taken into consideration" (Adrain, 1825-1826, p. 34). Strong quoted Laplace's expression of the friction for an inclined plan situation and adapted the formulae with his own notations. Speaking of celestial mechanics, journals diffusion answered the lack of sustainable books in vernacular language on the subject.

In *Traité des fonctions elliptiques* (1825), Adrien-Marie Legendre synthesized the computation of integrals whose general form was  $\int \frac{P(x)}{\sqrt{R(x)}} dx$  with  $P$  a rational function and  $R$  a polynomial of degree less than three. The French mathematician brought those integrals down to three species easily computable with tables (Legendre, 1825, pp. 14-17). The quotation of his treatise in American journals dealt as well with analytic problem solving. About ten American contributors to mathematical journals quoted the reduction to one of the three species and used the tables of Legendre when integrating a complex equation in geometry, mechanics or pure analysis problems. In *The Mathematical Miscellany*, Marcus Catlin faced the integration of:

$$\frac{n^2 c^2}{1 + n^2 \sin^2 \theta} \frac{d\theta}{\sqrt{1 - e^2 \sin^2 \theta}} + R^2 d\theta \sqrt{1 - e^2 \sin^2 \theta} - \frac{c^2 d\theta}{\sqrt{1 - e^2 \sin^2 \theta}}$$

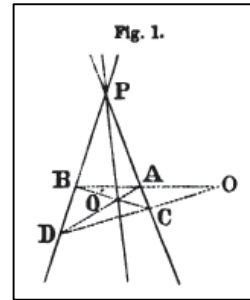
He noticed that the above equation "involves the three kinds of elliptic functions treated of by Legendre in his *Fonctions elliptiques*, see p. 19 of that work" (Gill, 1836-1839, p. 240). Quotations of Legendre's treatise were numerous between 1827 and 1837, right after its publication in France. This quick transatlantic circulation of his work was supported by journals and not by any translations or articles.

Other treatises were quoted at length and not meant only to serve as problem-solvers. Some contributors gave complete excerpts of new pure geometry treatises, as Jean-Victor Poncelet's *Traité des fonctions projectives des figures* (1822) or Michel Chasles's *Traité de géométrie supérieure* (1852). The revival of new pure synthetic geometry occurred in France in the first half of century within a group of mathematicians willing to cut loose from the complexity of algebraic

or analytical methods for problem solving (Kline, 1990, pp. 840-852). Their new methods relied on theory of projections (Poncelet, 1822), theory of transversals (Carnot, 1803) and theory of poles and polar lines (Poncelet, 1822). In *Traité de géométrie supérieure* (1852) Michel Chasles produced a compilation of all the methods in pure geometry. In America, first echoes were produced in *The Cambridge Miscellany* (Peirce & Lovering, 1842, p. 97). But most of the references were located in *The Mathematical Monthly* in the form of articles where theorems and proofs were entirely transcribed and translated, or introduced as courses notes for students.

For example, numbers nine and ten of the journal contained two contributions signed by Yale Professor Henry A. Newton and one of his students, Arthur W. Wright. Newton exposed different “geometrical construction of certain curves by points” (Runkle, 1860-1861, pp 235-244). He defined the polar to a point O with respect to an angle P as “that straight line which, together with the line drawn from the point to the vertex of the angle, divides the angle harmonically” (Runkle, 1860-1861, p. 235), exactly as Michel Chasles did in *Traité de géométrie supérieure* (Chasles, 1852, p. 251). Newton gave a method of construction of polar PO’: O’ is obtained by the intersection of quadrilateral ABCD diagonals, with D and B belonging to one side of the angle P, A and C to the other.

