Between biography and prosopography

the research school as a unit of analysis for considering the history of women in mathematics

History of mathematics beyond case-studies
AMS-EMS-SMF Joint Conference, Grenoble 2022

Jemma Lorenat, Pitzer College, jlorenat@pitzer.edu

The mathematician who is in any degree a specialist is in general rather solitary in the average college — he would have been better off in Noah's Ark, for at the worst there would have been two of a kind. For his mind's health it is well that he should occasionally be thrown in with those of kindred interests; it is well too that he should be made to feel the unity of mathematics.

Charlotte Angas Scott (1900)
The International Congress of Mathematicians in Paris
Bulletin of the American Mathematical Society

With the theme “beyond case-studies” the talks in this session have considered how to “draw together case-studies and examples within a sound and proper historical framework.”

We have seen examples of “drawing together” through terminology, theories, objects, citations, … with more examples later this morning.

Here I want to test the framework of a mathematical research school as a means of studying mathematics at Bryn Mawr College across the four decades when Charlotte Angas Scott led the department. I will say more about BMC and Scott shortly.

How is a research school a valuable unit of analysis for Bryn Mawr College mathematics?

While this will not be a global history, by moving from the individual mathematician or text to the research school, a more comprehensive and accessible picture emerges. In turn, the school may function as a comparable case study of learning and making mathematics. Is it representative? How might it fit in what framework? and the process continues…

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2. The research school in the history of science and mathematics
3. Hopes and plans for a research school
4. A Bryn Mawr mathematical research school
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the research school as a unit of analysis for considering the history of women in mathematics

Biography and prosopography

1. Biography
2. Prosopography

Accompagnée d’une véritable rigueur méthodologique, l’approche biographique possède alors un pouvoir heuristique réel en histoire des sciences: elle nous renseigne non seulement sur la réalité concrète de la production des savoirs, comme résultat d’un travail intellectuel qui trouve sens dans différentes espaces sociaux, mais aussi sur les conditions de possibilité de leur réception et sur leur existence dans la longue durée, tout en évitant l’opposition factice entre les oeuvres de science et le contexte social dans lequel elles prennent place.

Caroline Ehrhardt (2012)
“Approche biographique et biographie en histoire des mathématiques: le cas d’Évariste Galois”

Biography and prosopography

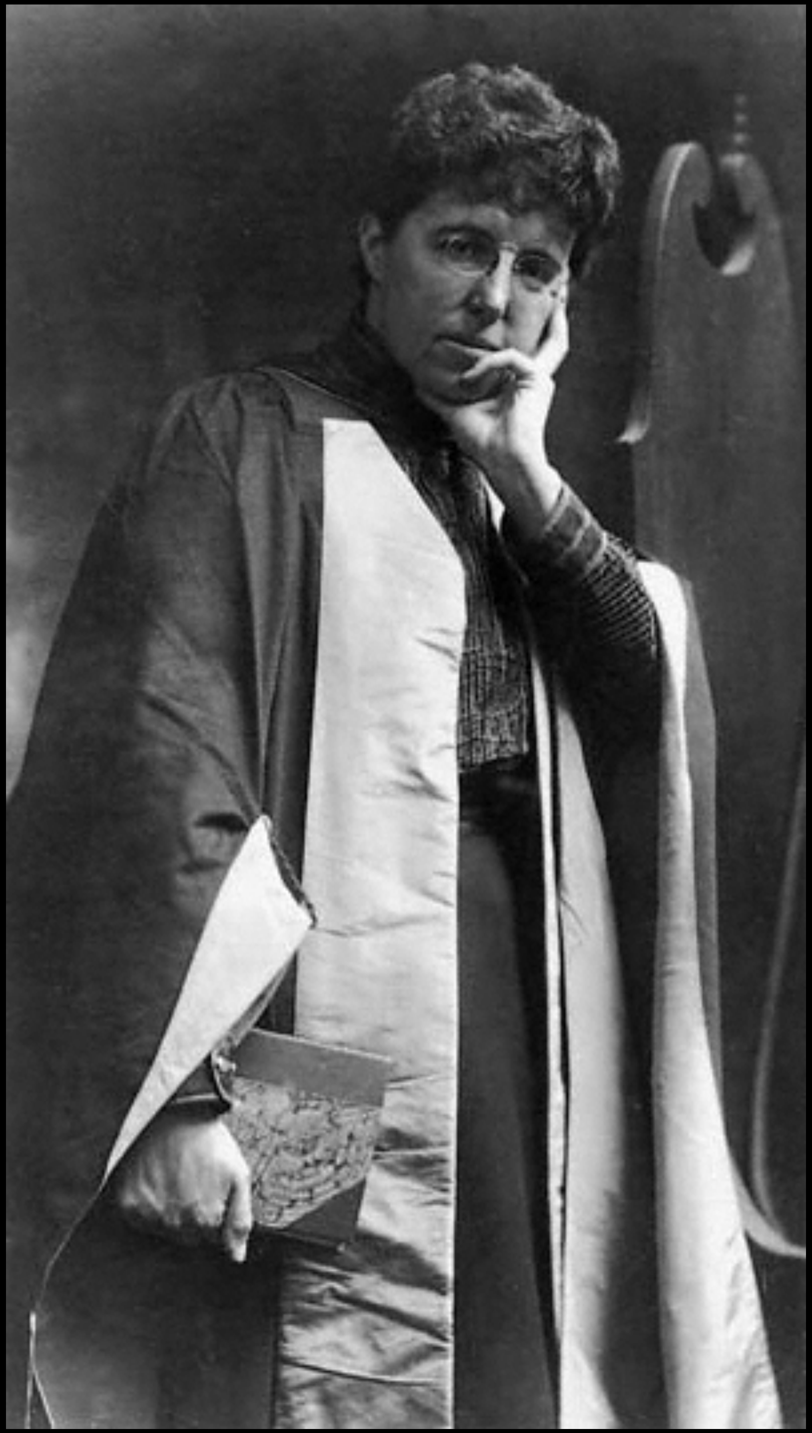
1. Biography
2. Prosopography

Scott crossed the Atlantic Ocean to become Bryn Mawr College's first mathematician as well as the first woman in the United States to hold a doctorate in mathematics. Her forty years in this country had an enormous impact on the young American mathematical community. In addition to her research, her widely used graduate text, and her influence as coeditor of the *American Journal of Mathematics*, Scott was an officer of the American Mathematical Society, a dynamic teacher of undergraduates, and a supervisor of doctoral dissertations. She inspired and enabled other women to enter mathematics.

Patricia Kenschaft (1987)
"Charlotte Angas Scott, 1858 – 1931"

Biography and prosopography

1. Biography
2. Prosopography



A favourite topic of Miss Scott's was higher singularities, on which she wrote several papers. The subject is abstruse, and not widely and completely known, and requires the explanation of several details in order that it may be clearly understood.

F. S. Macaulay (1931)
"Dr. Charlotte Angas Scott"

Biography and prosopography

1. Biography
2. Prosopography

MISS CHARLOTTE ANGAS SCOTT, OF GIRTON COLLEGE

Miss Scott will, we suppose, be made Mathematical lecturer at Girton now she has been bracketed with the eighth Wrangler. She should certainly have been born a boy instead of a girl.

Anonymous (1880)
"Gossip Pages"
Oxford and Cambridge Undergraduate Journal

Biography and prosopography

1. Biography
2. Prosopography

Strengths:

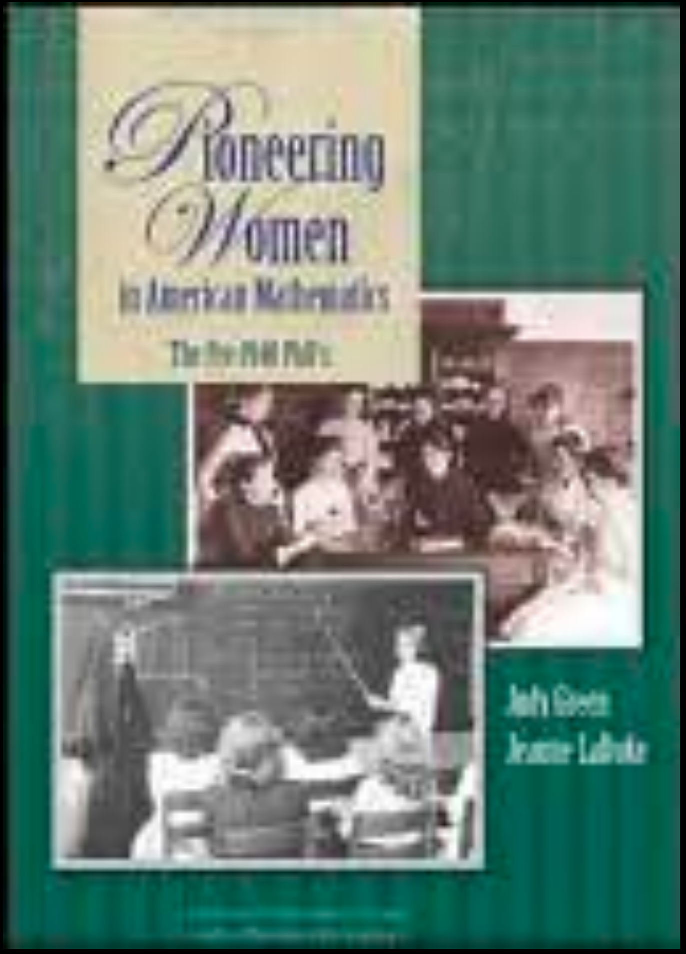
- documents Scott's early accomplishments, accolades, contributions, and affiliations
- renders Scott as human and personable
- assembles mathematical publications as part of chronology

Limitations:

- archival mismatch, no Nachlass
- research results abstruse, mostly set aside
- appears exceptional and extraordinary

Biography and prosopography

1. Biography
2. Prosopography



In this book, we focus on the work and careers of the 228 American women we have identified as receiving PhD's in mathematics before 1940. […] We do not include women who worked in the United States but were neither born nor received their doctorates there.

Judy Green and Jeanne LaDuke (2008)
Pioneering Women in American Mathematics: the Pre-1940 PhD's

Biography and prosopography

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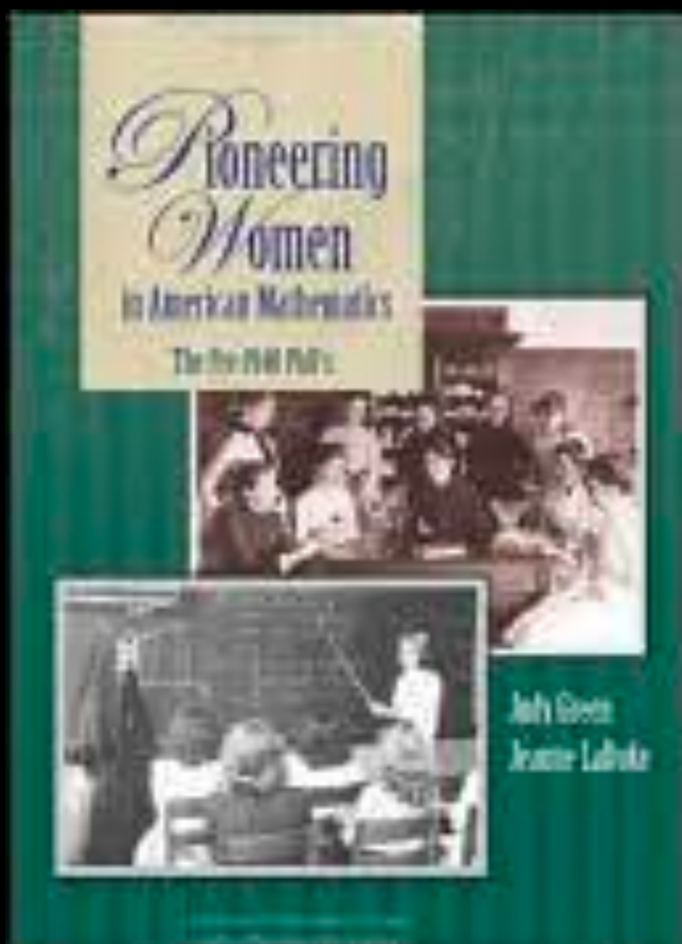
2. Prosopography



For the first two and one-half years the New York Mathematical Society had no women members, but the desire to publish a journal, the *Bulletin*, provided impetus for a major membership drive. Hence, in 1891, the first six women joined the NYMS. The first, admitted in May of that year, was Charlotte Scott of Bryn Mawr, a distinguished geometer who became one of the most active and recognized women in the early history of the Society, serving on the Council (1894–1897 and (1899–1901) and as vice-president (1906).

