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Retaining and Mobilising Geometric Knowledge. Corrado Segre's Card Index

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Retaining and Mobilising Geometric Knowledge

Corrado Segre's Card Index

Erika Luciano | ORCID: 0000-0002-4037-7676

Dipartimento di Matematica Giuseppe Peano, Università degli Studi di
Torino, Turin, Italy

erika.luciano@unito.it

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Abstract

This paper is dedicated to the history of an extremely particular manuscript: Segre's personal card index. Consisting of 515 handwritten cards on which he annotated bibliographic references, excerpts of readings that could be useful in his studies and teaching, comments and memoranda, Segre's Schedario is the manuscript catalogue of a virtual library, a sort of reasoned bibliography that photographs the cultural heritage of Corrado Segre and, more generally, of an Italian geometer of the Belle Époque. In this paper, we will analyse how Segre constructed, organised and used the Schedario in order to structure his teaching and research activity.

Keywords

mathematical libraries – Italian School of Geometry – Corrado Segre

1 Introduction: a First Glimpse within the History of Mathematical Libraries

The history of libraries of contemporary mathematicians is a long-neglected field of research. It only recently entered the agenda of the history of mathematics, which in this respect suffers a serious delay as compared with the material history of science. Measured against a well-established literature on

the libraries of scientists and nature philosophers, the contributions on the libraries of mathematicians are sporadic and of a mostly descriptive character. Those centered on the libraries of *contemporary* mathematicians are even more intermittent and consist of a tiny handful of works, published over decades, concerning the collections of V. Volterra, G. Mittag-leffler, D.E. Smith etc.¹ Objectively, these patrimonies are less ‘appealing’ than others: the libraries of contemporary mathematicians are worlds of papers, whose artistic, iconographic and antiquarian values are negligible.

However, they provide substantial information at different levels: studying the variable geometries of their evolution (how the collections were born, how and why they moved, were dispersed, etc.) leads us to investigate the personal and scientific trajectories of their owners. Such owners have often been directors of university mathematical libraries and have created research Schools. For all of them, the library was not only a place of conservation and fruition of knowledge, but also a site of intellectual production.² Thus, their personal assets represent a privileged observatory on various aspects of the sociology of mathematics in the nineteenth and twentieth centuries: the practices of collective work, the mathematical life that was lived in different university realities, and more.

That material conditions have an impact on the mathematical enterprise is now an established fact. The stereotype of the mathematician who only needs pen and paper to work has ceased to exist. And if there exists an anti-prototypical figure par excellence, it is Corrado Segre, a leading scholar in the Italian and international mathematical panorama not only for his academic contributions, but also for the work practices he adopted and with which he defined the activity of his School. Segre’s page, both that of the early writings on the geometry of hyperspaces, and that of the works of maturity, patrimonialised a good deal of historical and bibliographic information. Even more culturally circumscribed are his Notebooks of Higher Geometry, the courses that Segre held for forty years consecutively at the University of Turin, and that trained at least three generations of protégés.

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- 1 Skuli Sigurdsson, “17,000 Reprints Later: Description and Analysis of the Vito Volterra Reprint Collection,” *Historical Studies in the Physical and Biological Sciences* 22, 2 (1992): 391–397; Ivor Grattan-Guinness, “Materials for the History of Mathematics in the Institut Mittag-Leffler,” *Isis* 62, 3 (1971): 363–374; Bertha Margaret Frick, “The David Eugene Smith Mathematical Library of Columbia University,” *Osiris* 1 (1936): 79–84.
 - 2 Francesco Severi, “Les bibliothèques en tant qu’instruments de travail scientifique,” in *Actes du Comité International des Bibliothèques vol. 17* (Rome: 1952), 19–23.

The historic study of Segre's library(-ies) have uncovered a previous vantage point on this author's world and—to a lesser extent—on the material and immaterial heritage of his School. This paper will focus in particular on a single item of this heritage: Segre's personal card index (hereafter *Schedario*). Consisting of 515 handwritten cards, on which Segre annotated bibliographic references, excerpts of readings that could be useful in his studies and teaching, comments and memoranda, the *Schedario* is the manuscript catalogue of a virtual library, a sort of annotated bibliography that records the culture of Segre and, more generally, of an Italian geometer of the Belle Époque.

In this article we will offer an in-depth study of this tool developed by Segre and used throughout his career to organise his teaching and research works. After a brief introduction to the figure of its creator Corrado Segre (§2), we will propose a detailed investigation of this indexing system, offering a reconstruction of its history and its difficult conservation/reconstitution until today (§§3–6), and studying scenarios of its use (§7).

The objective will be twofold: on the one hand, to give an insight into the materiality of a mathematician's work, by following him through his almost routine activities (reading of scientific papers, memorisation, indexing, etc.); on the other hand, to open up some lines of thought concerning the patrimonialisation of mathematics. While the latter is a highly topical subject in the history of mathematics, the material history of knowledge is a field of investigation still largely to be explored. In the wake of F. Waquet's work *L'ordre matériel des savoirs*,³ this contribution can be considered as a case-study (the first in the realm of mathematics, and the only one so far, to our knowledge) of a well-documented scholarly practice: the personal habit of historians, naturalists, jurists, and *savants* in general, of 'making cards' to take notes, copy titles of works, or extracts from readings; the development of this habit into a system in the 19th century; the use of card indexes as a tool for storing and classifying information, the role that filing cabinets had in the economy of intellectual work and as a means of producing knowledge.

2 Corrado Segre and his Library(-ies)

Corrado Segre is one of the major protagonists of Italian mathematics and the leader of the so-called Italian School of algebraic geometry. Born in 1883, trained in Turin, he taught Higher Geometry there from 1888 to his death in

³ Françoise Waquet, *L'ordre matériel du savoir. XVIIe–XXIe siècle* (Paris: CNRS Éditions, 2015).

1924.⁴ After a brilliant debut with works in projective geometry of hyperspaces, in the wake of F. Klein, L. Cremona and E. d'Ovidio, in 1890–1891 Segre laid the foundations of algebraic geometry according to the Italian approach with a famous course dedicated to the *Introduzione alla geometria sugli enti algebrici semplicemente infiniti* (Notebook n. 3),⁵ which resulted in the publication, in 1894, of the article *Introduzione alla geometria sopra un ente algebrico semplicemente infinito*.⁶ With G. Castelnuovo, G. Fano, F. Enriques and F. Severi (all his students at different points in the period 1887–1900), Segre created the theory of algebraic surfaces, a trademark of the Italian synthetic style. His works on singularities constituted a landmark. In 1907, Segre inaugurated a new trend of studies in differential geometry, to which he would devote the last years of his life with the collaboration of a second generation of pupils (G. Fubini, A. Terracini, etc.).