Picture 1. From Henry A. Newton’s article in *The Mathematical Monthly* (Runkle, 1860-1861, p. 235)



The truth of the construction was provided by the following theorem borrowed to Chasles but not proven by Newton: “in every quadrilateral, the two diagonals and the lines drawn from their intersection to the intersections of the opposite sides form a harmonic beam” (Chasles, 1852, p. 251). It was Wright, a few pages later, who gave the proof to *The Mathematical Monthly* reader. He did so in a general article about the methods of projections (Runkle, 1860-1861, pp. 293-305). He worked on a quadrilateral ABDC and imagined then the figure to be projected in such a manner that points P and O passed to infinity, lines AB and CD became parallels and quadrilateral ABDC was turned into a parallelogram<sup>10</sup> (Runkle, 1860-1861, pp. 297-298). In the projected figure, Wright easily assumed the harmonic division which was also true for the original figure. This proof that relied on the conservation of the harmonic ratio by projection was found in Poncelet’s *Traité des propriétés projectives des figures* (Poncelet, 1822, p. 82).

*The Cambridge Miscellany* and *The Mathematical Monthly* were the first vectors of new pure geometry contents in the United States, years before Francis H. Smith or William Chauvenet produced appendices as introductions to modern

<sup>10</sup> The names of the points have been changed to fit Newton’s notations.

geometry in their respective geometry textbooks *Elements of geometry* (1867) and *A Treatise on Elementary Geometry* (1869) (Preveraud, 2014, pp. 289-295).

## Diffusion, translations and educational needs

The contents of French textbooks and treatises references revealed a group of transmitters who were mostly involved in education as shown in Table 4. For each contributor, his activity and residence at time of publication are indicated. Most of these prosopographical details were found in journals themselves: if not, *Appletons' Cyclopedia of American Biography* (Wilson & Fiske, 1887) was used.

Table 4. Contributors who quoted French textbooks and treatises in American mathematical journals (1818-1878).

Journal	Contributor	Activity	Residence
<i>Mathematical Diary</i>	Nathaniel Bowditch	Actuary	Boston life Insurance Company, MA
	Theodore Strong	Professor	Rutgers College, NJ
	Henry J. Anderson	Professor	Columbia College, NY
	Robert Adrain	Professor	Rutgers, NJ/University of Pennsylvania, PA
	Samuel Ward	Student	Columbia College, NY
	Eugene Nulty	Teacher	?
	Thomas J. Megear	Artist	-
	James Macully	Teacher	Secondary school, VA
	Analyticus	?	?
L'inconnu	?	?	
<i>Mathematical Miscellany</i>	Benjamin Peirce	Professor	Harvard College, MA
	Charles Gill	Professor	Saint Paul College, NY
	Theodore Strong	Professor	Rutgers College, NJ
	William Lehnart	Principal	York Academy, PA
	Marcus Catlin	Professor	Hamilton College, NY
	Charles Avery	Professor	Hamilton College, NY
	John B. Henck	Student	Harvard College, MA
	George Perkins	Teacher	Clinton Liberal Institute, NY
<i>Cambridge Miscellany</i>	Charles Gill	Professor	Saint Paul College, NY
	Theodore Strong	Professor	Rutgers, NJ
	William Brown	Student	Clinton Liberal Institute, NY
<i>Mathematical Monthly</i>	Matthew Collins	Professor	Trinity College, IR
	George W. Hill	Student	Rutgers College, NJ
	John B. Henck	Civil engineer	?
	Pike Powers	Principal	Staunton Academy, VA
	David W. Hoyt	Teacher	?
	John M. Richardson	Teacher	Secondary school, GA
	Hugh Godfray	Professor	Cambridge College, GB
	Thomas Hill	President	Antioch College, OH
	Henry A. Newton	Professor	Yale College, CT
	M.C. Stevens	Professor	Harverford College, PA
Arthur W. Wright	Student	Yale College, CT	
Thomas Sherwin	Principal	English High School, MA	

Most of these men were college professors, as Strong from Rutgers, Newton from Yale, Anderson from Columbia or Peirce from Harvard. Secondary schools teachers (Perkins, Lenhart) and students (Wright, Ward) were also found. Prosopographical studies on part or totality of the contributors of a

journal as in (Preveraud, 2011) for *The Mathematical Diary*, in (Hogan, 1985) for *The Mathematical Miscellany* or in (Kent, 2008) for *The Cambridge Miscellany* indicated that the percentage of men involved in education is higher in the group of contributors quoting French textbooks and references than in the general population of contributors (Preveraud, 2014, pp. 389-392). The diffusion of French mathematical education in American journals came within a group of mathematicians strongly connected to higher or secondary education.

