

THE PROCESS OF RECOGNITION IN THE HISTORY OF MATHEMATICS¹

Adriana Cesar de Mattos
Universidade Metodista de Piracicaba (UNIMEP)
London South Bank University (LSBU)
Address: rua 6, 2195,Rio Claro, São Paulo, Brazil, CEP:13500-190
amarafon@unimep.br

ABSTRACT

Mathematical ideas are constructed under political contexts. D'Ambrosio (2005) uses the term 'co-opt' to designate the "...strategy to organize a society and to legitimate a power structure". The power of scientific community is based on acceptance of the members on the authority (Weber, 1978) of committees that are established by such a specific community.

I decided to use the History of Mathematics as a way to support my thesis, as a methodology. Therefore I decided to focus on a name, a British mathematician from 19th century, Arthur Cayley. I have no interest in valuing a certain historical period or a particular mathematician. I decided to study the 19th century since it is a period not so far from our epoch, and at the same time enough far to guarantee Cayley's name in the History of Mathematics.

I decided to look for mathematicians who did not earn their income as mathematicians. In principle, I could have focused on Arthur Cayley or Sylvester, but since Sylvester lived for a long time in the USA and it would have been difficult to have access to his archives, I decided to focus only on Arthur Cayley. Mathematical historians believe that Cayley developed some of his best work when his income was not related to his research in Mathematics; it had been present in the community by means of publications. What is interesting is that although he did not have a direct connection with the Mathematics Community in terms of his income, he belonged to this community through his publications. In the following years, in 1863 to be precise, Cayley was appointed as Professor of Pure Mathematics at the University of Cambridge.

1. Introduction

I am considering as documents minutes, letters, statutes among others. I located the documents in *the London Mathematical Society* (sede), *the Special Collection, Royal Society of London*, *the Main Library* of University of Cambridge, *Trinity College* (University of Cambridge) *the British Library*, *the Berlin Academy of Sciences* and *the Municipal Library* of Berlin.

In London, I had access a system that links all the libraries of England to the British Library. I made use of this service and I requested books to be sent to the London South Bank University Library. This system enables common rules between libraries. It made my work possible, considering the time and funds I received for this research. If I have not found this

¹ This paper has been submitted for publication to the proceedings of ESU 5.

service the solution would have been to travel to the different libraries to find the books, old books, and to be submitted to different kind of rules.

The organization of archive is not an important detail in the work process. German or British archives are places prepared to accommodate historians. They have archivists in the archives, people who know how to find the information you need, and this is a crucial aspect. It is so far been true in any archive I have visited. It is very easy to be in the situation where the archive is not organized at all, no-one has any idea or responsibility about the documents you need.

2. Research Focus

The focus of this study is on recognition mechanisms. I considered it reasonable to base such a study on archives in order to establish an historical interpretation about ‘genius’ and ‘knowledge’ in Mathematics.

I aimed at answering the following questions:

- (1) What made Cayley’s work well-known?
- (2) Which were the conditions for a mathematician to belong to the British community of Mathematics in the nineteenth century?
- (3) Which are the conditions for a mathematician to exist in the History of Mathematics?

3. About Cayley

Cayley’s work had been known in the community by means of his publications. Although he did not have a direct connection with the Mathematics Community due to his income, he belonged to this community by through publications.

In 1863 Cayley was appointed as Professor of Pure Mathematics at the University of Cambridge. Cayley published in several journals such as the Cambridge Mathematical Journal, the Cambridge Philosophical Transaction, the Philosophical Magazine, the Cambridge and Dublin Mathematical Journal, Crelle, the Proceedings of the London Mathematical Society, the American Journal of Mathematics. Of course, publication is a necessary but not sufficient condition to make a work well-known. In the minutes of the London Mathematical Society or the Royal Society, one can find names of Committee members, such as referees and authors, who are not included in Mathematical History books.