A brilliant researcher, but excessively meticulous, Segre was not a prolific mathematician. However, he exerted an amazing influence on his students through teaching. In 40 years of mentorship, he created and directed a research team with its own identity, whose leadership position was internationally acknowledged. There is no Italian geometer of the late 19th and early 20th centuries who did not self-declare to be Segre's pupil. Those who did not attend his courses in Turin as university students did so as auditors, or procured his notes.

Segre was a man of power. Ascended to the chair very young (in 1892), he was dean of the faculty (1909–1916), director of the Teacher Training School from 1908 to the suppression of the School itself in 1921, co-director of the *Annali di Matematica pura ed applicata* (1904–1924), director of the Special Mathematical Library (1907–1924), and representative of the faculty of Sciences in the permanent Commission for the National University Library of Turin from 1908 until his death.

When Segre died suddenly on May 18, 1924, his colleagues Gino Fano and Carlo Somigliana immediately arranged the preservation of the patrimony of their 'beloved and august Master.' Three days after his demise, Somigliana had his collection of reprints transported to the Special Mathematical Library.⁷ A

4 On Segre's scientific biography see *inter alia* Alberto Conte, Livia Giacardi, Paola Novaria, Corrado Segre (1863–1924) a 150 anni dalla nascita. *Catalogo delle Mostre documentarie—Novembre 2013* (Torino: KWB, 2013).

5 The Notebooks of Segre's university lectures can be accessed at the website edited by Livia Giacardi <https://www.corradosegre.unito.it/>

6 Corrado Segre, "Introduzione alla geometria sopra un ente algebrico semplicemente infinito," *Annali di Matematica pura ed applicata* 22, 2 (1894): 41–142.

7 Corrado Segre Archives, University of Turin: *Elenco dei pacchi di opuscoli trasportati da casa-*

document dated May 23, 1924 certifies the expenditure of 50 lire “for transporting opuscles, in two stages, in the afternoons of 22 and 23 May 1924, from the home of prof. Corrado Segre, corso Vittorio Emanuele II, no. 85 (2nd floor) to the Mathematical Library, via Po no. 13 (3rd floor).”⁸ Fano, who succeeded Segre as director of the Special Mathematical Library, ordered the inventory of the *miscellanea*, which included 5,976 pieces. The booklets were filed in 21 tranches and entered between June 15, 1924 and May 28, 1926.⁹ Strangely, not one of these offprints was recorded in the Ministerial inventory. The catalogue of Segre’s collection was compiled by the assistants who served in the Library as temporary attachés between June 1924 and June 1926. The cataloguing was mainly conducted by Ada Terracciano who, on May 18, 1926, was paid a cheque of 334 lire for having recorded 4,115 opuscles (ASUT-BSM: *Assegni Ministeriali 1916–1926*). A part of the extracts was filed by Laura Hidalgo, who had been a pupil of Segre and who was in friendly contact with his family.¹⁰ On one of the reprints of his personal collection, in fact, the mathematics teacher Emilio Artom (another former pupil of Segre) noted: “This pamphlet was given to me by Dr. Hidalgo, who found two copies, among the opuscles left by Prof. C. Segre. 22.1.1926.”¹¹ The stereotyped reconstruction assumes that Segre’s collection was destroyed in the allied bombings that hit the Mathematical Library reading room on December 8, 1942. There is no evidence of this. The catalogue of losses suffered by the Turin Library makes no mention whatsoever of this collection.¹² It is

del prof. Segre alla Biblioteca Matematica, fols. 1^r, 2^r and Archivio Storico dell’Università di Torino, *Fondo Biblioteca Speciale di Matematica*, Amministrazione. The invoice is quoted in Livia Giacardi and Clara Silvia Roero, “Biblioteca speciale di matematica “G. Peano,” in *La Facoltà di Scienze Matematiche Fisiche Naturali di Torino 1848–1998*, t. 1, *Ricerca, Insegnamento, Collezioni scientifiche*, ed. Clara Silvia Roero (Torino: Centro Storia Univ. Torino, Dep. Sub. Storia Patria, 1999), 446.

- 8 Archivio Storico dell’Università di Torino, *Fondo Biblioteca Speciale di Matematica: Per trasporto opuscoli, in due riprese, nei pomeriggi dei giorni 22 e 23 maggio 1924 dall’abitazione del prof. Corrado Segre, in corso Vittorio Emanuele II, n. 85 (piano 2°) alla Biblioteca Matematica, in via Po n. 13 (piano 3°)*.
- 9 Archivio Storico dell’Università di Torino, *Fondo Biblioteca Speciale di Matematica: Registro di ingresso* numbers 2698–2807, 2807–2872, 2873–2900, 2900–2940, 2947–2973, 2976–3420, 3427–3479, 3489–3538, 3457–3652, 3670–3790, 3799–3872, 3877–3955, 4075–4241, 4255–4841, 4844–5198, 5201–5282, 5289–5354, 5367–5656, 5681–5701, 5783–5846, 5900–8866.
- 10 Corrado Segre Archives, University of Turin: L. Hidalgo to Olga Michelli Segre, 4.6.1924.
- 11 *Questo opuscolo mi è stato dato dalla Dott. Hidalgo, che ne ha trovato due copie, fra gli Op. lasciati dal Prof. C. Segre. 22.1.1926.*
- 12 Archivio Storico dell’Università di Torino, *Fondo Biblioteca Speciale di Matematica: Elenco degli opuscoli andati perduti per eventi bellici*, 28.3.1946–1910.10.1946, fols. 1^r–6^r.

bizarre that it records the inventory numbers of 3,856 reprints burnt up in the fire, and none of the pieces of Segre's miscellany. The fact remains that, to date, not one of the booklets in this collection has been found.