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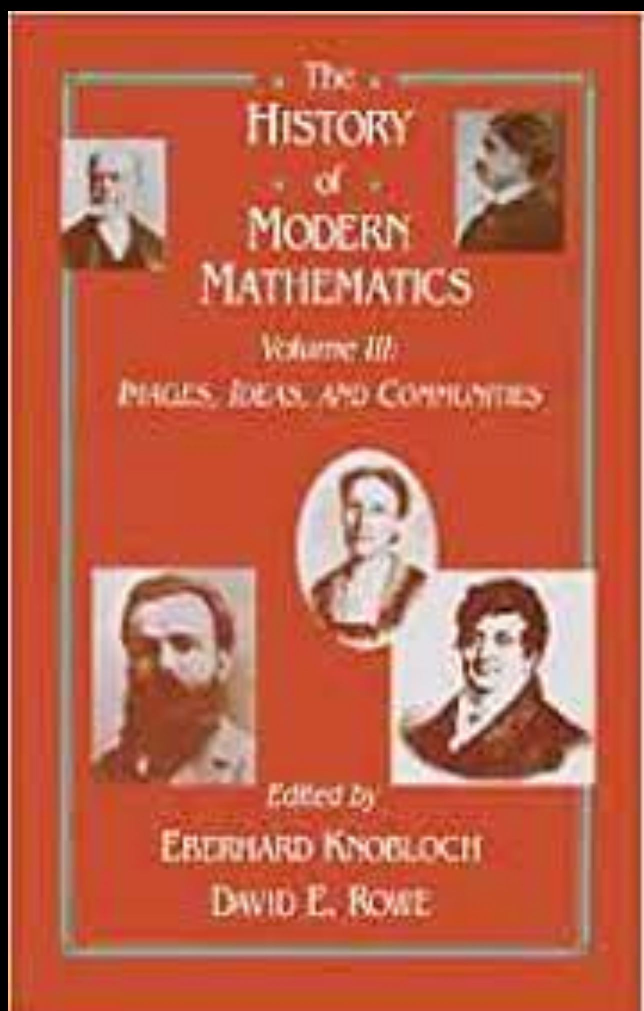
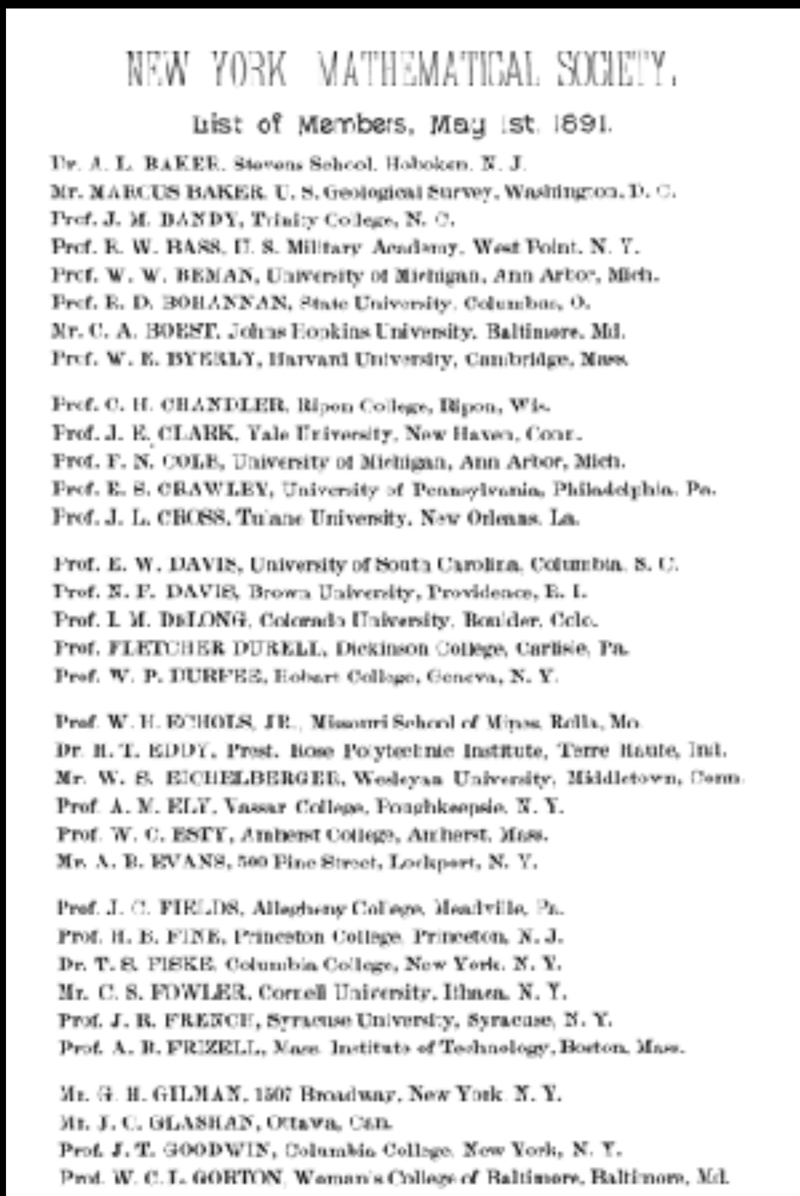


Scott read 12 papers before the Society, published 19 articles, and attended at least 23 mathematical meetings from 1891—1906. Her 18 service marks, however, reveal a great deal more about her influence and participation. She earned seven of these for the seven years she served on the(elected) Council of the AMS—the charter year of 1894, 1895–1897, and 1900—1902—and one for her year in the Society's Vice-Presidency in 1906. Her tenure as co-editor of the *American Journal of Mathematics* accounts for eight more, and the remaining two reflect her appointments both to the College Entrance Examination Board in 1903 with William H. Metzler and John S. French and as a collaborator on the French *Revue Semestrielle des Publications Mathematiques* in 1898

Della Fenster and Karen Parshall (1994)
"Women in the American Mathematical Research Community: 1891 – 1906"

Biography and prosopography

1. Biography
2. Prosopography


NEW YORK MATHEMATICAL SOCIETY.

List of Members, May 1st 1891.

Dr. A. L. BAKER, Stevens School, Hoboken, N. J.
Mr. MARCUS BAKER, U. S. Geological Survey, Washington, D. C.
Prof. J. M. BANDY, Trinity College, N. C.
Prof. E. W. BASS, U. S. Military Academy, West Point, N. Y.
Prof. W. W. BEMAN, University of Michigan, Ann Arbor, Mich.
Prof. E. D. BOHANNAN, State University, Columbus, O.
Mr. C. A. BORST, Johns Hopkins University, Baltimore, Md.
Prof. W. E. BYERLY, Harvard University, Cambridge, Mass.

Prof. C. H. CHANDLER, Ripon College, Ripon, Wis.
Prof. J. E. CLARK, Yale University, New Haven, Conn.
Prof. F. N. COLE, University of Michigan, Ann Arbor, Mich.
Prof. E. S. CRAWLEY, University of Pennsylvania, Philadelphia, Pa.
Prof. J. L. CROSS, Tulane University, New Orleans, La.

Prof. E. W. DAVIS, University of South Carolina, Columbia, S. C.
Prof. N. F. DAVIS, Brown University, Providence, R. I.
Prof. I. M. DeLONG, Colorado University, Boulder, Colo.
Prof. FLETCHER DURELL, Dickinson College, Carlisle, Pa.
Prof. W. P. DURFEE, Hobart College, Geneva, N. Y.

Prof. W. H. ECHOLS, JR., Missouri School of Mines, Rolla, Mo.
Dr. R. T. EDDY, Prest. Rose Polytechnic Institute, Terre Haute, Ind.
Mr. W. S. EICHELBERGER, Wesleyan University, Middletown, Conn.
Prof. A. M. ELY, Vassar College, Poughkeepsie, N. Y.
Prof. W. C. ESTY, Amherst College, Amherst, Mass.
Mr. A. B. EVANS, 500 Pine Street, Lockport, N. Y.

Prof. J. C. FIELDS, Allegheny College, Meadville, Pa.
Prof. H. B. FINE, Princeton College, Princeton, N. J.
Dr. T. S. FISKE, Columbia College, New York, N. Y.
Mr. C. S. FOWLER, Cornell University, Ithaca, N. Y.
Prof. J. R. FRENCH, Syracuse University, Syracuse, N. Y.
Prof. A. B. FRIZELL, Mass. Institute of Technology, Boston, Mass.

Mr. G. H. GILMAN, 1507 Broadway, New York, N. Y.
Mr. J. C. GLASHAN, Ottawa, Can.
Prof. J. T. GOODWIN, Columbia College, New York, N. Y.
Prof. W. C. L. GORTON, Woman's College of Baltimore, Baltimore, Md.

Strengths:

- Bryn Mawr identified as leading producer of doctorates
- general characteristics of women in mathematics (participation in AMS (about 7.5% of members in 1912), mostly teachers post-graduation, few research publications)

Limitations:

- Scott appears as an outlier
- shows that women participated in progressive era mathematics, but not *how* they began and sustained mathematical research

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Why and how to identify a “research school”

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In this paper, Morrell considers the factors that led to the success of Liebig's school, while Thomson's school remained "embryonic."

Later historians built on this work to explain the advantage of analyzing research schools, to extend the concept of a research school beyond the laboratory, and to identify defining features.

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The research school in the history of science and mathematics

A. Historical questions

B. Definitions

1. Coherence
2. Uniqueness
3. Success

[…] research schools offer historians a convenient category for better understanding how mathematicians produce their work, rather than focusing exclusively on the end products of these efforts, mathematical texts.

David Rowe (2008)
Mathematical Schools, Networks, and Communities

The research school in the history of science and mathematics

A. Historical questions

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[…] the types of problems they hoped to solve, the techniques available to tackle those problems, the prestige that mathematicians attached to various fields of research, and the status of mathematical research in the local environments and larger scientific communities in which higher mathematics was pursued.

David Rowe (2008)

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All these factors tend to 'localize' the historiography of mathematics, without, however, shifting the perspective simply to traditional accounts of individual achievements or intellectual biographies. Many recent studies in the history of mathematics address the level between universal and individual aspects, the level of intellectual environments and knowledge traditions, or research agendas and research tools shared by relatively small groups of scientists in a particular place and/or period.

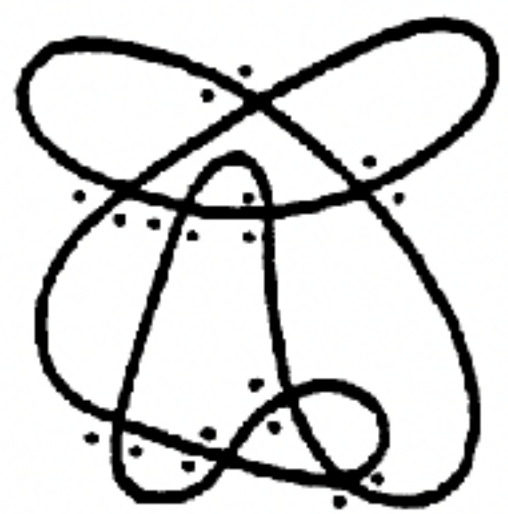

Fig. 942r.

Moritz Epple (2004)

Knot Invariants in Vienna and Princeton during the 1920s: Epistemic Configurations of Mathematical Research

The research school in the history of science and mathematics

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Putting together these characteristics of mathematics and its practice thus suggests the following components of at least a first approximation of a meaningful definition of a *mathematical* research school.

Karen Parshall (2004)

Defining a mathematical research school: the case of algebra at the University of Chicago, 1892–1945

The research school in the history of science and mathematics

1. a leader "who actively pursues research in a particular area of mathematics" and
2. "advocates a fundamental idea or approach to some set of inherently related research interests or research interests that become related by virtue of the idea or approach"
3. "trains students and, in so doing, imbues them with a sense not only of the validity and fruitfulness of the approach but also of the "right" way to go about asking and answering questions"
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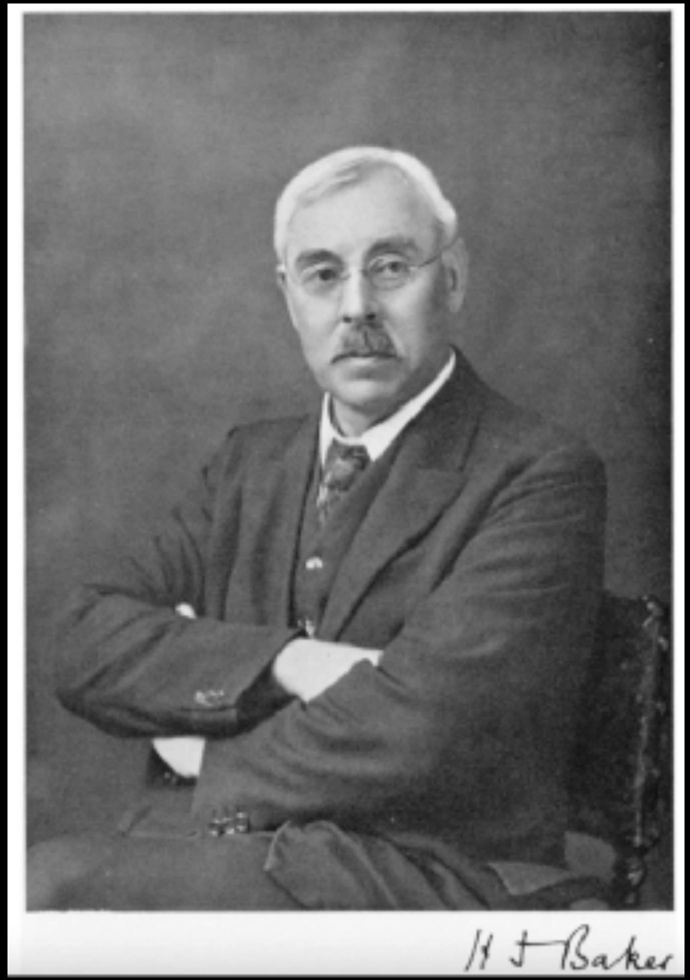

One could consider adding to Parshall's definition the further thought that the members of a school must themselves be cohesive — they must feel that they "belong."

June Barrow-Green and Jeremy Gray (2006)
Geometry at Cambridge, 1863—1940

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The coherence of a research school hinges on the fundamental approach or style of the school's leader.

Must the approach/style be unique?

Is success (Parshall's fourth component) a necessary factor to define a school?