Cayley was quoted in the books of History of Mathematics such as *A short Account of the History of Mathematics* (Ball, 1893, 1901,1919), *Men of Mathematics* (Bell, 1965), *História da Matemática* (Boyer, 1974), *A History of Mathematics* (Cajori, 1894, 1919, 1922, 1928, 1938), *Introdução à História da Matemática* (Eves, 1995), *A History of Mathematics: An Introduction* (Katz, 1998), *Development of Mathematics in The 19th Century* (Klein, 1928), *The short History of Mathematics* (Sandford, 1930), *History of Modern Mathematics*

(Smith, 1896, 1900, 1906), *The progress of Algebra in the last quarter of a century* (Smith, 1925), *History of Mathematics* (Smith, 1958), and *100 years of Mathematics* (Temple, 1981).

4. The dissemination of a work is essential

A work, to become part of the History, depends on a sort of effort, namely, an effort which produces value to a theory or to a name.

Who or what should produce value on a theory or a name? Remarkably, for a work to be considered valued must become known. It does not matter if people hate or love it, or make it trivial, but rather dissemination of a work is essential, since there is no work valued if it is not mentioned in the History. Referees, examiners, lecturers or interlocutors were part of Cayley's academic life. His credibility is the result of their effort, an effort to produce *prestige* based on his work. Dissemination is responsibility of historians. The archive organization provides *material conditions* to historians' work, insofar as it is a 'proof' of historical recognition. Historians of Mathematics and mathematicians occasionally organize the documents related to a person that they recognize as a meaningful name in order to preserve his/her memory. The historian of Mathematics, Walter Willian Rouse Ball, Fellow of Trinity College (University of Cambridge), and the mathematician Andrew Russel Forsyth, Sadlerian Professor of Pure Mathematics (University of Cambridge), were responsible for organizing Cayley's documents. It is possible to verify, based on their letters, that they put effort into organizing the documents in order to make the material accessible to the historians.

In a letter sent to Henry Cayley (Cayley's son) on 25th of September 1923, Ball said: *I gather that everything of value in the MS memoirs and papers has been already printed. All appears to have been carefully examined by Forsyth many years ago, and nothing more can be picked out for publication (9).*

5. Academic Recognition

Academic recognition is the *constitution of codes of prestige* (Baudrillard, 1972) exercised through *vigilance* (Foucault, 1977). It is produced in ideological apparatuses (Althusser, 1980) such as universities, research centres and academic societies. The basic element of these apparatuses is the fact that they are governed by decreed norms which must agree with the State of the Law, on behalf of an object such as engineering, mathematics, physics etc. Those objects should be invested with 'value' or prestige based on the *code of utility* (Baudrillard, 1972) which justifies and guarantees the financial and administrative maintenance of these institutions (Marafon, 2001).

6. Cayley's election to the Sadlerian Position at University of Cambridge

Clare College Lodge May 19, 1863 Notice is hereby given, that an Election of a person to fill the Office of Sadlerian Professor of Pure Mathematics will take place at Clare College Lodge, on Wednesday the 10th of June, at Ten o'clock in the Morning. All Candidates for Election to the said Professorship are requested to communicate with the Vice-Chancellor on

or before Saturday the 6th of June. The Electors are, the Vice-Chancellor, the Master of Trinity College, the Master of St Peter's College, the Master of St John's College, the Lucasian, the Plumian, and the Lowndean Professors. EDWARD ATKINSON, Vice-Chancellor. The candidates were T. Gaskin; J.G. Niould; P. Frost; A. Cayley; I. Todhunter; N.U. Ferrers; E.J. Roult; J.C.W. Ellis. No votes were given for any one but Cayley. (3) The candidate I. Todhunter published works in Algebra and History of Mathematics. It is possible to find his books in the British Library catalogues. With regard to the other names, except Cayley, I did not find them in the archives, in the catalogues of British Library or in the minutes of London Mathematical Society.

7. Mechanisms of recognition

In the minutes of the London Mathematical Society (LMS), I have observed that in the meetings between 1865 to 1880 the chair's position used to be taken by Prof. Hirst, Prof. Meph Adler, Prof. Sylvester or Prof. Cayley. In the meetings, the members used to distribute the papers to the referees and to organize the publication for the following number of the *Proceedings of London Mathematical Society*. The names related to papers used to be the same ones.