The manuscripts of the 40 courses in Higher Geometry delivered by Segre between 1888 and 1924, the manuscript of the lectures he held at the Teacher Training School from 1908 to 1924, and some other documents, were acquired by Fano for the Mathematical Library in 1926.¹³ The intention of G. Loria, A. Terracini and other former pupils of Segre was to publish a part of the Master's Notebooks, in which a massive corpus of collectively elaborated geometric knowledge had been patrimonialised.¹⁴

Segre's personal library (406 volumes, 18 bound collections of papers and 12 partial or complete series of journals)¹⁵ was the only part of the heritage not to be valorized. In December 1924, it was sold by Segre's heirs to a mathematician in Florence, Guido Toja, president of the Istituto Nazionale delle Assicurazioni.¹⁶ At that time, the Institute was practically devoid of a library and the acquisition of Segre's books was intended to fill the gap:

An embryonic library existed at the beginning of the Institute's activities, but since it was not properly cared for and organised, and without the necessary nourishment, it could not even partially achieve the purpose of responding to current research needs. In recent years, book purchases have improved the situation, especially in insurance, economic, statistics and actuarial science. Few occasions have presented themselves to provide the library with volumes of pure mathematics [...]. The late lamented

13 Archivio Storico dell'Università di Torino, Carteggio 1926 1.4, Biblioteche: *Deposito temporaneo presso la Biblioteca di Matematica "dei fascicoli manoscritti contenenti i sunti delle lezioni" di Corrado Segre da parte della vedova Olga Michelli è conservato il verbale, corredato di "Elenco dei fascicoli", trasmesso da Fano al rettore*, fols. 1^r, 2^r.

14 G. Loria to Arturo Segre, 10.12.1924 in Erika Luciano and Clara Silvia Roero, "Corrado Segre and his Disciples. The Construction of an International Identity for the Italian School of Algebraic Geometry," in *From Classical to Modern Algebraic Geometry*, eds. Gianfranco Casnati, Alberto Conte, Letterio Gatto, Livia Giacardi, Marina Marchisio, Alessandro Verra (Cham: Springer, 2016), 210 and Alessandro Terracini, "I quaderni di Corrado Segre," in *Atti del IV Congresso UMI* (Roma: Cremonese, v. 1, 1953), 259.

15 Corrado Segre Archives, University of Turin: [*Catalogo dattiloscritto della Biblioteca del Prof. Segre*], 18 fols.; *Inventari topografici della Biblioteca del Prof. Segre*, 20 fols. manuscripts of different hands.

16 Guido Toja to Adriana Morpurgo Segre, 31.12.1924, in Luciano and Roero, "Corrado Segre and his Disciples," 210–211. The complete catalogue of Segre's books sold to Toja is also provided (pp. 211–230).

Corrado Segre, a distinguished mathematician who recently died in Turin, left a remarkable library which was purchased by the President of the Institute on his own behalf; since a considerable number of mathematics books in Segre's library are already owned by the President, so he is willing, before turning to others who would have requested, to sell them to the Institute at the same price at which they were bought by him. However, he desires the unanimous consent of his colleagues, based not only on the total expense to be made, but also on the advisability of purchasing such books for the Institute, having regard to the nature of the books themselves and in relation to the needs of the Institute. The Committee, fully approving the concept that informs the President's communications, approves the plan for the purchase by the Institute of the books in the Segre's Library.¹⁷

In actual fact, for budgetary reasons, the operation was not successful. Segre's library would land in Florence, together with that of Toja, at the death of the latter in 1933.¹⁸

17 Archivio Storico dell'Istituto Nazionale delle Assicurazioni, Roma, *Verbali delle Adunanze del Consiglio, Adunanza del 20 dicembre 1924*, pp. 163–166: *Una biblioteca allo stato embrionale esisteva fin dall'inizio delle operazioni dell'Istituto, ma non essendo stata convenientemente curata ed ordinata, ed ancor meno non avendo avuto l'alimento necessario, non ha potuto raggiungere neppure in parte lo scopo di rispondere alle correnti esigenze. A migliorare la situazione sono intervenuti, in questi ultimi anni, acquisti di libri, specialmente nelle materie assicurative, economiche, statistiche ed attuariali. Poche occasioni si sono presentate per fornire la biblioteca stessa di volumi riguardanti le matematiche pure [...]. Il compianto Corrado Segre, insigne matematico morto mesi or sono a Torino, ha lasciato una notevole biblioteca acquistata dal Presidente dell'Istituto per proprio conto; poiché un numero non indifferente di libri di matematica della biblioteca Segre sono già posseduti dal Presidente, così questi è disposto, prima che ad altri che avrebbero fatta richiesta, a cederli all'Istituto al prezzo medesimo al quale furono da lui acquistati. Egli desidera però il consenso unanime dei Colleghi basato non solo sopra la spesa complessiva da farsi, ma anche sull'opportunità di acquistare tali libri per l'Istituto, avuto riguardo alla natura dei libri stessi in rapporto con le esigenze dell'Istituto. Il Comitato approvando pienamente il concetto che informa le comunicazioni del Presidente approva il progetto di acquisto, da parte dell'Istituto, dei libri della Biblioteca Segre.*

18 Università di Firenze, Archivio della Biblioteca di Scienze – Sede di Matematica, *Inventario e variazioni in aumento o diminuzione degli oggetti nella Biblioteca Matematica 2*, numbers 1801–2107 and *Inventario e variazioni in aumento o diminuzione degli oggetti nella Biblioteca Matematica 3*, 2108–3563.

3 Segre's Card Index

Among the manuscript materials entrusted to the Special Mathematical Library of Turin in 1926 there was also, with great probability, the *Schedario*, compiled by Segre until a few days before his death. Fano remembered Segre's habit of compiling and updating a filing cabinet.¹⁹ The discovery of a pile of autograph bibliography cards in 1996 by Livia Giacardi provided documentary proof of this practice.²⁰

Enclosed in two hardcovers, the *Schedario* consists of 538 manuscript cards (Figs. 1a–b). The first 45 sheets contain notes for talks, thesis dissertations and research topics. We will not analyze these in this contribution. The remaining 493 billets are thematic cards arranged alphabetically by title. A section of 30 cards is isolated between two further hardcovers and concerns exclusively mathematics education. The cards are visibly of different quality paper and were made economically by cutting A4 ruled sheets into four parts. This is confirmed by the fact that, at the bottom of the *Schedario*, numerous blank cards were found ready for use.

All the cards are handwritten, except for the hardcover which is not by Segre's hand, nor by Fano's or any other known hand. The integrity of the manuscript is relatively complete, with only a dozen cards being lost. However, the wooden filing cabinet that contained the *Schedario* is lost.