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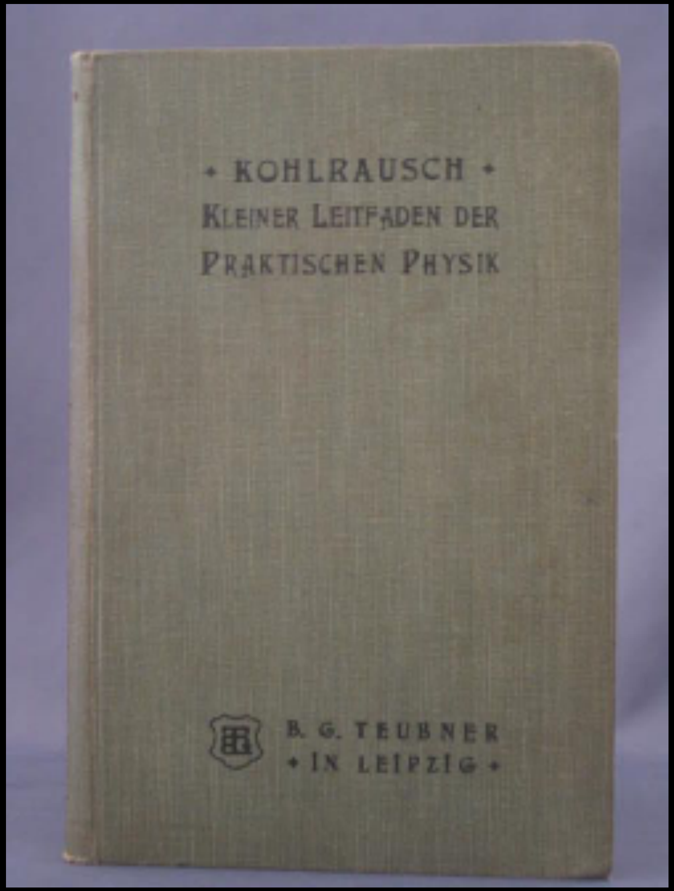

The explicit codification of practices, including those of data analysis, helped to create a school at Göttingen. But the widespread popularity of the Göttingen style, following Kohlrausch's publication of its characteristic practices in his textbook, diluted the distinctiveness of the school's identity.

Kathryn Olesko (1993)
Tacit Knowledge and School Formation

The research school in the history of science and mathematics

A. Historical questions

B. Definitions

1. Coherence

2. Uniqueness


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An abstract and structural approach came to characterize much of the algebraic work that issued from the University of Chicago over the course of the first five decades of the 20th century.

Karen Parshall (2004)

Defining a mathematical research school: the case of algebra at the University of Chicago, 1892–1945

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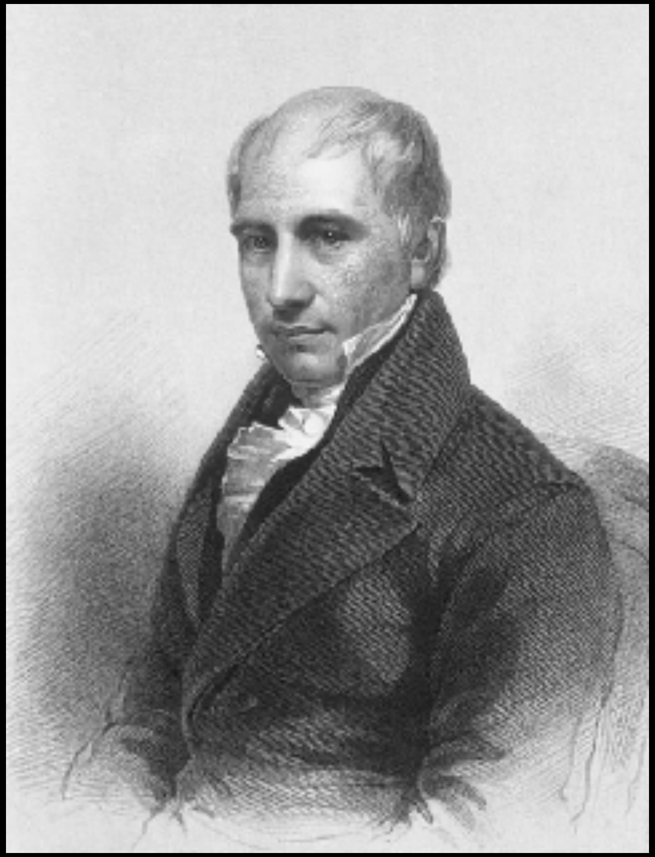

All this leads to the conjecture that in his Edinburgh laboratory Thomson had created a very small embryonic research school working on mineralogical analysis in a Wernerian framework. […]

In general, therefore, Thomson's laboratory was not a finishing school for prospective academic chemists: it was a nursery.

[…] his students lacked a set of routine dependable techniques with which they could occupy and colonise an area of research.

J. B. Morrell (1972)
The Chemist Breeders: the Research Schools of Liebig and Thomas Thomson

The research school in the history of science and mathematics

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But room should be left for the possibility of unsuccessful schools, which are perhaps too narrow, or go into a decline, as well as for the powerful successful schools that go on to produce new directions in mathematics.

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Did she aspire to create one at Bryn Mawr College? (Possibly)

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Hopes and plans for a research school

A. At Cambridge University

B. At Bryn Mawr College

C. Structural features

But what to us as mathematicians is more than all, as bearing on the future of our science, is that now for the first time will it be possible in Cambridge for an able and earnest worker and teacher to interest and engage his pupils in his work, and found a school such as we are so familiar with in foreign Universities, where the presence of a great professor has been almost invariably marked by a succession of illustrious pupils — pupils worthy of their master and worthy to carry on his work.

J. W. L. Glaisher (1886)
The mathematical tripos: a presidential address delivered before the London Mathematical Society

Hopes and plans for a research school

A. At Cambridge University

B. At Bryn Mawr College

C. Structural features

If one considered the ideas which were connected with such names as Cauchy, Riemann, Weierstrass, Lie, and Cantor, he [E. W. Hobson] thought it would be recognised that those ideas had never permeated the teaching of Cambridge mathematics to a sufficient degree to form a real school of mathematics which was in line with the best Continental schools.

On the Report, dated 16 March 1906, of the Special Board for Mathematics on the Mathematical Tripos
Cambridge University Reporter

Hopes and plans for a research school

A. At Cambridge University

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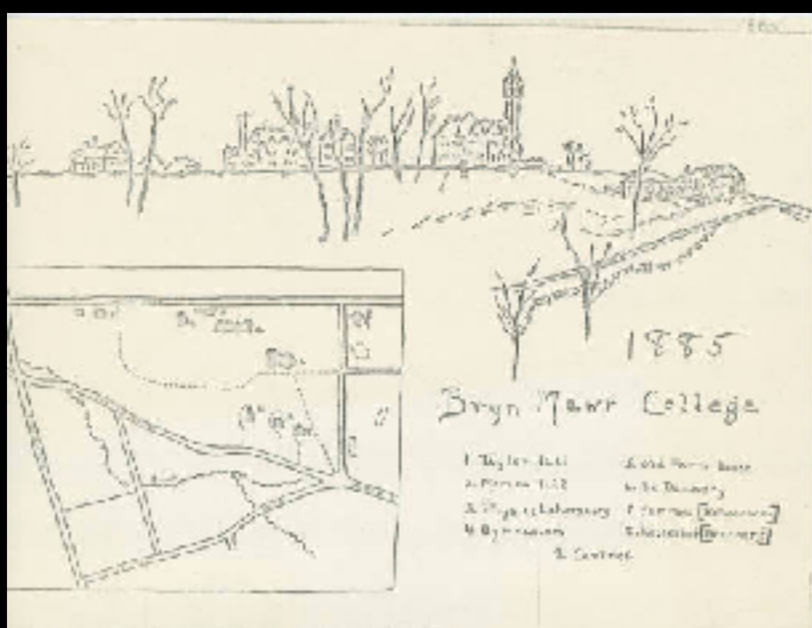

The duties will be to organize a department of Mathematics in the College and to teach not less than ten hours a week nor more than eleven during the first two years; the hours after that to be determined by the possibilities of diminishing the number consistently with the number of students and the means at command of the College.

James E. Rhoads, President of Bryn Mawr College (1884)
Contract of Employment for Charlotte Angas Scott

Hopes and plans for a research school

A. At Cambridge University

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C. Structural features

The supervision of professors, modern in their methods, will make it possible for such students to become acquainted with the progress already made in their own lines of work, while enabling them to become independent investigators.

Bryn Mawr College Circular (1884)

Hopes and plans for a research school

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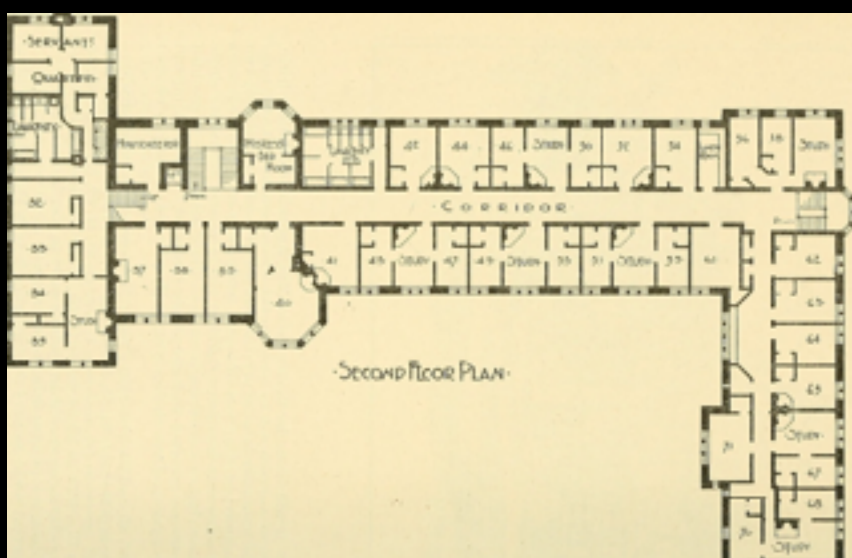
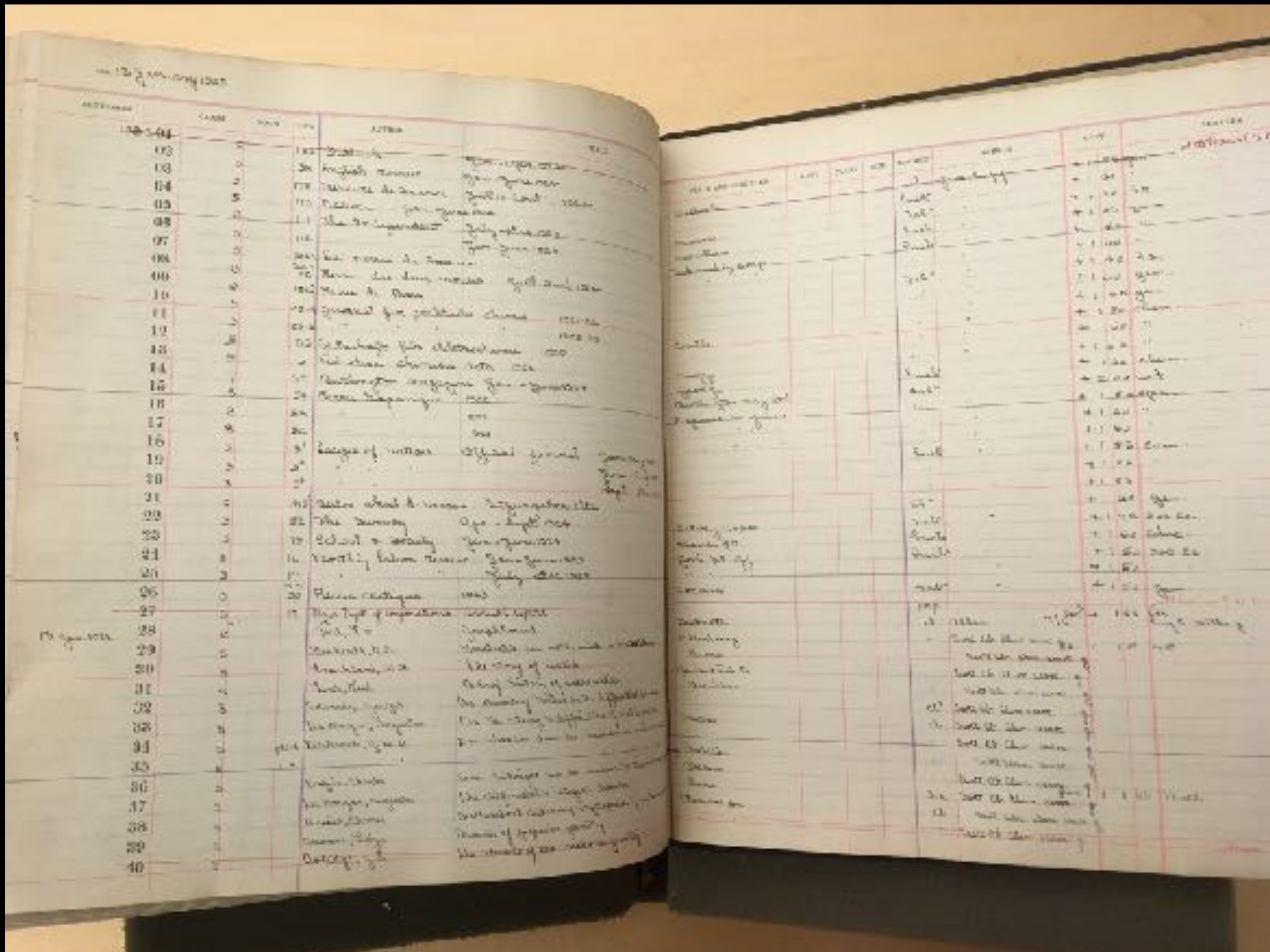
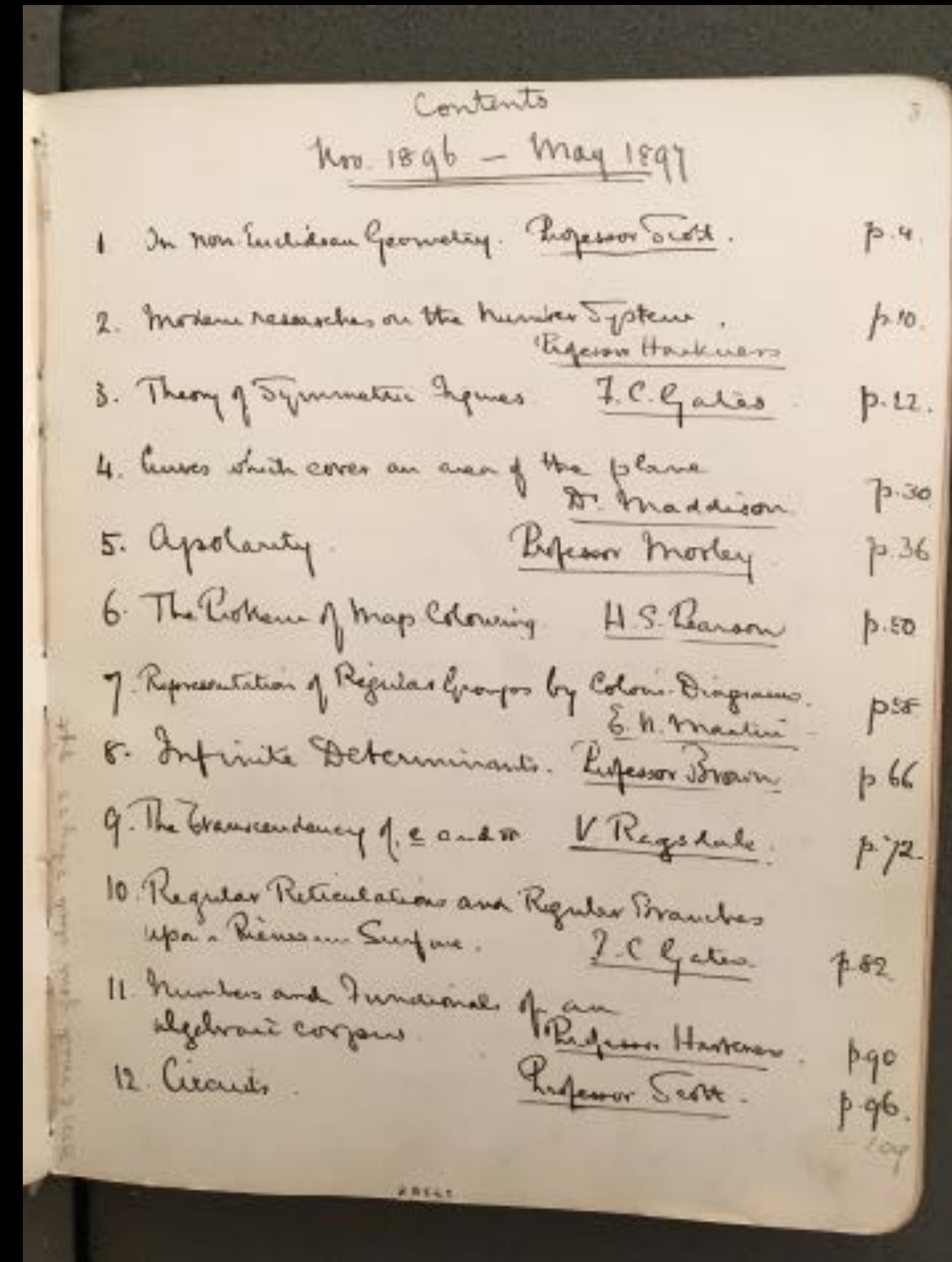