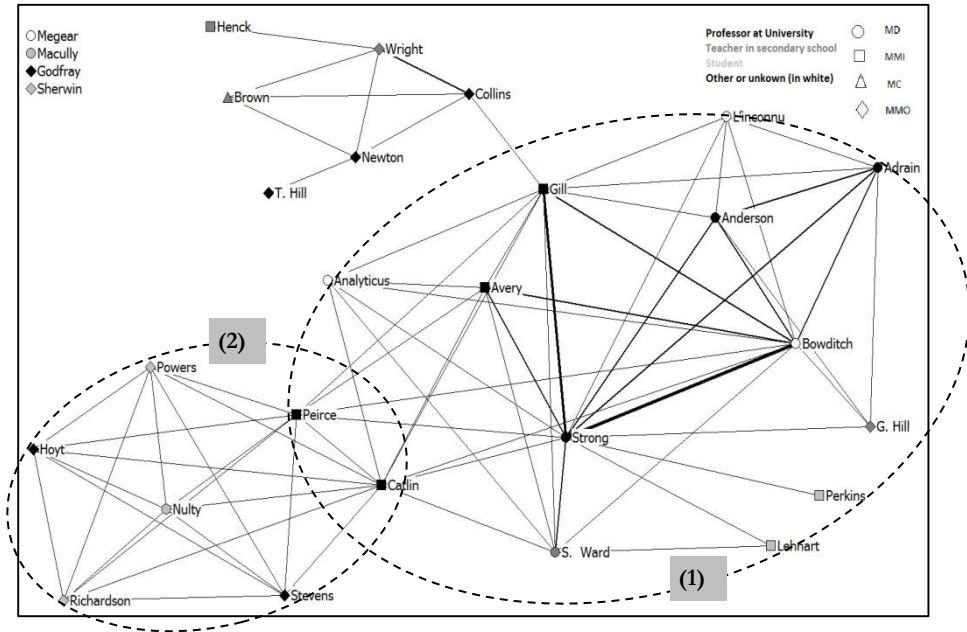
The previous analysis of French references contents has highlighted the mathematical tools the contributors used, the given and proven results they published, and the problems they were interested in. But it missed the relationships between authors and the circulation of references in terms of education needs. Were textbook references used both by teachers and students? Did celestial mathematics (Laplace and Lagrange) treatises' users also quote pure analysis textbooks? Did pure geometry treatises circulate independently of more elementary textbooks? In order to locate the connections between references and education needs of the contributors, social networks analysis provided specific tools (UCINET software and its drawing extension NETDRAW). The analysis relied also on the methodology of studies who gave knowledge to intellectual and social circulation of mathematical ideas through quantitative methods as in (Goldstein, 1999).

By counting the number of common references for every contributor, a thematic network of contributors was built. Each vertex of the network represents one of the contributors that quoted French textbooks or French treatises in one of the American journals<sup>11</sup>. Connections between individuals were obtained by computing common references of contributors: the more reference in common two contributors had, the more the link between them was type drawn bold. For example, Strong and Bowditch gave four common references of French publications, whereas Gill and Collins only one. Isolated men (as James Macully) gave reference(s) that no one else quoted.

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<sup>11</sup> The color of the vertex refers to the activity of the contributor, its shape to the journal he published (MD for *The Mathematical Diary*, MMI for *The Mathematical Miscellany*, CM for *The Cambridge Miscellany*, MMO for *The Mathematical Monthly*). In case the contributor quoted French references in several journals, he was attributed the publication in which he wrote the more.