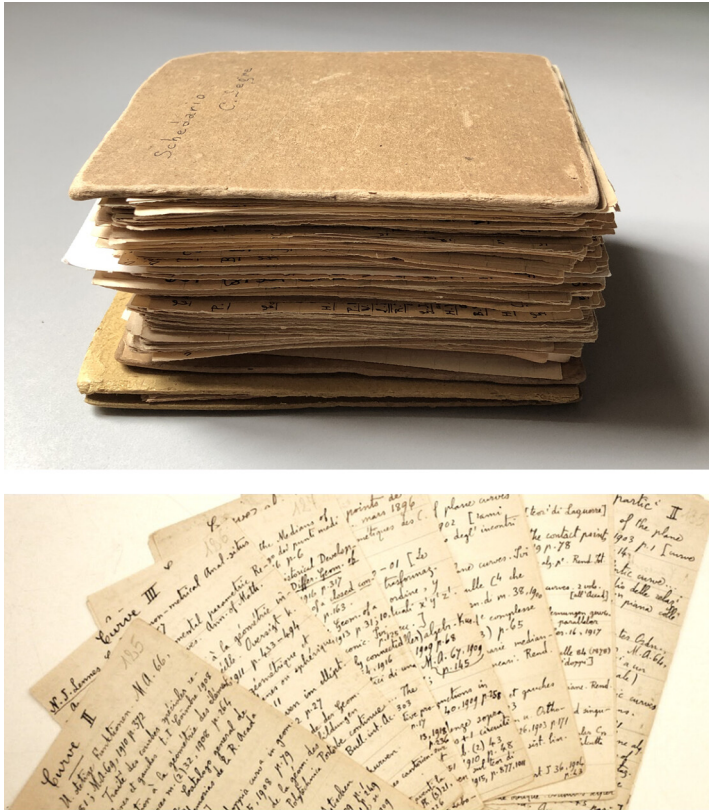
The 493 files all have the same structure: they have a single subject heading and contain a list of bibliographical references. The number of items varies from a minimum of 1 for the entry *Postulazione* (fol. 301) to a maximum of 241 works for *Curve I, II, III, IV* and *V* (fols. 124–128). The *Schedario*, however, is not merely a reasoned bibliography. The cards are in fact scattered with notes, which reflect different aspects and features of the patrimonialisation process. The notes essentially belong to five categories.

- 1) notes that indicate where a text can be localised. They show how Segre moved between three libraries: his personal library (129 notes), the Special Mathematical Library (15) and the Library of the Turin Academy of Sciences (11), of which Segre was a member from 1889.
- 2) “with other citations,” “with other bibliographic references,” “with rich bibliography,” “with citations of previous works,”²¹ etc. These notes reveal

19 Gino Fano, “Corrado Segre. Cenno necrologico,” *Annuario R. Università di Torino* 12 (1924–1925): 222.

20 Livia Giacardi and Tiziana Varetto, “Il Fondo Corrado Segre della Biblioteca ‘G. Peano’ di Torino,” *Quaderni di Storia dell'Università di Torino* 1 (1996): 344, 367–368.

21 *con altre citazioni, con altre indicazioni bibliografiche, con ricca bibliografia, con citazioni di lavori precedenti*



FIGURES 1A–B Segre's *Schedario*: hardcover (1a) and a selection of cards (1b)

the extent to which Segre appreciated works that traced the state of the art on a certain subject (surveys, annotated bibliographies, summaries and catalogues). Registering these types of publication in the *Schedario* was functional to a sort of law of labour economy, i.e. in a cost-benefit analysis, the advantage of capitalising such patrimonies of data outweighed the biases that could be present in the appropriation of eterocollected and organised cultural assets.

- 3) quotations from the *Jahrbuch über die Fortschritte der Mathematik* (65 notes). They testify to the importance that Segre attached to this international repertoire, to which he also looked for publications in languages he was unable to read such as Russian, Dutch, etc. Basically, if a work had been positively reviewed in *Jahrbuch*, Segre recorded it in his *Schedario* even without reading it. A positive review in *Jahrbuch* was considered a sufficient validity indicator of the product. This kind of notes lead us to draw a parallel with other national and international projects of

bibliographic indexing of knowledge which were set up at the time of Segre (*Revue semestrielle des publications mathématiques*, *Répertoire bibliographique des sciences mathématiques*, *International catalogue of scientific literature*, etc.). Segre was not involved in these projects but they were undoubtedly part of the general landscape in which his own practices were embedded. The Mathematical Library of Turin subscribed to the *Revue semestrielle* from 1893 to 1934. The *Index du Répertoire* was bought for the Library by D'Ovidio in 1893, and then by Segre, in 1908 and 1916. In some ways, Segre's *Schedario* was kept more up to date than both those ideal bibliographies, but two facts should be taken into consideration: the lengthy publication times required by international projects and the fact that geometry was only one of the sectors indexed, and not even the most sizeable. At the current state of archive research, no point of contact has emerged between the indexing project carried out by Segre and the *International catalogue of scientific literature, part A Mathematics*, which was not available in any library in Turin and which in Italy was only available in few libraries (Rome, Genova, etc.).

- 4) Value judgments, even harsh, such as “the work contains nothing new,” “Nothing essential,” “It does not work.”²² Since it is hardly plausible that a content whose validity, originality or usefulness are denied then be awarded a place in a personal card index, one should argue that Segre added these comments a posteriori, in view of better quality readings he had discovered in the meanwhile.
- 5) Notes placed next to the headings of the cards, which postulate links between the entries. Connections are of various types: those who couple two items, for example *Fondamenti della Geometria* and *Geometria non Euclidea* (fols. 173–176, 212–217); triangle-shaped connections, either closed or open, and tree-shaped connections which link several sheets to a single ‘mother card.’ The four files *Congruenze*, *Sistemi di superficie*, *Equazioni differenziali (Geometria)* and *Superficie (geometria generale) IV* are connected, for example, to the mother board *Sistemi di curve* (fols. 83–84, 364, 162–165, 378, 360–361). More articulated semantic networks, with different hierarchical levels, are created by Segre around specific contents, e.g., curvature, transformations, etc. These latter give us excellent information on the organisation of algebraic geometry according to Segre, including hierarchies between its domains and sub-domains.