Publication is the most important evidence of recognition, of the *constitution of prestige* (Baudrillard, 1972), and of course it is exercised by vigilance, which is the role of the referees. In D'Ambrosio's (1989) view, the publication is based on a filter system, it has a function: the maintenance of the principles of a Scientific Society or a Scientific Academy or an Institution or so on. Althusser (1976) would call the filter system an ideological apparatus, which works to maintain the hegemonic ideology. The documents I have collected, related to British community of Mathematics in the 19th century, were associated with the Institutions: Trinity College at Cambridge University, London Mathematical Society, Royal Society, Berlin Science Academy (*Crelle*), Académie des Sciences (Paris) and others.

On one hand, to publish in reputable journals was condition for being considered a respectable mathematician. On the other hand, it is possible to find personalities who were not members of a specific scientific society nor had published in a respectable journal.

De Morgan, responsible for the creation of London Mathematical Society, was not member of Royal Society, he refused a Fellowship; G. Cantor did not publish in *Crelle's* journal. In both cases, the names were well known between the members of the Royal Society or *Crelle's* publishers. Mechanisms of recognition such as examinations, publications or scientific societies, produce a result according to the expectation, at least for an important fraction of the Institution or Community. It is clear that in the Cayley's election to the Sadlerian position, all the votes were for Cayley. It does not matter whether people involved with the election liked him or not but, since the name was 'Cayley', many observers were judging Cayley's election. The Mathematics Community expected Cayley's recognition by the University of Cambridge. And it happened, since Cayley became a Sadlerian Professor.

When Cayley applied for the Sadlerian position, he had published yearly from 1841 onwards. We can't forget that he used his free time to work on Mathematics. For about 15

years he worked as a barrister. It does not matter whether he liked Mathematics very much, whether he understood something more than the others, whether God gave the talent to him or even if he was different in a biological sense. The fact is that he spent his life on Mathematics.

Cayley was British, he was student of King's College School, he was student of Trinity College, three aspects that increase the probability for a person to become at least a mathematician integrated into the scientific community.

If the Educational System expects to produce a good result, it is sure that Cayley is an appropriate example. I cannot answer for the role of his teachers in high school, or his family in his mathematical progress. I don't know how many students were encouraged to make their careers as a mathematician like him. The documents about him are part of the archive, and obviously ordinary names evaporated.

REFERENCES

Index of Documents

- (1) Royal Society of London. *Statutes of The Royal Society*. London: MDCCCXLVII, 1847, pp. : 21-22.
- (2) University Archives. *University of Cambridge*. Sadlerian Professor. 21 October, 1857. CUR 39.27.pp. : 2-8,29-32
- (3) University Archives. *University of Cambridge*. Election of Professors from 1826. 19 May, 1863. O.XIV.52.pp. : 127-8, 224.
- (4) London Mathematical Society. *Minutes*,. 16 April, 1866.
- (5) London Mathematical Society. *Minutes*,. 19 May, 1866.
- (6) London Mathematical Society. *Minutes*. 18 June, 1866.
- (7) Trinity College Library. *University of Cambridge*,. Portraits of Maths: 1882-1910. A. Cayley/ W.W.R.Ball. 1 November, 1888. ADV Album 3, volume C, 11.1.
- (8) Trinity College Library. *University of Cambridge*,.A.R.Forsyth/ W.W.R.Ball. 13 June,1923. Add.22.1.
- (9) Trinity College Library. *University of Cambridge*,. H. Cayley/ W.W.R.Ball. 25 September, 1923. Add. 0.6.6³⁹⁽¹⁾.
- (10) Trinity College Library. *University of Cambridge*,. H. Cayley/ W.W.R.Ball. 27 September, 1923. Add. 0.6.6³⁷.
- (11) Trinity College Library. *University of Cambridge*, W.W.R.Ball/H.F.Barker. 1 October, 1923. Add. 0.6.6¹⁰.
- (12) Trinity College Library. *University of Cambridge*, W.W.R.Ball/G.T.Bennet. 1 October, 1923. Add. 0.6.6²⁰.
- (13) Trinity College Library. *University of Cambridge*, W.W.R.Ball/R.F.Scott. 1 October, 1923. Add. 0.6.6²⁹.
- (14) Trinity College Library. *University of Cambridge*, W.W.R.Ball/D.E.Smith. 1 October, 1923. Add. 0.6.6³⁰.
- (15) Trinity College Library. *University of Cambridge*, W.W.R.Ball/E.H. Neville. 6 October, 1923. Add. 0.6.6²⁷.
- (16) Trinity College Library. *University of Cambridge*, R.F.Scott/W.W.R.Ball. 1 October, 1923. Add. 0.6.6⁹.
- (17) Trinity College Library. *University of Cambridge*, H.W. Richmond/W.W.R.Ball. 2 October, 1923. Add. 0.6.6⁸.
- (18) Trinity College Library. *University of Cambridge*. H.W.Turnbull/W.W.R.Ball. 2 October, 1923. Add.0.6.6¹².
- (19) Trinity College Library. *University of Cambridge*. P.W.Wood/W.W.R.Ball. 2 October, 1923. Add. 0.6.6¹⁵.
- (20) Trinity College Library. *University of Cambridge*.D.E.Smith/W.W.R.Ball. 11 October, 1923. Add. 0.6.6¹¹⁽¹⁾.
- (21) London Mathematical Society. *Memorandum and Articles of Association and BY – LAWS of London Mathematical Society*, June of 1936, pp. : xvi- xvii.