There is complete autonomy of teaching. Each member of the faculty has always given at least one-third of his or her hours of teaching to seminary work in the graduate school. Great stress is laid on research work, publication and success in seminary teaching in promotions.

M. Carey Thomas (1911)
Bryn Mawr College 25th Anniversary





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7. Representation of Regular Groups by Colour-Diagrams. E. N. Martin p.58
8. Infinite Determinants. Professor Brown p.66
9. The Transcendency of e and π V. Ragsdale p.72
10. Regular Reticulations and Regular Branches upon a Riemann Surface. F. C. Gates p.82
11. Numbers and Functionals of an algebraic corpus Professor Harkness p.90
12. Circuits Professor Scott p.96

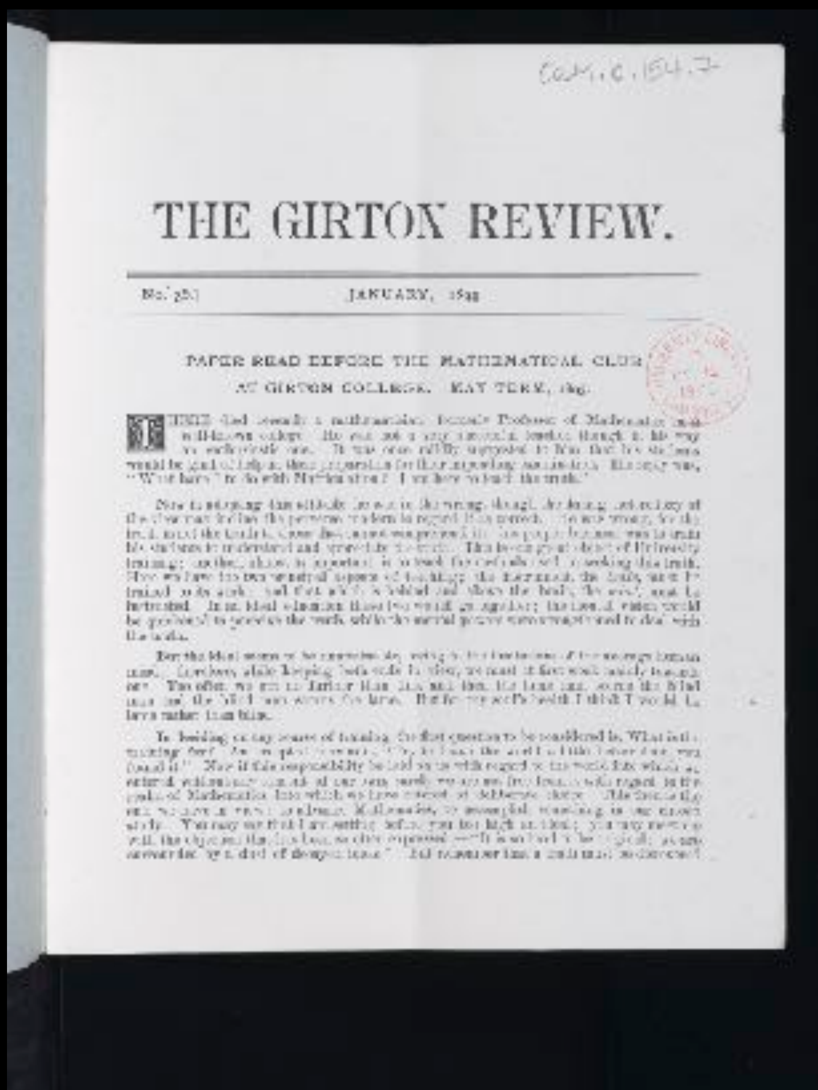
The archives of Bryn Mawr College evidence Scott's attention to institutional features promoting student research including books and periodicals, balanced and evolving course offerings, graduate fellowships, opportunities and funding for study in Europe, a biweekly Mathematics Journal Club, and the requirement to publish a dissertation in order to receive the doctorate.

Hopes and plans for a research school

A. At Cambridge University

B. At Bryn Mawr College

C. Structural features


THE GIRTON REVIEW.

JANUARY,

PAPER READ BEFORE THE MATHEMATICAL CLUB

AT GIRTON COLLEGE. MAY TERM,

What is the training for? An accepted maxim is, "Try to leave the world a little better than you found it." Now if this responsibility be laid on us with regard to the world into which we entered without any consent of our own, surely we are not free from it with regard to the realm of Mathematics, into which we have entered of deliberate choice. This then is the end we have in view : to advance Mathematics, to accomplish something in our chosen study.

Charlotte Angas Scott (1894)

Paper read before The Mathematical Club at Girton College

1. Biography and prosopography
2. The research school in the history of science and mathematics
3. Hopes and plans for a research school
4. A Bryn Mawr mathematical research school
5. Conclusions

Adopting the framework of a mathematical research school to historically situate Scott and her students and the environment of Bryn Mawr College requires the identification of a coherent fundamental approach or style.

Here I will define the Bryn Mawr College mathematical style (BMC style) in an iterative process beginning with a close comparative reading of Scott's research and the research of her students in the 1890s. From this corpus I determined three persistent features (motivation, theme, technique).

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Then I expanded the corpus to later graduate students (those who completed PhDs, those who published articles while at BMC, those who contributed to BMC Journal Club).

When their work exhibited these three features, I claimed these students as members of the Bryn Mawr mathematical research school. In turn their work served to refine the motivation, theme, and technique as fruitful in posing and answering problems outside the initial domain of application.

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A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

C. Technique: curve tracing

The analytical discussion of any geometrical theorem consists of four parts: —

I. The statement of the geometrical data; there are certain elements, whose positions are controlled by given conditions :
II. The algebraic expression of these conditions, by which certain equations are obtained :
III. Algebraic combinations and transformations applied to these equations :
IV. Geometrical interpretation of the results of these algebraic operations.

Charlotte Angas Scott (1894)
An Introductory Account of Certain Modern Ideas and Methods in Plane Analytical Geometry

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

C. Technique: curve tracing

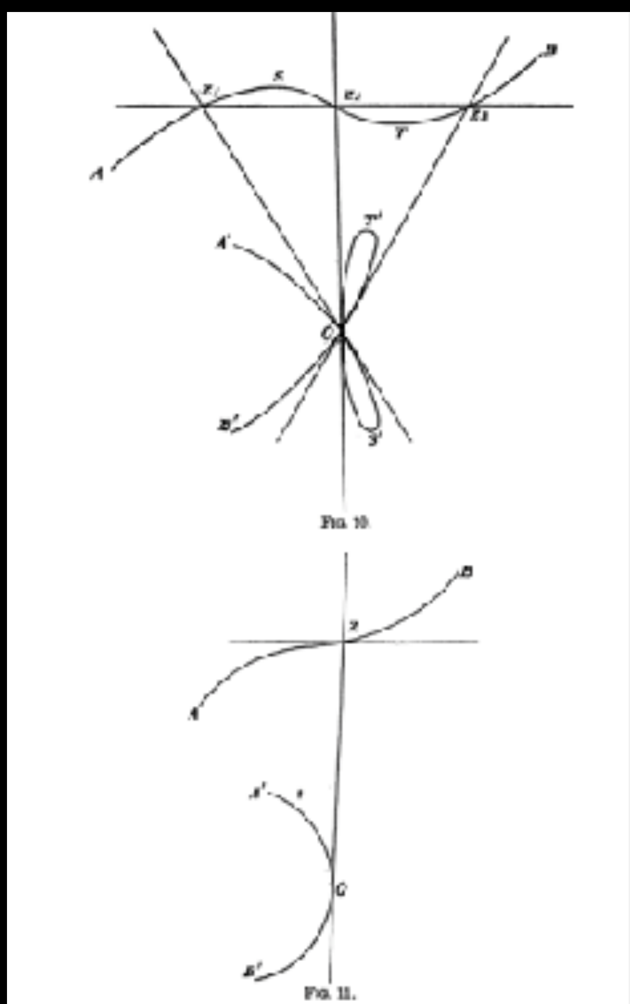


FIG. 10.
FIG. 11.

Is there any geometrical reality corresponding to this algebraic symbol? Do the numbers δ, χ , express actual facts or are they a conventional representation of the point to satisfy Plücker's equations? i.e. having determined that a certain compound singularity is equivalent to δ nodes, χ cusps, etc., is there a penultimate form in which these singularities exist indefinitely near together?

Charlotte Angas Scott (1892)
On the Higher Singularities of Plane Curves

THE

QUARTERLY JOURNAL

OF

PURE AND APPLIED

MATHEMATICS.

EDITED BY

J. W. L. GLAISHER, Sc.D., F.R.S.,

FELLOW OF TRINITY COLLEGE, CAMBRIDGE.

VOL. XXVIII.

LONDON:
LONGMANS, GREEN, AND CO.,
PATERNOSTER ROW.

1896.

CONTENTS OF VOL. XXVIII.

WITH PLATES I AND II.

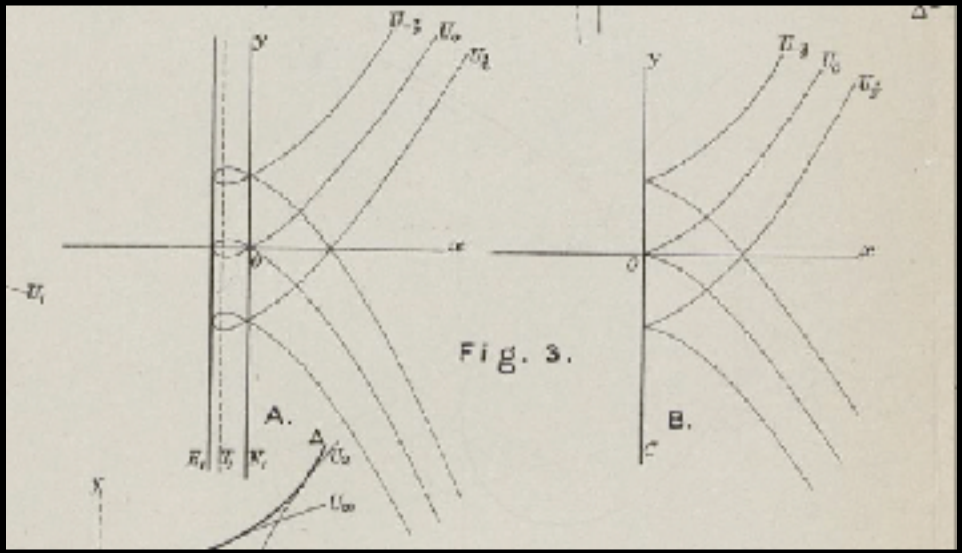
On singular solutions. By *Miss I. Maddison* - - - - - 311

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

C. Technique: curve tracing



It is evident that other invariants and covariants of these quantics must represent curves and families of curves related in some special way to the original family. The investigation of certain of these invariants and covariants and their geometrical properties is the principal object of the present paper.

Isabel Maddison (1896)
On Singular Solutions of Differential Equations of the First Order and the Geometrical Properties of Certain Invariants and Covariants of their Complete Primitives.