²² *non contiene nulla di nuovo, nulla di essenziale, non va!*

The date when the *Schedario* arrived at the Mathematical Library is unknown. Only conjectures can be made. The card index could have landed in 1924, with the collection of reprints, in 1926 together with Segre's Notebooks and manuscripts, or in 1949 when his daughter Elena donated his collection of portraits of mathematicians.²³ Undoubtedly, if it arrived in 1924 or 1926, the card index was not kept in the reading room of the Library, together with the collection of opuscles, as would have been in some sense logical due to its nature as a filing cabinet. The reading room was in fact destroyed by the bombings of World War II. The room's furniture did not survive the fire.

4 Contents

Segre's card index is not a manuscript of which it is possible to provide a 'classical' edition. We have thus chosen to transform it into an Excel database. All the data recorded by Segre have been reported and at the same time the references have been completed, and misprints and typos corrected. The database, edited by E. Luciano and E. Scalambro, is freely accessible at https://www.corradosegre.unito.it/doc/Segre_LoSchedariocompleto.pdf The spreadsheet is structured in 11 columns. The first, *Numero Scheda*, gives the card's number in the current foliation; the column *Titolo scheda* faithfully reports the subject headings given by Segre to the sheets; the columns from C to J contain the bibliographical references stored in each card, in the original order of appearance. Metadata (author, title, journal, series, volume, year, pages) have been always completed. The column *Note* reproduces Segre's marginal annotations. The content analysis greatly benefited from the decision to turn the original files into a database, since this made it possible to take advantage of digital-humanities software such as *Palladio* for the management and visualisation of big data networks.

The *Schedario* records 6,238 bibliographical references. Articles represent 91% of the total, followed by volumes (227 titles, 4% of the total), dissertations (136) and pamphlets (92). The articles listed come from 207 journals, published in 25 countries and in 137 different editorial hubs. The most represented (i.e. frequently-appearing) heading is *Mathematische Annalen*, with 650 references, followed by the *Rendiconti del Circolo Matematico di Palermo* with 283 indexed works. The numerical consistency of citations from *American Journal of Mathematics* and *Transactions of the American Mathematical Society* is quite

²³ Fondo *Alessandro Terracini*, Biblioteca Speciale di Matematica, Università di Torino: Elena Fuà Segre to Alessandro Terracini, 3,3,1949.

intriguing. At the time, in fact, these two journals were rarely frequented by Italian mathematicians. The statistical analysis of the items shows that Segre's culture was visibly Italo-German. Items deriving from *Mathematische Annalen* alone represent 11% of the total; out of the entire 1550 authors referenced, 30% are German and 20% Italian.

Browsing the lists of major occurrences, one could be driven to notice false anomalies in the process of information storage. The two authors who individually are most recorded in the *Schedario* are a Dutchman (Jan De Vries) and a Belgian (Lucien Godeaux). Among the Italians, the most cited is Severi, followed by Enriques. These are not anomalies. Segre had not read more De Vries than Noether, or more Severi than Castelnuovo! We will return to this point, but as of now we should observe that the *Schedario* does not capture Segre's culture in its entirety, neither in terms of chronology nor of substance. In addition, popular psychology teaches that people tend to note what they fear to forget. Thus, for example, Klein who was and would remain for Segre the great *maitre à penser* is almost absent from the card index because Segre had no need to store the information concerning Kleinian production, with which he was perfectly familiar.

Finally, 110 works by 51 female authors are filed in the *Schedario*. Those of C. Scott, H. Hudson and E. Nöther have geometric content, dealing with curves, Cremonian transformations, the theory of invariants, etc. The consistency of the female presence, however, reflects above all a typical character of the sociology of mathematics of the time, namely the fact that at this junction many middle-secondary school teachers began to publish works pertaining to mathematics education. Segre, who taught for twenty years at the Teacher Training School in Turin and had a sensitivity to methodological issues, kept himself informed of the literature in this field and filed the relevant data in the *Schedario*. Many of the indexed female authors had been his students.

5 Construction of the Card Index

Reconstructing the genesis of this manuscript was a considerable challenge. The cards are undated and there obviously is no correlation between the dates of publication of the catalogued works and that of recording in the card. Most of the titles were classified not in the year of publication, but in the medium-long term, according to Segre's research interests and to the development of his courses. So, the question arises: how did Segre design, build and update over time his storage and retrieval system?

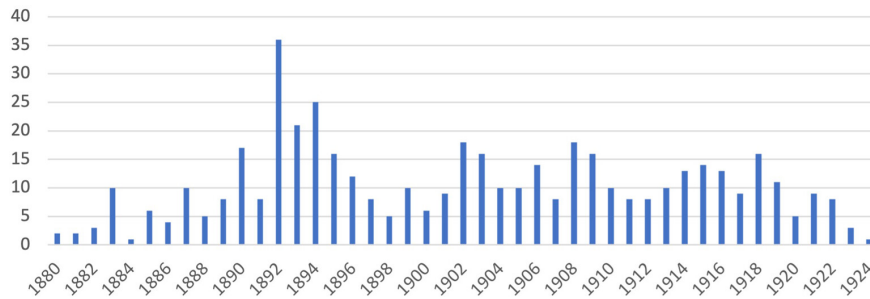


FIGURE 2 Chronological distribution of first records

In order to date the files of the *Schedario*, I started from a trivial working hypothesis: the particular significance of the first rows. A purely quantitative analysis of the years of publication of the first titles recorded resulted in the following graph, which highlights a peak in correspondence with the year 1892 (Fig. 2).

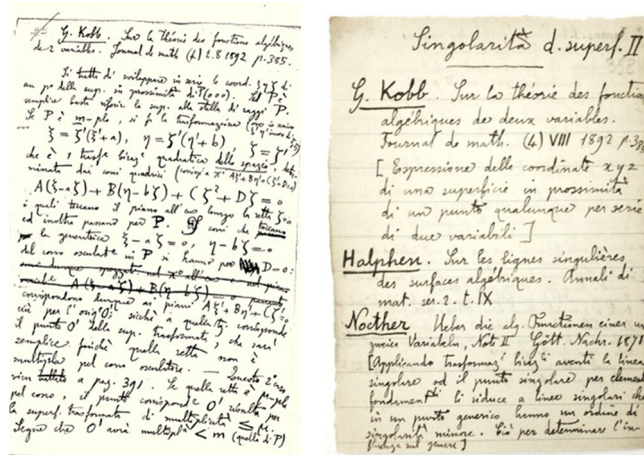
I then isolated the cards that open with a work published in 1892 (in total, 33). Another 96 sheets open with works published before 1892. I then cross-referenced the data with those derived from another Segre's manuscript, under the title *Resoconti di scritti letti*.²⁴ The latter contains summaries of 131 papers which appeared between 1862 and 1894 that Segre read during his university studies and in the first years of scientific training. From this comparative analysis there emerged 5 points of contact, namely 5 works of which there is both the summary in *Resoconti di scritti letti* and the citation in the card index (Figs. 3a–b).