Printed Works

- Althusser, L., 1976, *Posições - 2*. Tradução: Manuel Barros da Motta, Maria Laura Viveiros de Castro e Rita Lima. Rio de Janeiro: Edições GRALL Ltda.
- Baldino, R.R. ; Cabral, T.C.B., 1997, Os quatro discursos de Lacan e a Educação Matemática. *Quadrante*, v. 6, n.2, p.1-23.
- Ball, W.W. R., 1893, *A short Account of the History of Mathematics*. Second edition. London: Macmillian an CO., Limited:
- _____, 1901, *A short Account of the History of Mathematics*. Third Edition. London: Macmillian an CO., Limited.
- _____, 1918, *Cambridge Paper*. Second Edition. London: Macmillian an CO., Limited.
- _____, 1919, *A short Account of the History of Mathematics*. Streotyped Edition. London: Macmillian an CO., Limited:
- _____, 1921, *Cambridge Notes*. Second Edition. Cmbridge: W.Heffer & Sons LTD.
- Baudrillard, J. , 1972, *Para uma crítica da Economia Política do Signo*. Trad. A. Alves. São Paulo: Livraria Martins Fontes Editora Ltda.
- Bell, E.T. , 1965, *Men of Mathematics*. New York: Simon and Shuster.
- Boyer, C.B., 1974. *História da Matemática*. Edgard Blücher. São Paulo.
- Burrage, M. ; Torstendahl, R., 1990,. *Professions in theory and history : rethinking the study of the professions*. London : Sage.
- Cajori, F., 1894, *A History of Mathematics*. Macmillan & Co.: New York & London.
- _____, 1919, *A History of Mathematics*. Second edition, revised and enlarged, Macmillan & Co.: New York & London.
- _____, 1922, *A History of Mathematics*. Ed.2, revised and enlarged, Macmillan & Co.: New York & London.
- _____, 1928, *A History of Mathematical Notations*. Volume I. London: Te open court company, publishers.
- _____, 1938, *A History of Mathematics*. Ed.2, revised and enlarged, Macmillan & Co.: New York & London.
- Carson, G,St,L. e Smith, D. E., 1914, *Elements of Algebra: part I*. Lodon, Boston, New York, Chicago:Ginn and Company.
- Crilly, T., 1986, *Historia Mathematica*. Volume XIII. Berlin, International Commission on the History of Mathematics of the Division of the History of Science of the International Union of the History of Philosophy of Science.
- D'Ambrosio, U., 1989, Do Misticismo à Mistificação. In: *Congresso Latino-Americano de História da Ciência e da Tecnologia*, 2., Nova Stella, SP. *Anais...*, p. 505-509.
- _____, 2005, *Sobre uma história da criação e a idéia de cooptação presente nessa história*. [HTTP://WWW.KULT.LU.SE/LATINAM/UVLA/HISTÓRIA_DA_CRIAÇÃO.HTM](http://www.kult.lu.se/LATINAM/UVLA/HISTÓRIA_DA_CRIAÇÃO.HTM)
- Doll, W., [s/d], *Manter o Conhecimento Vivo*. In: www.artmed.com.br.
- Enciclopédia Mirador Internacional., 1983. Rio de Janeiro e São Paulo: *Encyclopaedia Britânica do Brasil*. Publicações Ltda.
- Eves, H., 1995, *Introdução à História da Matemática*. Editora da Unicamp.
- Foucault, M., 1971, *A Ordem do Discurso: aula inaugural no Collège de France*. Trad. L. R. Baldino. Edições Gallimard. (Mimeog.)
- _____, 1974, *As Verdades e as Formas Jurídicas: conferências*. Rio de Janeiro (RJ): Pontificia Universidade Católica do Rio de Janeiro – PUC. (Mimeog.)
- _____, 1977, *Vigiar e Punir: nascimento da prisão*. Tradução de Lígia M. Pondé Vassallo. Petrópolis, Vozes.
- _____, 1985, *Microfísica do Poder*. 4.ed. Tradução de Roberto Machado, Rio de Janeiro, Edições Graal.
- Gillispie, C.C. *Dictionary of Scientific Biography*. New York: Charles Scribner's sons, 1981.
- Gray, J. J., 1995, *The Mathematical Intelligencer*. v. 17. New York. Springer-Veriag.
- Katz, V.J., 1998, *A History of Mathematics: An Introduction*. 2.ed. Massachusetts, Addison-Wesley.
- Klein, F. 1979. *Development of Mathematics in The 19th Century*. Translated by M. Ackerman. Massachusetts: Math SCI Press, (Translation of *Vorlesungen uber die Entwicklung der Mathematik im 19 Jahrhundert*. Teil I, Berlin, 1928).
- Lacan, J., 1992, *O Seminário, Livro 17 : o avesso da psicanálise 1969-1970*. Trad. Ari Roitman. Rio de Janeiro: Jorge Zahar Ed.
- Ling, G. H., Wentworth, G. and Smith, D. E., 1922, *Elements of Projective Geometry*. Lodon, Boston, New York, Atlanta, Dallas, Columbus, San Francisco, Chicago:Ginn and Company.
- Marafon, A.C.M., 2001, *A vocação matemática como reconhecimento acadêmico*. Campinas (SP): UNICAMP, 2001. 325p. Tese de Doutorado – Curso de Pós-Graduação em Educação, UNICAMP-FE.
- Oliver, J.O., 1999, *Classical Invariant Theory*. London Mathematical society: Student Text 44.