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

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C. Technique: curve tracing

	Geometrical Signification.	Δ_1	k_1	Δ_{ρ_1}	θ_1	Casorati's.
1	Ordinary Envelope, Singular Solution.	1	0	1	0	1
2	Tac-locus of r-point contacts.	0	$r-1$	$2(r-1)$	0	6
3	Locus of singularity whose penultimate form is λ adjacent nodes on a curve of finite curvature.	2λ	$2\lambda-1$	$2\lambda-2$	2λ	7
3′	Special case, node-locus.	2	1	0	2	5
4	Locus of singularity whose penultimate form is a loop followed by λ adjacent nodes	$2\lambda+3$	$2\lambda+2$	$2\lambda+1$	$2\lambda+3$	4
4′	Special case, cusp-locus.	3	2	1	3	3
5	P.I.'s belonging to distinct curves $a'P^{\mu}\Omega^2+2b\Omega+c'P^{\nu}=0.$	0	$\mu+\nu+\rho-1$	$2\rho+2$	$\mu+\nu-2$	6
6	P.I.'s as parts of coincident or consecutive curves $a'Q^{\mu}\Omega^2+2b'Q^{\nu}\Omega+c=0,$ $\mu=2\nu+r,$	2ν	$3\nu+r+\rho-1$	$2\rho+2$	$4\nu+r-2$	7
7	$\mu=2\nu,$	$2\nu+\lambda$	$3\nu+\lambda+\rho-1$	$2\rho+2+\lambda$	$4\nu+\lambda-2$	4 or 7
8	$\mu=2\nu-s.$	$2\nu-s$	$3\nu-s+\rho-1$	$2\rho+2+s$	$4\nu-2s-2$	2, 4 or 7
9	P.I. as part of one curve only, $a'P^{\mu}\Omega^2+2b\Omega+c=0.$	0	$\mu+\rho-1$	0	$\mu+\rho-1$	

A Bryn Mawr mathematical research school

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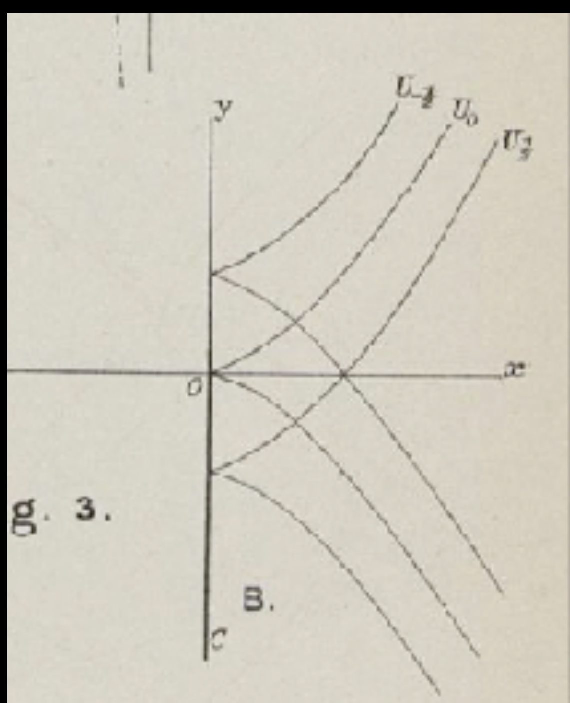

The true explanation lies in the dual relation between two equations. The Ω- and ρ-equations represent in different ways the same family of curves […] This is obvious from geometrical considerations.

Isabel Maddison (1896)

On Singular Solutions of Differential Equations of the First Order and the Geometrical Properties of Certain Invariants and Covariants of their Complete Primitives.

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results
B. Theme: the balance between appearance and reality
C. Technique: curve tracing

In Scott's research and the research of her PhD students, problems are often identified as symbolical results requiring interpretation or reinterpretation.

Such reinterpretation can take many forms:

- geometrically interpreting results from algebra,
- using duality to find two meanings from a single analytical expression,
- redefining internal/external to positive/negative,
- determining new symbolic systems within knot theory,
- …

A Bryn Mawr mathematical research school

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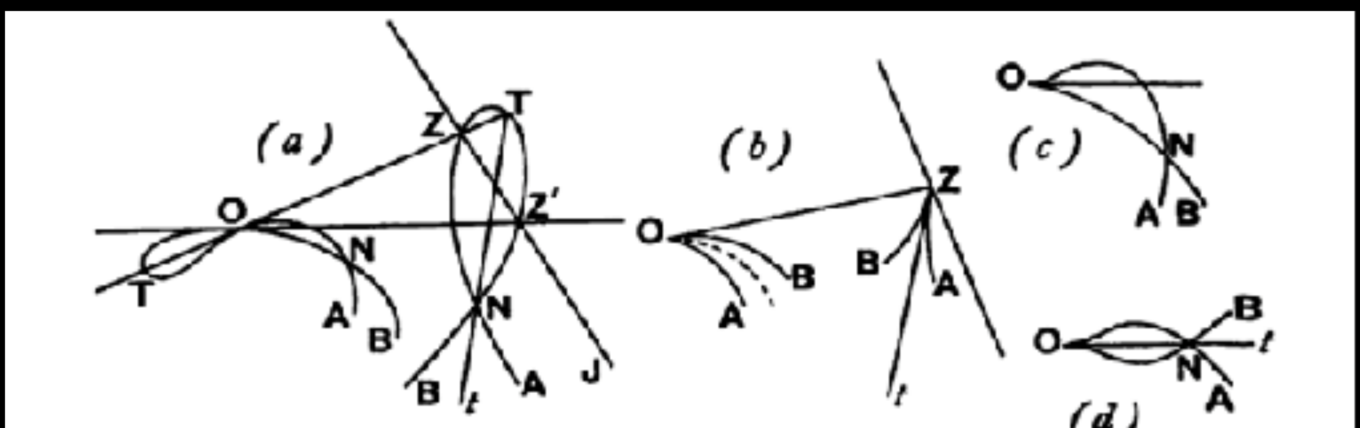

FIG. 55.

To investigate the nature of the singularity at *O* due to a cusp at *Z*, we replace the cusp by its penultimate form (Fig. 55(a)) [...] If however *t* pass through *O*, the corresponding diagrams show that the appearance is that of the ordinary cusp, but that there is in reality a cusp, followed by a node *N* lying on the cuspidal tangent (Fig. 55 (d)).

Charlotte Angas Scott (1894)

An Introductory Account of Certain Modern Ideas and Methods in Plane Analytical Geometry

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

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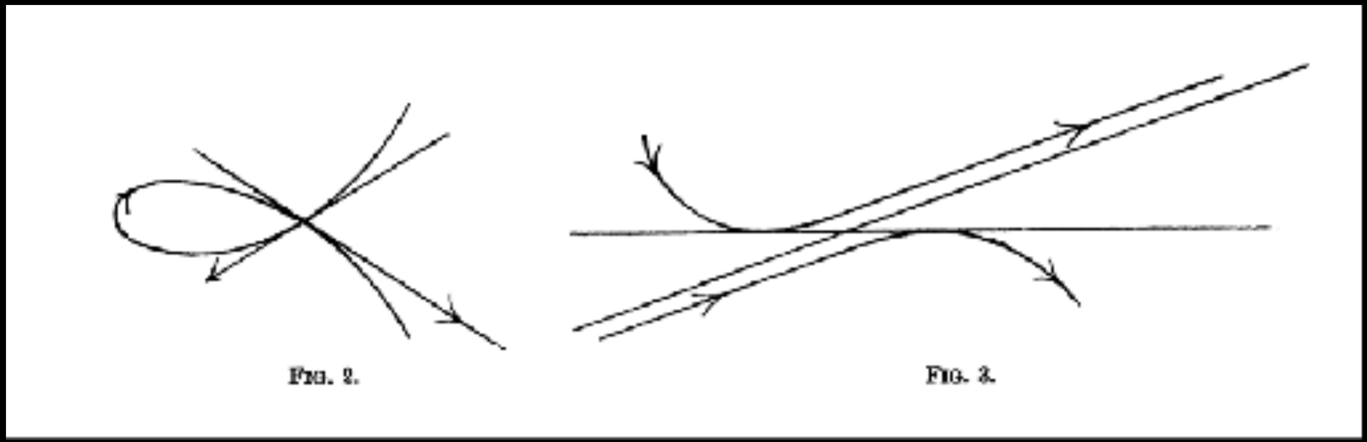


Now the accepted penultimate form for a cusp, the evanescent loop (Fig. 2), appears to justify the view that the tangent at a cusp makes a half turn […] but it makes the inflexion a point singularity, and the cusp a line singularity, contrary to what we know to be the case.

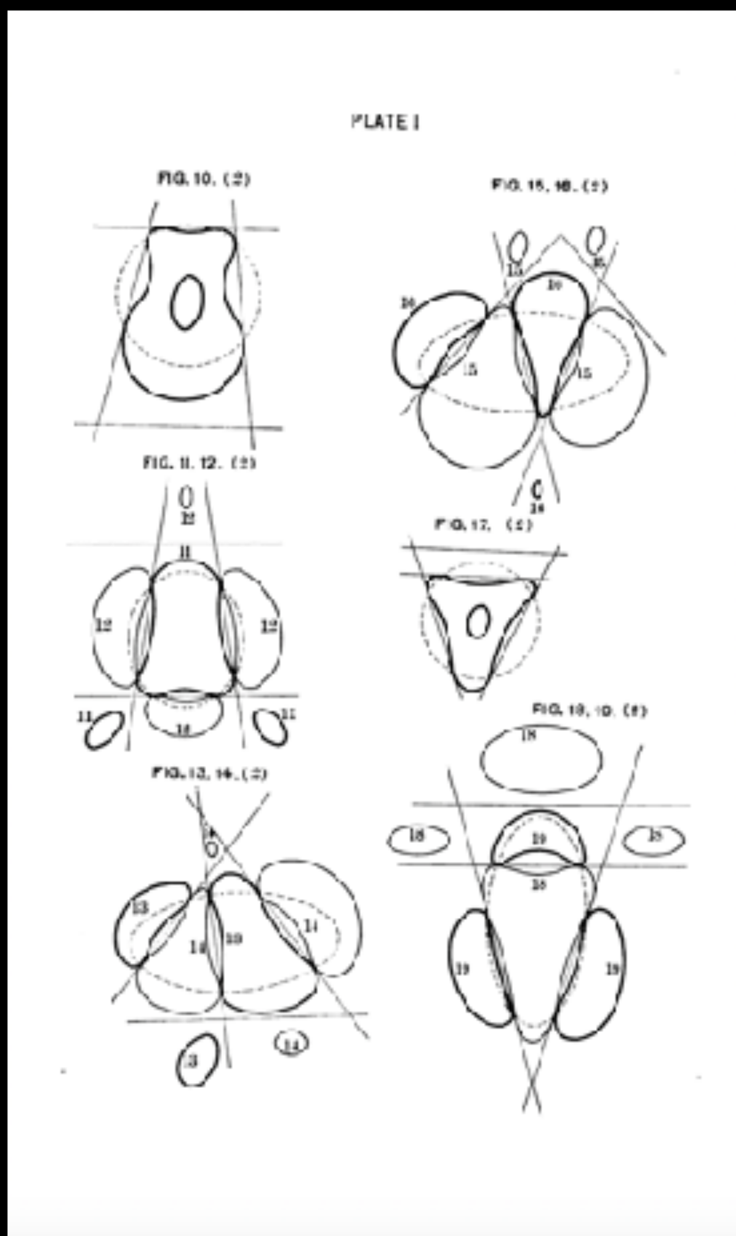
Charlotte Angas Scott (1893)
The Nature and Effect of Plane Algebraic Curves

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

C. Technique: curve tracing



Many papers dealing with curves of the fourth order, or Quartic Curves, are to be found in the various mathematical periodicals; but these leave the actual appearance of the curve as a whole so largely to the reader's imagination that it is here proposed to give a complete enumeration of the fundamental forms of Plane Quartic Curves as they appear when projected so as to cut the line infinity the least possible number of times, together with evidence that the forms presented can exist.