Four of these were published in 1892. The conjecture is, therefore, that Segre used the system of tracking his readings that we will call A (that is, the system of the *Resoconti*) until 1892, when he passed to the system B of registration (that of the *Schedario*). Indeed, 1892 marks an important turning point in Segre's academic career, because in that year he was promoted to the rank of full professor.

Having identified the 129 cards which may have been the first to be produced, I moved on to a second level of analysis. Codicology allowed me to identify four types of ancient sheets, which will be labelled S1, S2, S3 and S4 (Figs. 4a–d).

The S1 sheets begin with references written on single lines; authors' surnames are in bold and underlined. S2-s have references written in single line

²⁴ Corrado Segre Archives, University of Turin: *Resoconti di scritti letti*, fols. AP1-AP131.



FIGURES 3A–B G. Kobb, “Sur la théorie des fonctions algébriques de deux variables,” *Journal de Mathématiques Pures et Appliquées*, 4, 8 (1892): 385–419, in *Resoconti di scritti letti* AP21 e *Schedario*, fol. 368

spacing; surnames and initials of authors’ names are in bold and underlined. S₃ begin items with surnames in bold and underlined; bibliographic data are abbreviated. In S₄, Segre starts to use space more effectively, writing between line spacing and with more minute handwriting. Surnames are no longer in bold. Bibliographic references are restored in non-abbreviated form, with the metadata recorded *in extenso*. The cards of the types S₁–S₄ all open with works prior to 1892, or published in the years 1892–1894. This means that the readings of ancient works that Segre made after 1892 no longer produced a summary in the manuscript *Resoconti di scritti letti*, but a line of text in the *Schedario*. Ultimately: the original nucleus of *Schedario* consists of 129 cards, of which 33 opened in 1892, 22 in 1893, 25 in 1894 and the remaining ones launched between 1892 and 1894.

From 1895 onwards, one should ask which new cards were inaugurated and how the existing ones were updated. The post-1895 cards belong to two categories: those that are ** II, III, IV, etc. (for example *Curve* II, III, IV, or *Superfici algebriche* II, III, IV, v, etc.). These are cards that were clearly launched when existing cards had no more space. The opening date generally coincides with the year of publication of the first item recorded, or it is slightly later. Challenging cards are those that are not ‘continuation of.’ Their implementation reflects the itineraries of Segre’s research and teaching activity. For example, 19 of the 30 files belonging to the didactics section were initiated together, between November 1907 and early 1908, when Segre succeeded D’Ovidio as professor

Coniiche
Analys. situs
Commissione 38

Tonelli. Osservazioni sulla teoria della connessione [negli iperspazi]
Atti Lincei (2) I 1873-74
p. 594-601

Bortolotti. Alcune osservazioni sulla definizione di connessione
Bologna Rendic. 1889-90 p. 132-133

Dyck *Analys. situs* M.A. 32, 37

W. Boy U. "Curvatura delle superf."

Curvatura (raggi, linee) 120

Plücker M.A. IX

Weyr M.A. III

Marx Synth. Nachweis d. Euler'schen Satz u. Krümmungsradien M.A. 17

D'Ocagne Sur la relation entre les rayons de courb. de 2 courbes planes reciproq. An. M. (3) 4, 1892

Libenthal U. geodätische Krümmung M.A. 12

Mehrmke Plem. Zeitschrift Schönmacher 37 (1892)

V. Snyder Lines of curvature on Annular Surfaces having two spherical Directrices Amer. J. 22, 1900

G. Scheffers Sächs. Ber. 52, 1900 [u. d. F⁴ Gruppe der archi osculatorii alle regionen normal. di una superficie in un suo punto.]

L. Schlesinger U. geodätische Krümmung. Archiv f. M. u. Ph. (3) 5, 1903

J. Knödel Die geodätische Krümmung der Krümmungslinien. Sächs. Ber. Math. Phys. II 1903 nell' Archiv f. M. u. Ph. (3) 6, 1903

A. Wahlen P. la forme des lignes de courbure d'une surface d'un ombilic. Archiv für Math. Physik 1903

Analys. situs
Curvatura
Sistemi di curve 1360

G. Scheffers. Evidenzschaaren, die auf jeder Geraden eine Involution bestimmen. Berichte der k. sächs. Ges. d. W. Leipzig 1892 p. 269-278
[Due tali sistemi costituiscono un fascio di coniche]

V. Libenthal U. Krümmung von Curvenschaaren M.A. 32 c 38

E. Bossert P. les surfaces de singularités des systèmes de courbes construites avec un élément donné. P.R. octobre 1888

Levi-Civita L. congruenze di curve Rend. Linc. (5) 8, 1899

E. Bossert P. le cercle considéré comme élément générateur de l'espèce Trilicci Annals 3, 1889

A. Greal Scharen von ∞^4 Kurven... durch jede Kurve einer gewissen Anzahl von Punkten hindurchgeht, welche je ∞^2 Kurven der Schaar enthalten. Zeits. Geogr. 1905 [1902]

Coniche I 93

Hierholzer. Ueber Kegelschnitte im Raume. Düroth Aufg. u. Kegelschn. im R. M.A. II

Rosanes Z. Theor. d. Kegelschn. M.A. III

Stüdy Abbildung d. Mann. aller Kegelschn. c. d. h. auf einen Punktraum M.A. 40

Montesano S. un sistema lineare [∞^2] di coniche nello spazio. Torino Atti 27 (1892) p. 660

Montesano Su i vari tipi di congruenze lineari di coniche. Rend. Acc. Napoli. 1895

Reye u. konfokale Kegelschnitte (Mittelschweizer. d. nat. phys. Gesellsch. Zürich, 1896)

Ignia Massarani Sott. alle coniche rispetto alle quali due altre son tra loro polari reciproci. Giornale 37 1899

Wiman M. d. Anzahl d. C^2 , welche durch Punkte, Tangenten und Normalen bestimmt sind. Zeitschr. f. M. u. Ph. 40, 1895.