- Platon., 1978, *Las leyes*. [S.l.] : Libro Séptimo, v.2. (Obras Maestras).
- Sandford, V., 1927, *The History and significance of certain standard problems in algebra*. New yourk city: Bureau of Publications. Teachers College, Columbia University.
- _____, 1930, *The short History of Mathematics*. New York, Boston, Chicago, Dallas, Atlanta, San Francisco: Houghton Mifflin company.
- Smith, D. E., 1896, *History of Modern Mathematics*. New York; Jon Wiley & Hall Limited, 1896.
- _____, 1898, *History of Modern Mathematics*. Second Edition. New York; Jon Wiley & Hall Limited.
- _____, 1900, *History of Modern Mathematics*. Third Edition. New York; Jon Wiley & Hall Limited.
- _____, 1906, *History of Modern Mathematics*. Fourth Edition. New York; Jon Wiley & Hall Limited.
- _____, 1925, *The progress of Algebra in the last quarter of a century*. Lodon, Boston, New York, Atlanta, Dallas, Columbus, San Francisco, Chicago:Ginn and Company.
- _____, 1958, *History of Mathematics*. Volume I. New York: Dover Publications, Inc.
- Temple, G., 1981, *100 years of Mathematics*. London: Gerald Duckworth & Co. Ltd.
- Weber, M., 1968, *Ciência e Política: Duas vocações*. Tradução de Leonidas Hegenberg e Octany Silveira da Mota. São Paulo: Editora Cultrix. 1968.
- _____, 1978, *Economy and Society*. Edited by Guenther Roth and Claus Wittich. University of California Press. Berkeley, Los Angeles, London.
- Wentworth, G. e Smith, D. E., 1911, *Vocational Algebra*. Lodon, Boston, New York, Chicago:Ginn and Company.
- _____, 1913, *Academic Algebra*. Lodon, Boston, New York, Chicago:Ginn and Company.
- _____, 1891, *High Algebra*. Boston, U.S.A:Ginn and Company.