Ruth Gentry (1896)
On the Forms of Plane Quartic Curves

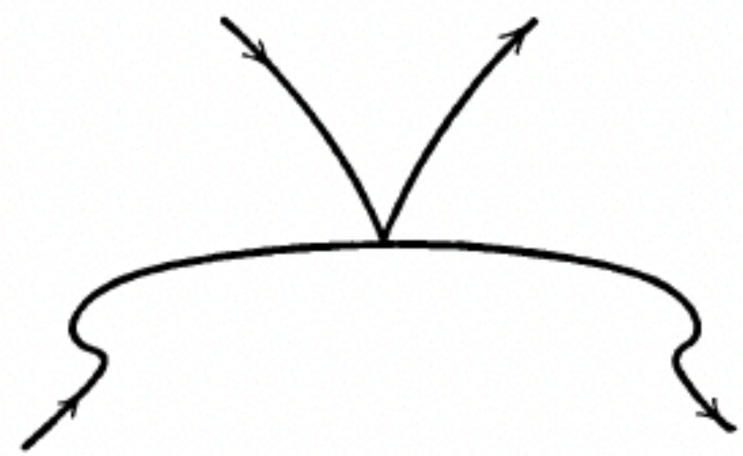
A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

C. Technique: curve tracing

This curve is the last of the double-odd circuits among unicursal quartics. Here, as in preceding cases, each of the two real inflexions has full range of its half-circuit. It is perhaps worthy of notice that, although the figures shown in Plate II present no turnings-back in the neighborhood of the real inflexions, such are possible. The present type, for instance, might have the form of the adjoined figure, which, though not drawn to scale, has the general appearance of the curve



$$x^4 - 14y^4 + 13x^2y^2 + 30x^2y = 0.$$

Ruth Gentry (1896)

On the Forms of Plane Quartic Curves

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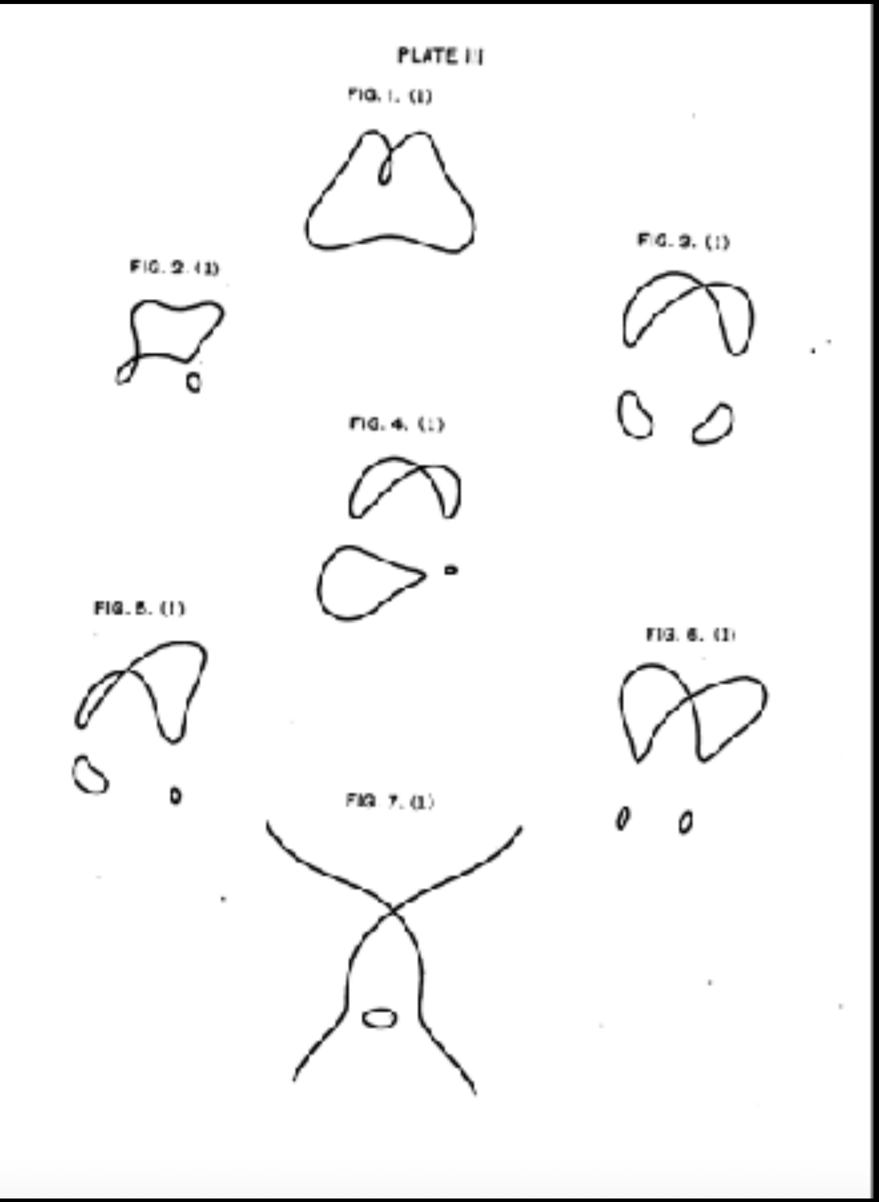

The figures of Plates I – IV, P, with the exception of perhaps a dozen, copied from Zeuthen (loc. cit.) and Salmon (Higher Plane Curves), are only rough drawings intended to illustrate the salient features of the types. For instance, often in plates I, III, IV some or all of the ovals would probably be impossible with the remainder of the figure as drawn, but they are inserted to mark the divisions of the plane in which they belong when the constants are such that the ovals do all exist.

Ruth Gentry (1896)
On the Forms of Plane Quartic Curves

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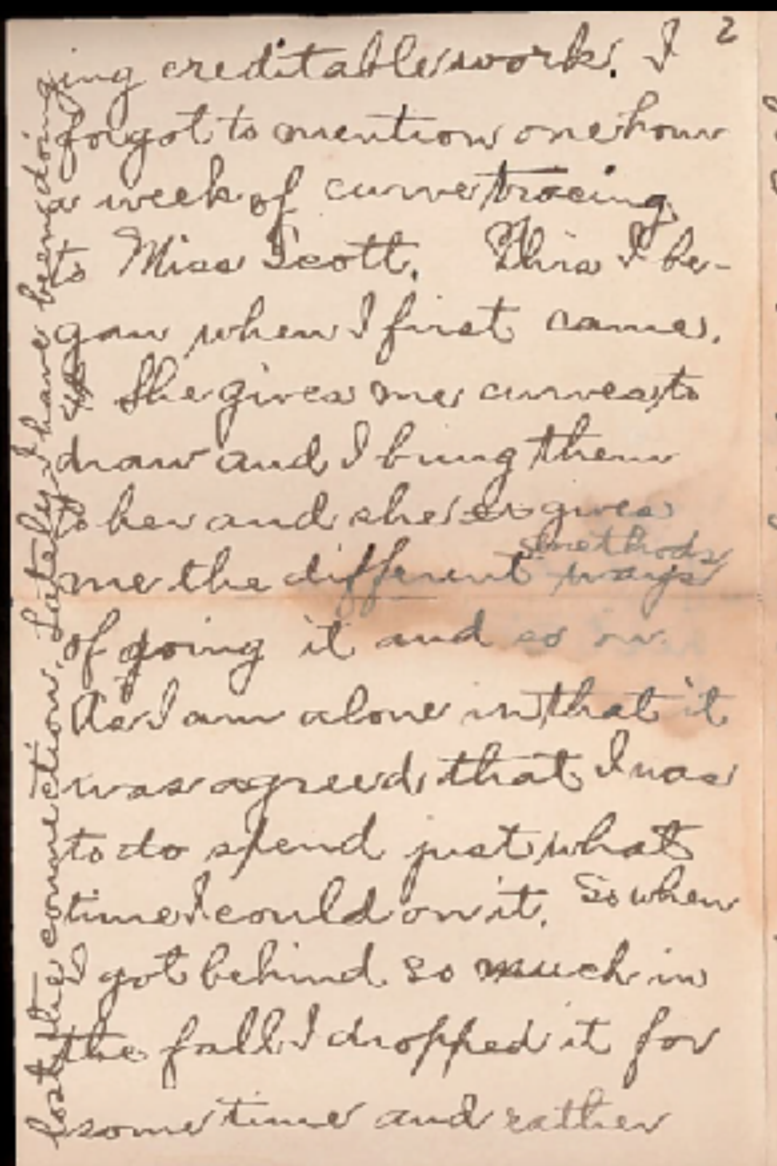


ing creditable work. I 2
forgot to mention one hour
a week of curve tracing
to Miss Scott. This I be-
gan when I first came.
She gives me curves to
draw and I bring them
to her and she gives
me the different ways methods
of doing it and so on.
As I am alone in that it
was agreed that I was
to do spend just what
time I could on it. So when
I got behind so much in
the fall I dropped it for
some time and rather

connection. Lately I have been doing

She gives me curves to draw and I bring them to her and she gives me the different methods of doing it and so on.

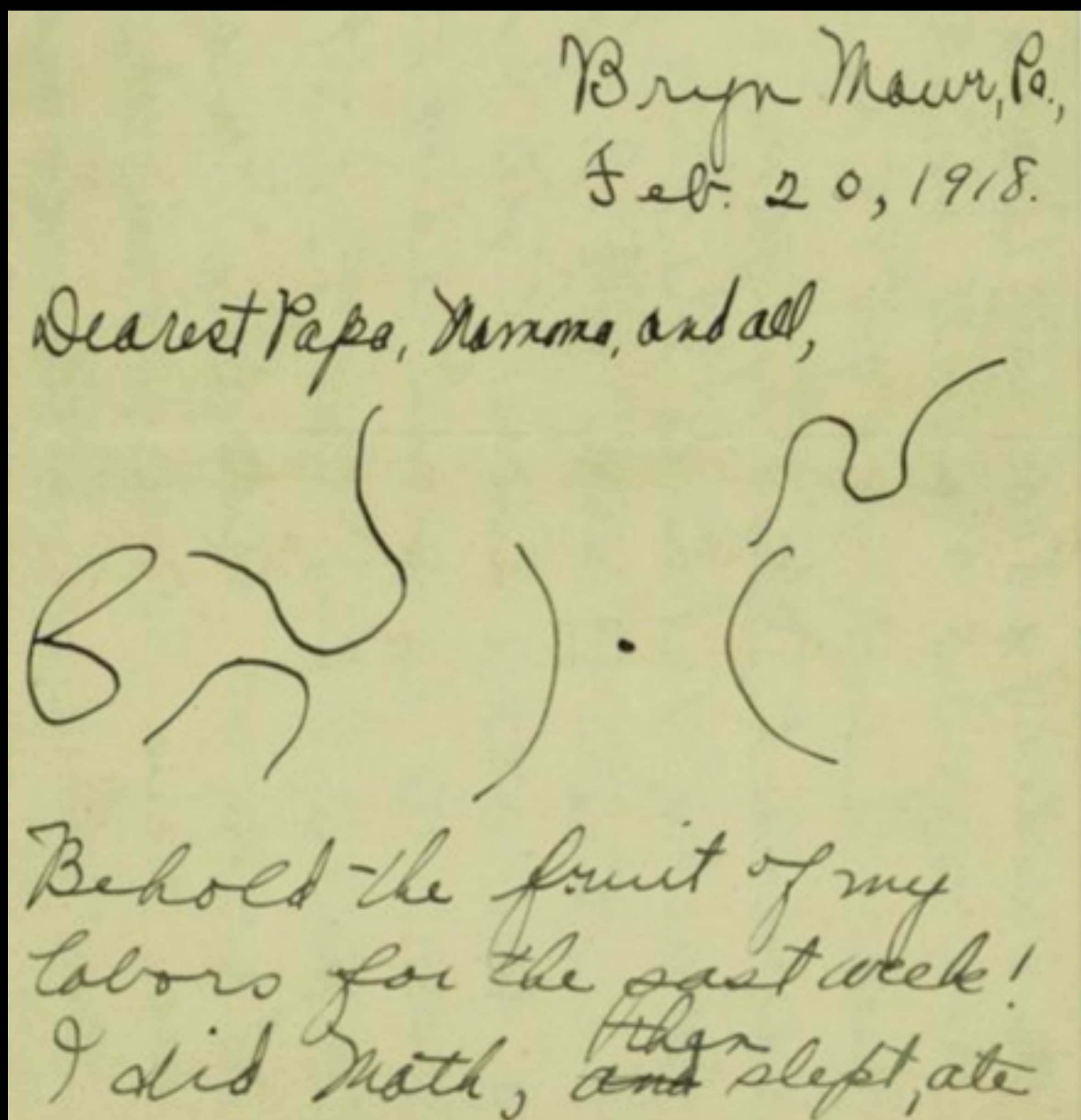
Mary Frances Winston (1892)
Letter from Bryn Mawr to her family

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

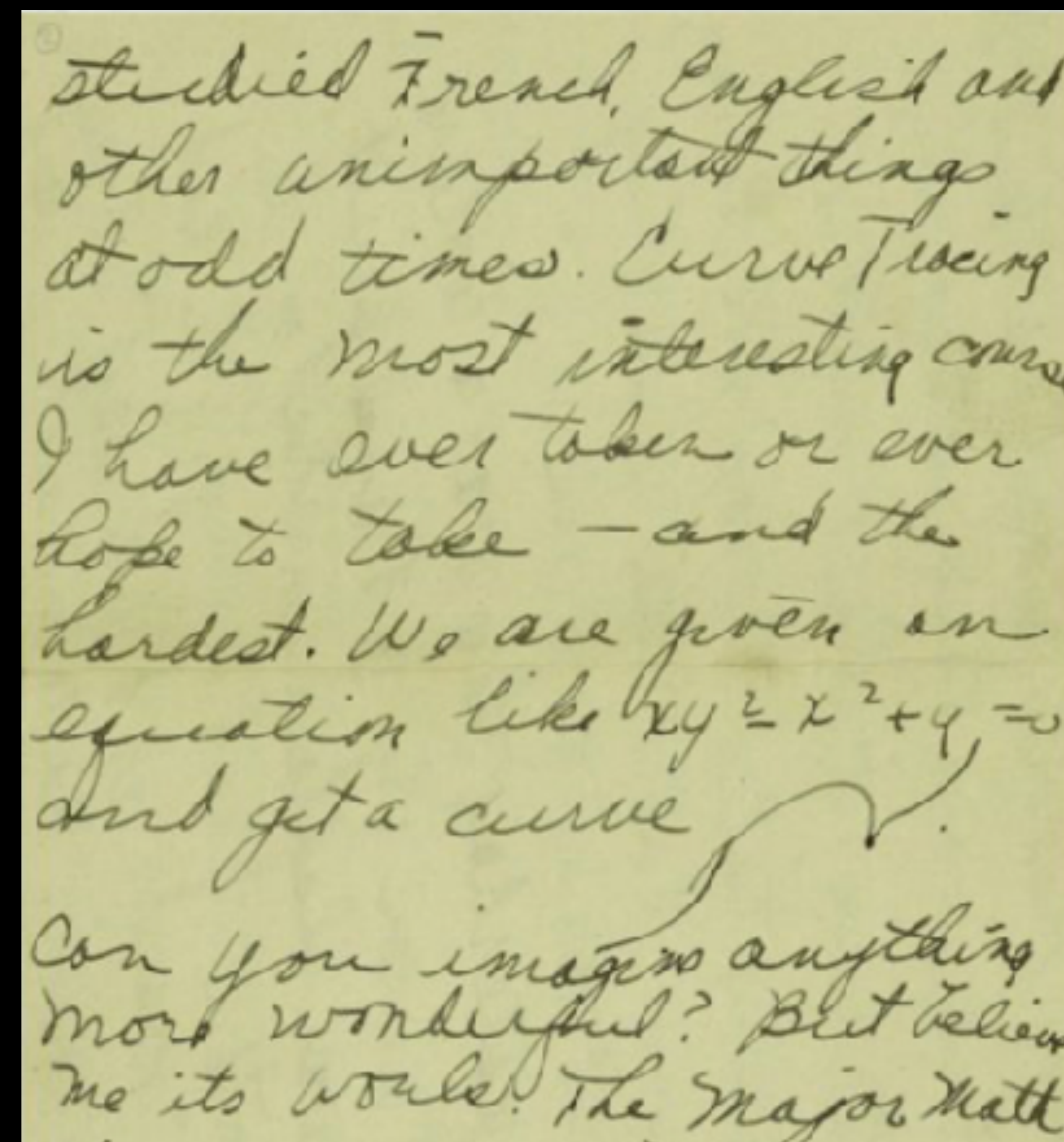
C. Technique: curve tracing



Bryn Mawr, Pa.,
Feb. 20, 1918.