W. Spottiswoode On the 21 Coordinates of a Conic in Space. Proc. Lond. Math. Soc. 10, 1879 p. 185

K. Reher Construction des Krümmungsradien $c. C^2$ durch 5 Punkte. Sächs. Ber. 52, 1900

Picci Congr. di coniche e archi. Atti Torino 28, 1893

FIGURES 4A–D The four types of ancient sheets revealed from the codicological analysis

of mathematics at the Teacher Training School.²⁵ According to our hypothesis on the launch date of the card index (i.e., the year 1892), the correspondences between the bibliographies of the first 4 courses in Higher Geometry held by Segre and the titles archived in the *Schedario* are occasional. A high degree of overlap between the items in the *Schedario* and the bibliographies of the lessons is achieved with the course of 1896–1897 onwards (*Lezioni sulle singolarità delle curve e superficie algebriche*, Notebook n. 8).

The *Schedario* is a permanent construction site. The division into items reflects the progressive stratification of knowledge. The most generic entries are the oldest; in the case of surfaces, for example, the earliest relate to general and particular surfaces. Hand in hand with the construction of a theory, Segre felt the need to open more specific tabs: *Superficie (classi speciali) I, II, III, IV, V, Superfici del 4° ordine, Superficie del 7° ordine, 8° etc., Superfici razionali*, etc. (fols. 380–384, 397, 405, 408, etc.). Analogously, when planning the lectures devoted to the theory of ruled surfaces for the courses delivered in 1907–1908, 1910–1911 and 1912–1913,²⁶ Segre added to the generic entry *Rigate* the specialistic ones: *Rigate algebriche* and *Rigate di 4° grado, 5° grado, 6° grado* etc. (fols. 340, 341, 342). As a consequence, in 1913, *Schedario* included 99 references on ruled surfaces and their properties alone.

6 The Features of Segre's Indexing Project

Segre's card index is an adequate source to articulate legitimately a reflection on the cultural heritage of this mathematician. In fact, in compiling the index, there is no doubt that Segre carried out an operation of analysis and selection of the material at hand, classifying the works that he considered, for one reason or another, significant. Why were they so? An initial relationship can be established between the progressive construction of the *Schedario* and Segre's scientific biography. For simplicity it will be divided into four moments: the years 1883–1891, 1892–1904, 1905–1913 and 1914–1924.

The first period is that of Segre's apprenticeship and debut on the mathematical scene. 60% of the items registered in the *Schedario* are of German

25 *Analisi indeterminata di 1° grado; Approssimazioni numeriche; Didattica; Didattica (sulla geometria elementare); Divisibilità; Equazioni; Euclide; Fondamenti dell'Arithmetica; Frazioni; Funzioni; Fusione (geometria); Geometria; Impossibilità; Numeri trascendenti; Pitagora (teorema di); Probabilità; Quadratura del circolo; Teoria dei numeri; Trigonometria piana.*

26 Fondo Corrado Segre, Biblioteca Speciale di Matematica, Università di Torino: *Capitoli vari di Geometria della retta* (Notebook no. 21); *Le curve e le superficie algebriche, dal punto di vista della Geometria delle trasformazioni birazionali* (Notebook n. 24); *Enti geometrici legati ai sistemi lineari di coniche e quadriche* (Notebook no. 26).

production (Fig. 5a). This means that Segre, at those times, read mainly ‘German things,’²⁷ possibly motivated by his advisor D’Ovidio and by the correspondence he entertained with Klein, A. Voss, L. Kronecker, etc.²⁸

Between 1892 and 1904, not only did Segre’s institutional role in Turin strengthen, but also his prestige in Italy and abroad.²⁹ Most of his energies went into the creation, management, and affirmation of his School. From 1897, Segre entered the international mathematical arena with full rights: he participated in international congresses, made new encounters, and new friends sent him their papers. The range of his readings consequently expanded while retaining a German-speaking imprint. At this stage, Segre began to file publications by Scandinavian, Hungarian, Argentine and Spanish authors (Fig. 5b). From 1904, Segre also joined the editorial board of the *Annali di Matematica pura ed applicata* and this allowed him to receive in exchange the journals *Jahrbuch über die Fortschritte der Mathematik*, *Monatshefte für Mathematik und Physik*, *American Journal*, *Journal des mathématiques pures et appliquées*, *Acta mathematica* and the *Annales de l’Ecole Normale Supérieure*.³⁰

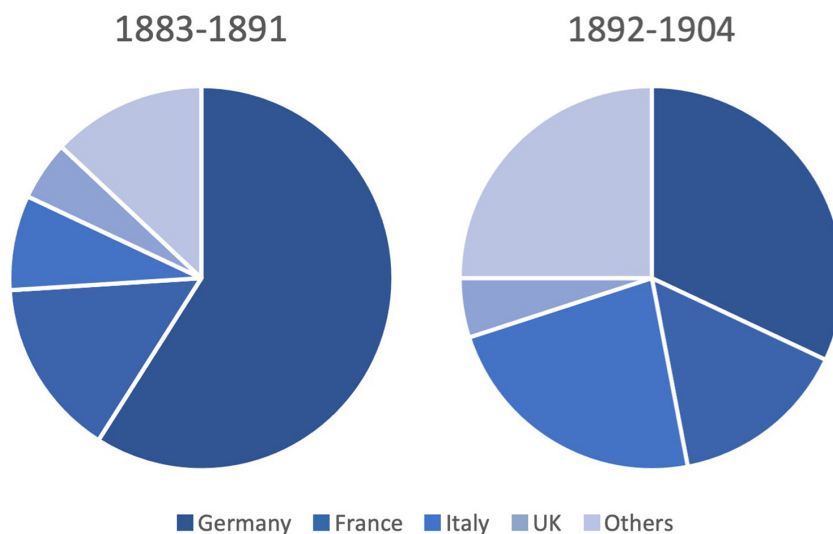
Throughout the period 1905–1913, Segre took advantage of relational capital built up in twenty years of profession. The weight of Italian references remained fixed, but the diversity of authors increased, probably because a rising number of Italian mathematicians, especially the young ones, sent their works to Segre, also for reasons of scientific opportunism. From the point of view of the geography of quotations, American literature assumed a more important role, passing in 8 years from 1% to 10% of the titles in question (Fig. 6a). More and more often, the works were accompanied by the note ‘my library’ (*mia biblioteca*) or by the position in the Special Mathematical Library. Segre began to need to keep track of the physical position of texts he wished to consult. Management of the Library, a role taken up in 1907, gave him direct and immediate access to all books, extracts and journals that entered the insti-

27 Chart pies were elaborated by Dr. Elena Scalambro, to whom we express our gratitude. National characterization refers to the authors. If a German mathematician published a paper in a Swedish journal, for example, the item was counted in the ‘Germany’ quota. The very few cases of works by authors of two different nationalities were counted twice.