Picture 2. Thematic network of contributors quoting French textbooks or treatises in American mathematical journals (1818-1878).



One can point out a large sub-network (1) where Lacroix's *Traité élémentaire de calcul différentiel et de calcul intégral* was widely quoted. Meanwhile, those contributors all referred to one or both of the two treatises about mathematics mechanics: Laplace's *Mécanique céleste* and Lagrange's *Mécanique analytique*. In other words, transmission in American journals of the high-level French mathematics contents as those included in Laplace and Lagrange's works, came within a group of men who had to use and quote also the more elementary textbook of Lacroix in order to solve differential equations displaying movements of bodies. A large part of this group of men's contributions occurred between 1825 and 1839, in the two first journals of the studied period. Uses and needs of Lacroix's book disappeared in the 1840s with the death of some of contributors but mainly because mathematical physics problems to be solved with analysis seemed to interest fewer and fewer mathematicians in the studied journals<sup>12</sup>. For the analytical mathematics and applied mathematics to mechanics, the choice in terms of education readings was strongly correlated to high level and research interests.

Also, this thematic sub-network fits quit well the personal and professional network: Anderson and Adrain taught at Columbia; Catlin and Avery worked at Hamilton College; Adrain and Gill, both editors in chief of *The Mathematical*

<sup>12</sup> Mechanics and physics problems occupied 60% of all the questions in *The Mathematical Diary*, 19% in *The Mathematical Miscellany*, 0% in *The Cambridge Miscellany* and 14% in *The Mathematical Monthly* (Preveraud, 2014, pp. 363-367).

*Diary* and *The Mathematical Miscellany* drove exchanges between this group of contributors; Bowditch, Strong and Adrain were members of the same learned societies and published their works in the *Memoirs of the Academy of Arts and Sciences*; Bowditch was the tutor of Peirce, etc. This crossed approach indicates a close superposition of the social network and the thematic network, which tends to prove that diffusion of pure and applied analysis texts occurred in a community of mathematicians who knew each other and exchanged within the framework of their professional activities.

On the contrary, the introduction and circulation of Legendre's *Éléments de géométrie* came in a group of individuals (2) who were professionally, geographically and temporarily not or weakly connected. Plus, when they quoted Legendre, most of them only quoted him and did not refer to any other French publication. For example, none of them quoted modern geometry textbooks<sup>13</sup>. The lack of personal connections between these contributors has to be correlated with the good diffusion of Legendre's textbook in American teaching and publishing through its early translations (1818 and 1828). Those translations were mostly faithful to the original. Later ones (1834, 1844) transformed more deeply the French book contents and structure (Preveraud, 2014, Chapter 5 and Schubring, 2007, p. 49). They were widely used in colleges and high schools during the whole 19<sup>th</sup> century and became, as well as later French editions of Legendre's textbook, a source for other American geometry textbooks writing (Preveraud, 2014, Chapter 5).

Legendre's *Éléments de géométrie* was only quoted by teachers, whom four taught in secondary schools geographically isolated from each other: Hoyt worked in Massachusetts, Powers in Virginia, Richardson in Georgia, and Nulty in Pennsylvania. Men who quoted Legendre were not familiar with each other and worked at different moments of the time period 1818-1878. For example, Peirce directed *The Cambridge Miscellany* but Stevens wrote in Runkle's journal. The reputation and the large print-out of the text and of its translations that continued to be published for higher and secondary education even after 1850 enabled Legendre's *Éléments de géométrie* to be spread largely to individuals for their use in class without the support of a dense network like Lacroix's *Traité élémentaire de calcul différentiel et de calcul intégral* needed.