Dearest Papa, Mamma, and all,

Behold the fruit of my labors for the past week! I did Math, ~~and~~ then slept, ate



studied French, English and other unimportant things at odd times. Curve Tracing is the most interesting course I have ever taken or ever hope to take — and the hardest. We are given an equation like $xy^2 = x^2 + y = 0$ and get a curve

Can you imagine anything more wonderful? But believe me its work! The Major Math

Marie Litzinger (1918)
Letter from Bryn Mawr to her family

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

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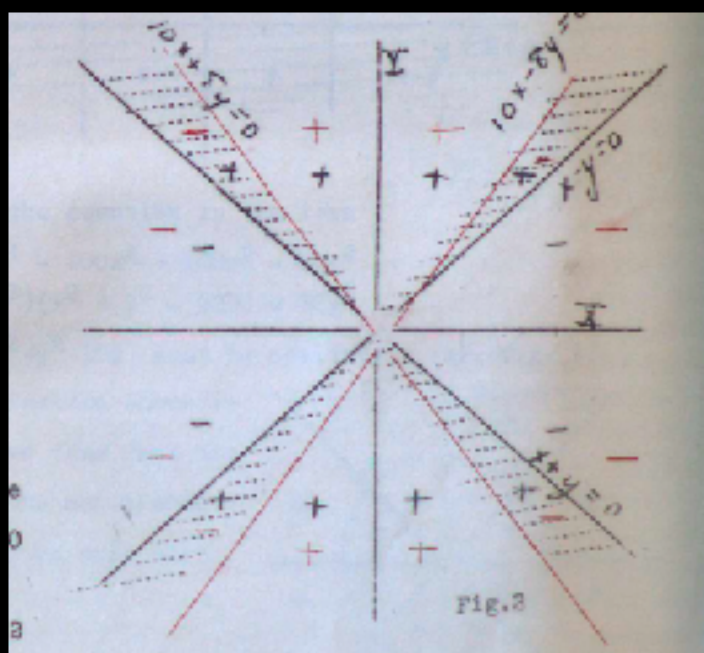


If a student is to develop power in attacking problems and to make rapid progress in mathematics, he should be versed in the geometric as well as the analytic processes. One of the best ways of accomplishing these ends is by means of curve tracing.

The information is not original with me, but is taken, for the most part, from a course of lectures given to sophomores at Bryn Mawr College by Professor Charlotte Angas Scott.

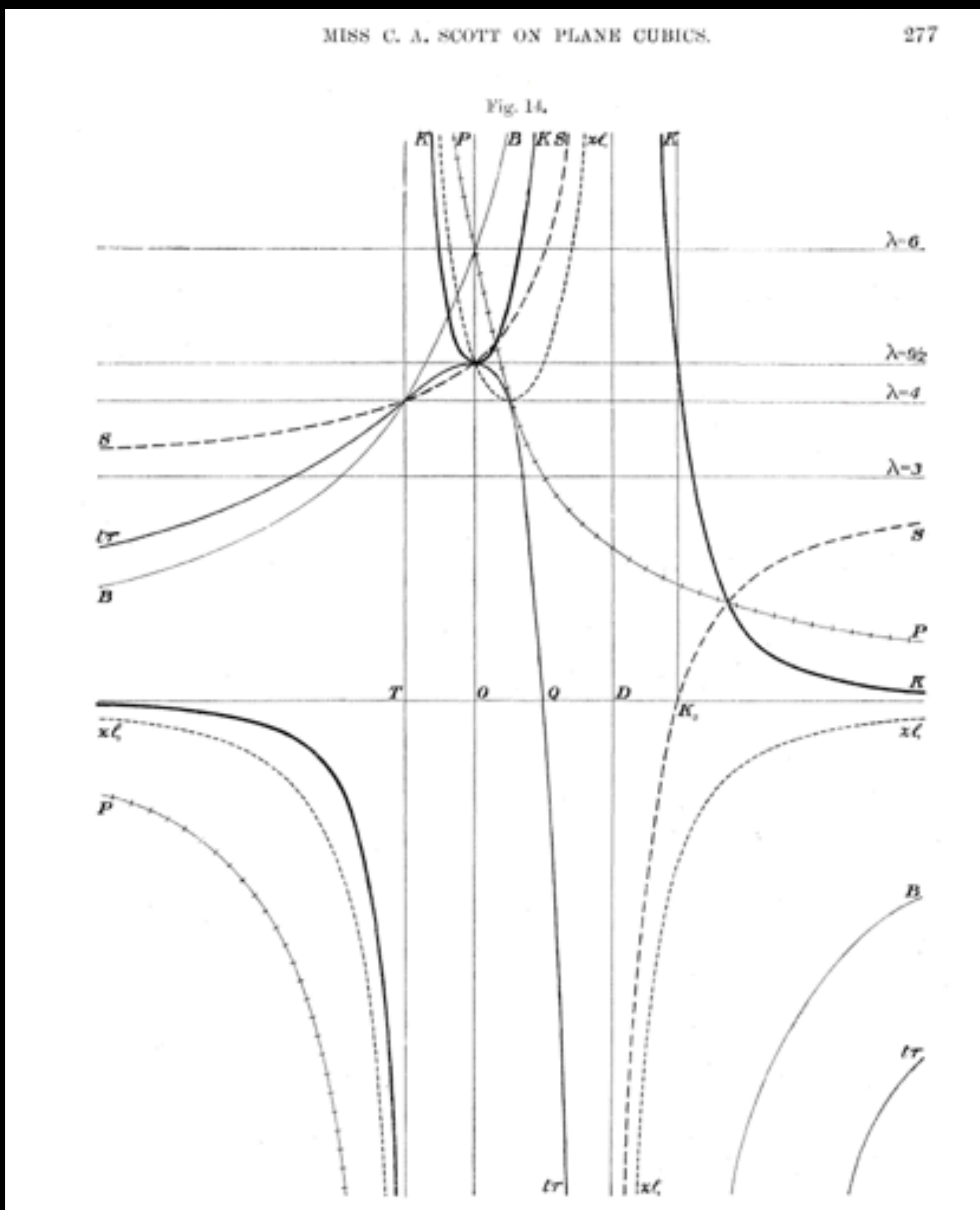
Mary Gertrude Haseman (1920)
Typed manuscript on Curve Tracing

A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance between appearance and reality

C. Technique: curve tracing



By means of these six curves, all of which can easily be drawn with a considerable degree of accuracy, we have a diagram (fig. 14), in which for any arbitrarily chosen ordinate λ the abscissae give the positions of all the points required in constructing the selected cubic, its Hessian, and its Cayleyan.

Charlotte Angas Scott (1894)
On Plane Cubics

A Bryn Mawr mathematical research school

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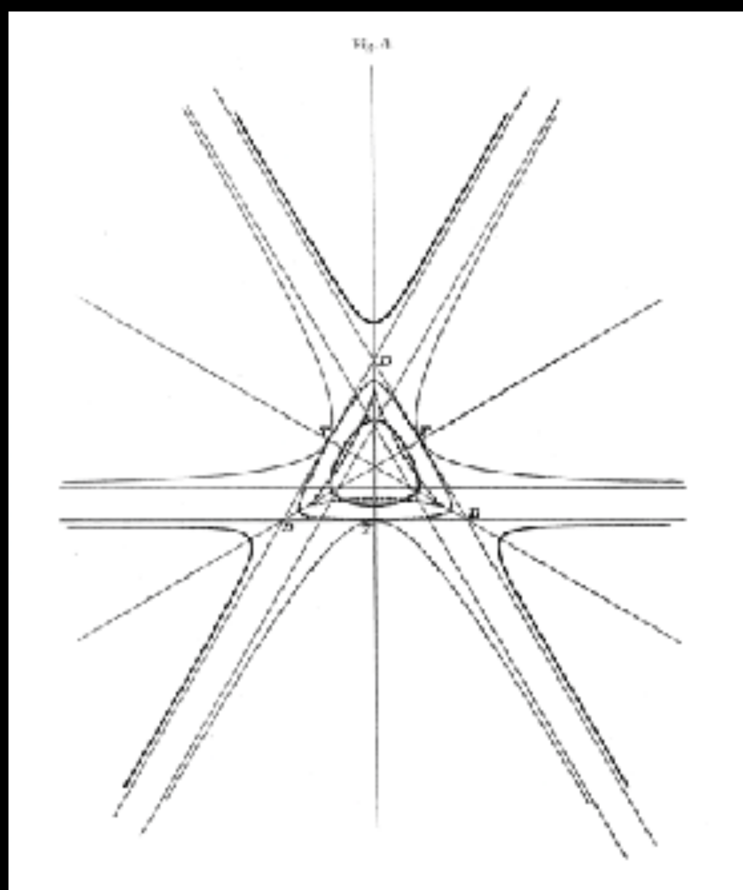
B. Theme: the balance between appearance and reality

C. Technique: curve tracing



The plates will be very useful for reference, and the purely geometrical investigations on which their construction is based are precisely expressed without waste of space and, as a rule, without undue compression.

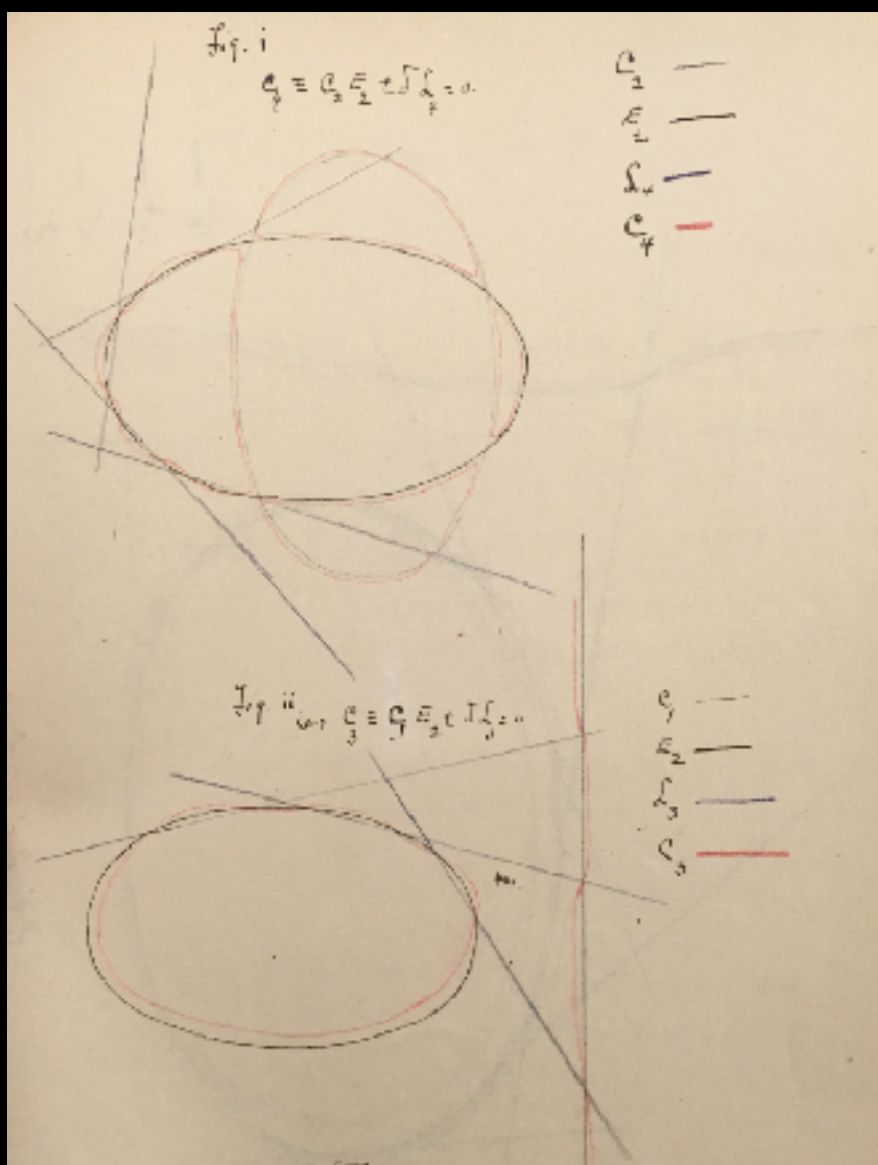
Letter from E. B. Elliot to Lord Rayleigh, Secretary of the Royal Society
Peer review of Scott's "On Plane Cubics" for the *Transactions of the Royal Society*

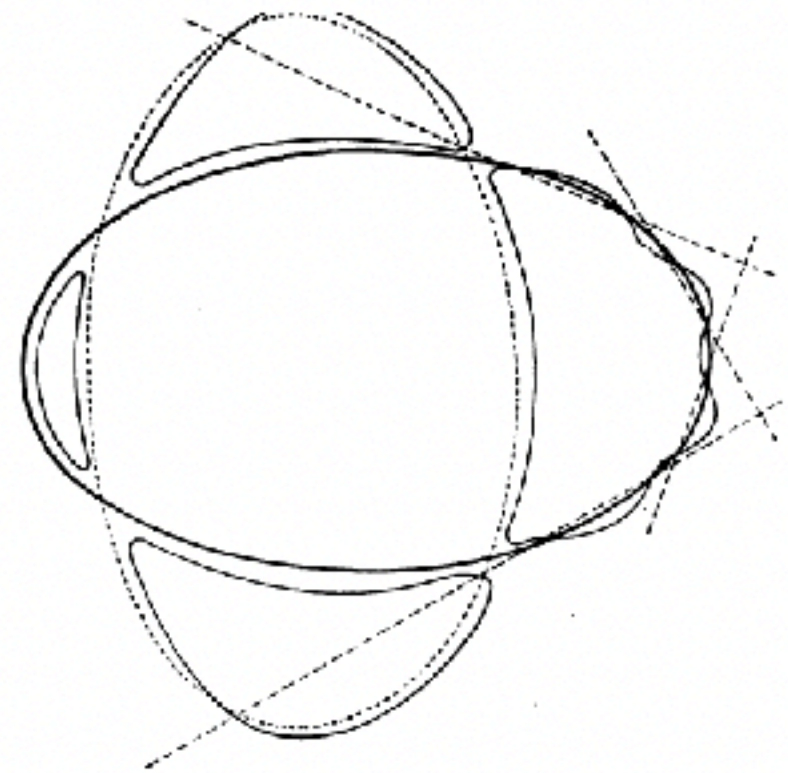
A Bryn Mawr mathematical research school

A. Motivation: to (re)interpret symbolical results

B. Theme: the balance

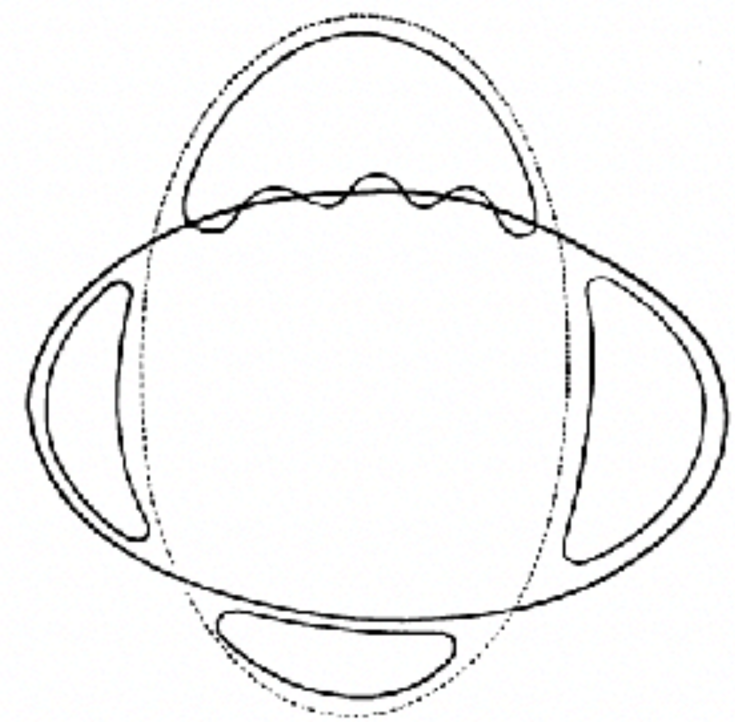
C. Technique: curve tracing





$C_4 \equiv C_2 \cdot E_2 + \delta \prod_{i=1}^{i=4} l_i = 0.$

FIG. 1.



$C_4 \equiv C_2 \cdot E_2 + \delta \prod_{i=1}^{i=4} l_i = 0.$

FIG. 2.

Virginia Ragsdale (1901 and 1906)

On the Arrangement of the Real Branches of Plane Algebraic Curves

A Bryn Mawr mathematical research school

The first enumeration of varieties of a curve of any order beyond the second is Newton's 'Enumeratio linearum tertii ordinis,' 1706. He proves that all the 72 varieties (it should be 78) can be obtained by projection from the five types of cubic with an inflexional tangent at infinity (divergent parabolas), bipartite, unipartite, crunodal, acnodal, and cuspidal. Similarly when once the distinct types of a curve of any order have been enumerated, the varieties can be obtained at once. There are 144 types of quartic (R. Gentry, 'On the forms of plane quartic curves,' 1896); the number for higher curves, even for quintics, must be very great. It does not appear that any special purpose would be served directly by the enumera-

ovals do exist.

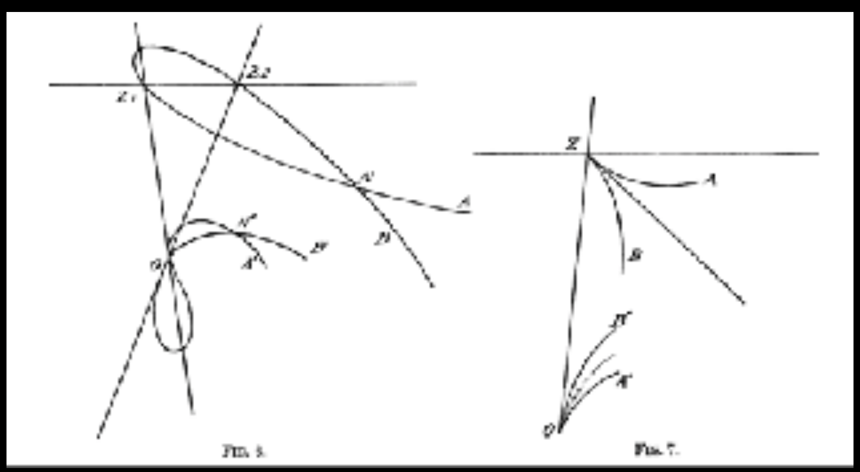
Hilbert draws attention to the arrangement of the eleven ovals of a non-singular sextic ($q = 10$); he states that one of these must lie inside another (p. 118). It appears highly probable (V. Ragsdale, 'Bull. Am. Math. Soc.,' v. 11, p. 464, 1905) that this unproved theorem of Hilbert's is the simplest case of a general law in accordance with which at least $\frac{1}{2}(q-1)(q-2)$ of the circuits of a non-singular curve of order $2q$ must lie inside some of the remaining $q^2 + \frac{1}{2}(q-1)(q-2)$.

Thus as regards circuits the only question

Charlotte Angas Scott (1906)
"Higher Plane Curves"
Encyclopedia Americana

A Bryn Mawr mathematical research school

Reading each article in isolation the features of the BMC style have varied prominence— some are conveyed only in footnotes or explanations of figures, others are positioned as the research objective.



While subtle, this style persists across several areas of mathematics (analytical geometry, differential equations, topology).

This style connect a range of students' work over time and across different kinds of texts: social, pedagogical, research in progress, published research.

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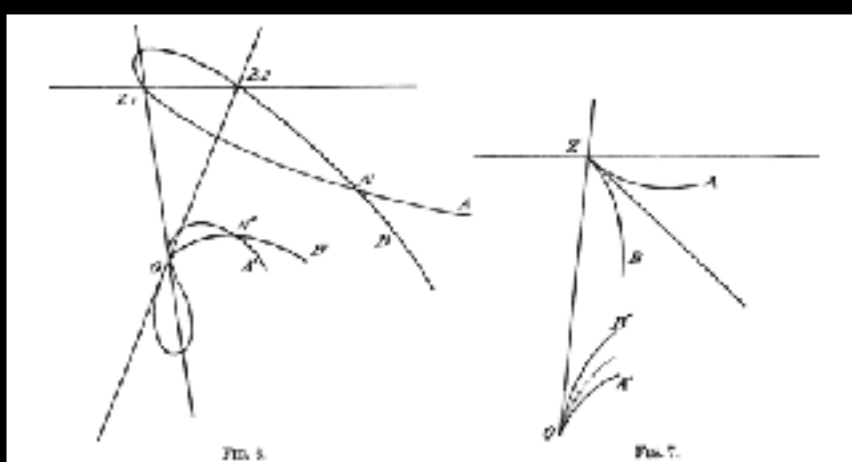

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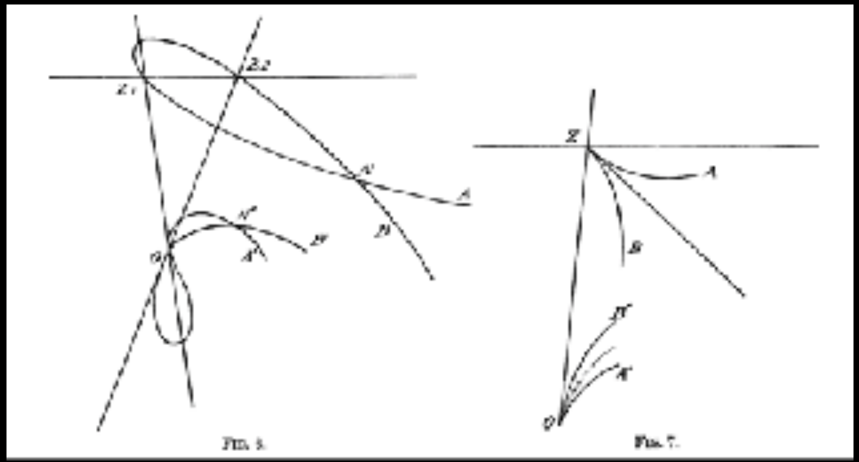

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Conclusions

A. Reading mathematics
B. Seeing mathematicians
C. A school as a case

- Consideration of style/approach more readable and relatable than specific results
- Connections in motivation, theme, and technique to other mathematical disciplines and later work on analytical/algebraic geometry
- Echoes how Scott oriented her contributions
  - "to find another road to it, to trace an unsuspected connection"
  - "while recognizing that many of the *results* are standard, I have not been able to find that these *conceptions* are equally so"

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- Fit with institutional archive across multiple contributors, kinds of sources
- wider lens on practicing mathematicians and their mathematics
  - Paula Findlen "Listening to the Archives: Searching for Eighteenth Century Women of Science" (2014):

    "we cannot understand the visible center of how the woman of science emerged in the eighteenth century without exploring all of these other genealogies that do not become the subject of biography but belong to a very different kind of history."
- Scott within environment of BMC is central (neither an exception nor an outlier)

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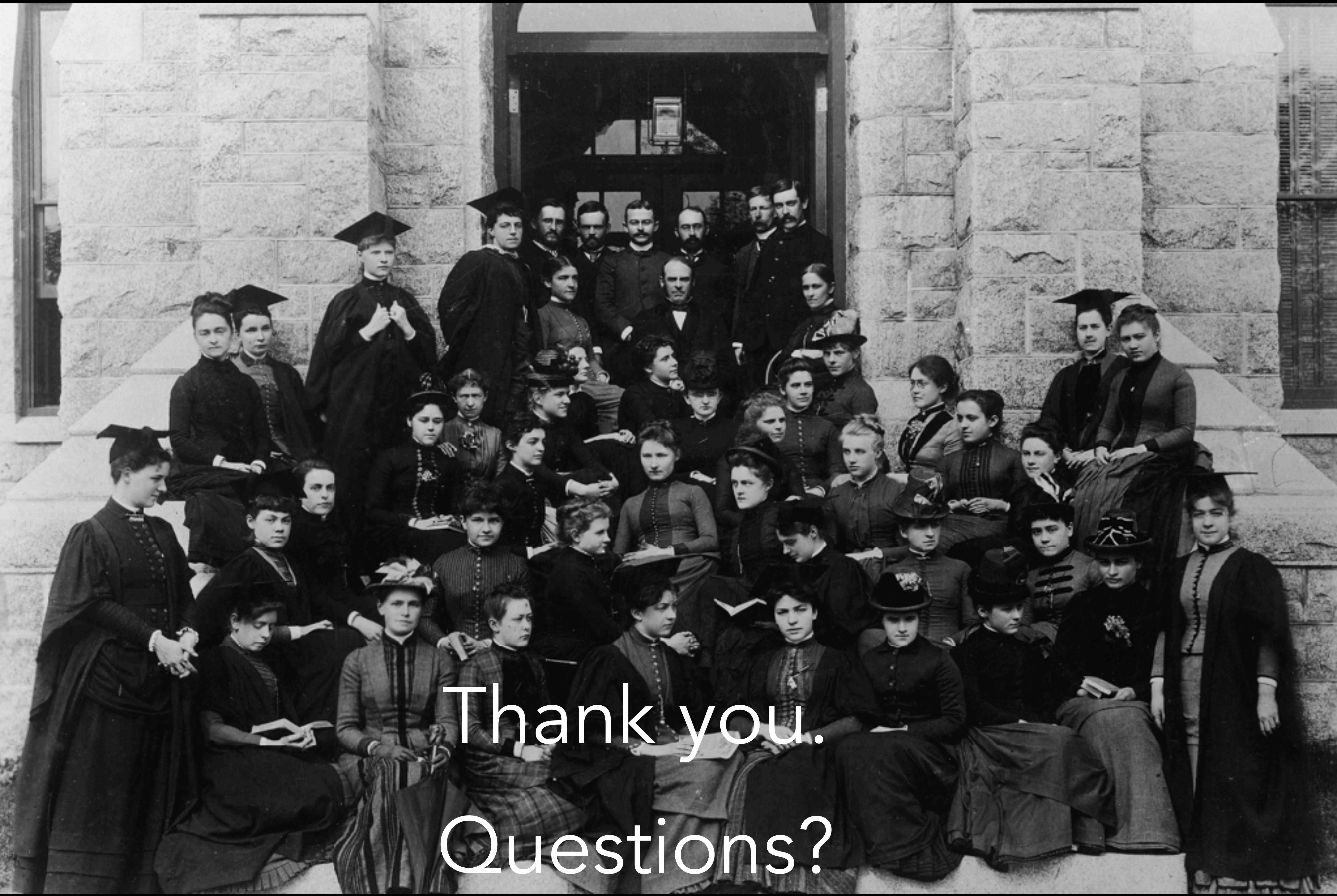
Thank you.
Questions?