## Concluding remarks

First textbooks and treatises references in American mathematical journals enabled early contributors to shorten their proofs in problem solving writings. Later authors used French education contents rather to bring out to American readers new mathematical contents produced in France. Thus, the form of

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<sup>13</sup> Modern geometry treatises were quoted by mainly *Mathematical Monthly* writers: Collins, Newton, Wright, Henck, Brown and Hill.

quotations changed. At first only furtive references (author, title and concerned pages), they took the shape of shorts translations: theorems and proofs were produced with pedagogical goals.

Transmission of French education contents through journals was strongly correlated to uses of the existing textbooks corpus in American education. Early (1818, 1828) and well diffused translations of Legendre's *Éléments de géométrie* facilitated its dissemination to isolated secondary schools teachers who widely used it in their communications. On the opposite, the absence of Lacroix and Bourdon's books quotations in journals must be associated with the decline of algebra textbooks publications only relying on pure French analytical methods. In case of a translation's lack (as for Lacroix's *Traité élémentaire de calcul différentiel et de calcul intégral*, Laplace's *Mécanique céleste* before 1829 or pure geometry works), journals were the only way to diffuse foreign new contents as shown in (Bret, 2012, p. 960), and transmission concerned a small group of teachers at colleges and their students, all professionally and personally related.

Thus, American mathematical journals did not produce, transmit and diffuse scientific contents independently of education context. Partly because some of their contributors were involved in teaching mathematics, they responded to the evolution of mathematical science in France but within the yardstick of scholars' needs and uses, approaches and tendencies of American textbooks publishing.

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## References

- Adrain, Robert (Ed.) (1825-1826). *The Mathematical Diary, 1*. New-York: Ryan.
- Ackerberg-Hastings, Amy (2002). Analysis and Synthesis in John Playfair's Elements of Geometry. *The British Journal for the History of Science*, 35, 1, 43-72.
- Albree, Joe & Brown, Scott H. (2009). A valuable monument of mathematical Genius: *The Ladies' Diary* (1704-1840), *Historia Mathematica*, 36, 10-47.
- Bret, Patrice (2012). Sciences et techniques. In Chevrel, Yves, D'Hulst, Lieven & Lombez, Christine (Eds.), *Histoire des traductions en langue française- XIX<sup>e</sup> siècle* (pp. 927-1005). Paris: Verdier.
- Carnot, Lazare (1803). *Géométrie de position*. Paris: Duprat.
- Cajori, Florian (1890). *The Teaching and History of Mathematics in the United States*. Washington: Bureau of Education.
- Cauchy, Augustin Louis (1821). *Cours d'analyse de l'École royale polytechnique. 1<sup>re</sup> partie. Analyse algébrique*. Paris: Debure frères.
- Chasles, Michel (1852). *Traité de géométrie supérieure*. Paris: Bachelier.

- Crosland, Maurice (1992). *Science under control, The French Academy of Sciences, 1795-1914*. Cambridge: Cambridge University Press.
- Dhombres, Jean (1895). French Mathematical Textbooks from Bézout to Cauchy. *Historia Scientiarum*, 28, 91-137.
- Dhombres, Jean & Otero, Mario (1993). Les Annales de mathématiques pures et appliquées: le journal d'un homme seul au profit d'une communauté enseignante. In Ausejo, Elena & Hormingon, Mariano (Eds.), *Messengers of Mathematics: European Mathematical Journals, 1810-1939* (pp. 3-70). Madrid: Siglo XXI de España Editores.
- Gill, Charles (Ed.) (1836-1839). *The Mathematical Miscellany*. New York: Flushing Institute.
- Hahn, Roger (2005). *Pierre Simon Laplace, 1749-1827: A Determined Scientist*. Cambridge: Harvard University Press.
- Hogan, Edward R. (1985). The Mathematical Miscellany (1836-1839). *Historia Mathematica*, 12, 245-257.
- Karpinski, Louis C. (1940). *Bibliography of Mathematical Works Printed in America through 1850*. Ann Arbor: University of Michigan Press.
- Kent, Deborah (2008). The Mathematical Miscellany and The Cambridge Miscellany of Mathematics: Closely connected attempts to introduce research-level mathematics in America, 1836-1843. *Historia Mathematica*, 35, 102-122.
- Kline, Morris (1990). *Mathematical Thought From Ancient to Modern Times*, 3. New York: Oxford University Press. 1972.
- Lacroix, François-Sylvestre (1815). *Éléments d'algèbre*. Paris: Courcier (11<sup>th</sup> edition).
- Legendre, Adrien-Marie (1794). *Éléments de géométrie*. Paris: Didot.
- Legendre, Adrien-Marie (1825). *Traité des fonctions elliptiques*. Paris: Huzard-Courcier.
- Michalowicz, Karen D. & Howard, Arthur C. (2003). Pedagogy in Text: An Analysis of Mathematics Texts from the Nineteenth Century. In Stanic, George M.A. & Kilpatrick, Jeremy (Eds.), *A History of School Mathematics* (pp. 77-109). Reston: National Council of Teachers of Mathematics.
- Parshall, Karen H. & Rowe, David E. (1994). *The Emergence of the American Mathematical Research Community, 1876-1900: J.J. Sylvester, Felix Klein, and E. H. Moore*. Providence: American Mathematical Society.
- Peirce, Benjamin & Lovering, Joseph (Eds.) (1842-1843). *The Cambridge Miscellany of Mathematics, Physics and Astronomy*. Boston: Munroe & Co.
- Poncelet, Jean-Victor (1822). *Traité des propriétés projectives des figures*. Paris: Bachelier.
- Preveraud, Thomas (2011). *Vers des mathématiques américaines. Enseignements et éditions : de Robert Adrain à la genèse nationale d'une discipline (1800-1843)*. Master degree dissertation. Nantes: université de Nantes.
- Preveraud, Thomas (2013). Destins croisés de manuels français en Amérique (1819-1862). L'exemple des *Éléments de géométrie* d'Adrien-Marie Legendre. In Barbin, Évelyne & Moyon, Marc (Eds.), *Les ouvrages de mathématiques dans l'histoire. Entre recherche, enseignement et culture* (pp. 43-56). Limoges: PULIM.
- Preveraud, Thomas (2014). *Circulations mathématiques franco-américaines (1815-1876) : Transferts, réceptions, incorporations et sédimentations*. Ph. D. dissertation. Nantes: université de Nantes.
- Pycior, Helena (1989). British Synthetic versus French Analytic Styles of Algebra in the Early American Republic. In Rowe, David E. & McCleary, John (Eds.), *The History of modern mathematics* (pp. 125-154). San Diego: Academic Press.
- Runkle, John D. (Ed.) (1858-1859). *The Mathematical Monthly*, 1. Cambridge: Bartlett.
- Runkle, John D. (Ed.) (1860). *The Mathematical Monthly*, 2. New-York: Ivison, Phinney & Co.



- Runkle, John D. (Ed.) (1860-1861). *The Mathematical Monthly*, 3. Cambridge: Sever and Francis.
- Ryan, James (Ed.) (1826-1832), *The Mathematical Diary*, 2. New-York: Ryan.
- Schubring, Gert (2007). La diffusion internationale de la géométrie de Legendre: différentes visions des mathématiques, Raisons - Comparaisons - Éducatons. *La Revue Française d'Éducation Comparée*, 2, 31-54.
- Simons, Lao G. (1931). The influence of French Mathematics at the End of the Eighteenth Century upon the Teaching of Mathematics in American Colleges. *Isis*, 15, 1, 104-123.
- Timmons, Todd (2003). A prosopographical analysis of the early American mathematics publication community. *Historia Mathematica*, 31, 429-454.
- Wilson, James Grant & Fisk, John (Eds.) (1887). *Appletons' Cyclopaedia of American Biography*, 1-6. New-York: Appleton and Company.