28 Erika Luciano and Clara Silvia Roero, “From Turin to Göttingen: Dialogues and Correspondence (1879–1923),” *Bollettino di Storia delle Scienze Matematiche* 32 (2012): 7–232.

29 Alberto Conte and Livia Giacardi, “Segre’s University Courses and the Blossoming of the Italian School of Algebraic Geometry,” in *From Classical to Modern Algebraic Geometry*, eds. Gianfranco Casnati, Alberto Conte, Letterio Gatto, Livia Giacardi, Marina Marchisio, Alessandro Verra (Cham: Springer, 2016), 3–91.

30 Salvatore Pincherle to Corrado Segre 3.11.1923, in Luciano e Roero, “Corrado Segre and his Disciples,” 206–207.



FIGURES 5A–B Geography of titles recorded in the *Schedario* in the first two periods of Segre's biography ■ figures merged, ok?

tution.³¹ The *Schedario* reflects this new component of Segre's undertaking: on one hand, the number of works registered yearly (about 200) increased, on the other hand the requests for the purchase of books and offprints that he received from colleagues, led him to turn attention to new fields of study. As a result, in these years Segre initiated several new cards on subjects that until then had remained marginal to his interests: set theory, theory of groups, relativity, etc.

The last fifteen years of Segre's scientific activity are characterised by the opening of a new field of study, differential geometry, of which he traces a research programme in 1909–1910.³² The differential turn, which arose from the reinterpretation of the geometric theory of differential equations from the projective point of view and from its generalisation to spaces of higher dimension, is returned by the *Schedario*. First, Segre launched a lot of new cards.³³ This

31 Erika Luciano, "Constructing an International Library: The Collections of Journals in Turin's Special Mathematics Library (1883–1948)," *Historia Mathematica* 45, 4 (2018): 433–449.

32 Corrado Segre, "Preliminari di una teoria delle varietà luoghi di spazi," *Rendiconti del Circolo Matematico di Palermo* 30 (1910): 87–121 and *Fondo Corrado Segre, Biblioteca Speciale di Matematica, Università di Torino: Rassegna di concetti e metodi della Geometria moderna (1908–1909)*, Notebook n. 22.

33 *Affinità, Antiproiettività, Collineazioni in S_n , Corrispondenze; Curve algebriche iperspaziali; Derivazione; Fondamenti S_n , Geometria affine; Geometria a più dimensioni, in generale; Geometria conforme; Geometria delle rette; Geometria differenziale proiettiva; Geometria*

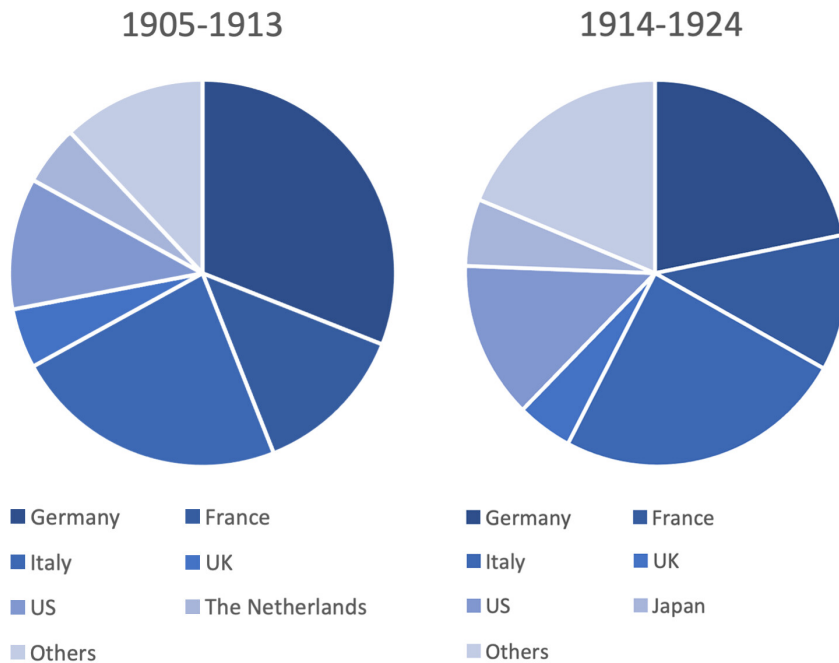
is typical: every time a new field of study is inaugurated, many new readings are to be made. In these years, Segre also organised the bibliographic references according to cards of ‘general-differential-infinitesimal geometry’ and ‘algebraic geometry’ depending on whether a given theme is addressed from one point of view or the other. This also happens for very specific entries, such as twisted curves, for which there are two billets: *Curve sghembe (geometria differenziale)* and *Curve sghembe algebriche* (fols. 142, 143–144). In this case, the two cards include, respectively, 33 and 18 references, with a single intersection, a work by T. Hayashi (*On the surface of lowest degree passing through a given curve in space*, *Annals of Mathematics*, 2, 18, 1916, pp. 1–3). Furthermore, in the context of this new field of study cultivated by Segre and his protégés, we notice the appearance in the *Schedario* of various works by Japanese differential geometers (such as Hayashi) and/or published in Japanese journals (Fig. 6b).

Beyond the different dynamics of the patrimonialisation of geometric knowledge in the four periods considered, there are two elements that globally characterise the indexing project carried out by Segre. The first is the regularity with which the cards were updated. Very few cards stopped at a certain date or were not reviewed for long periods. By way of example, suffice it to say that in 1922, 1923 and 1924 Segre updated 109, 90 and 30 cards, recording 224, 190 and 38 publications respectively. The second permanent feature is the short cataloguing times. Some loose sheets that have been found together with the *Schedario* confirm this: the volume by J. Coolidge *The geometry of the Complex Domain* entered the Special Mathematical Library on May 2, 1924 and was recorded by Segre on the card *Imaginari (numeri complessi ecc.)*.³⁴ Before May 18,³⁵ Weltzenböck’s book *Invariantentheorie*, which arrived on May 10, 1924, was filed on a small slip of paper. Segre did not have time to copy the title in the card *Invarianti*, as he planned to do.³⁵

differenziale proiettiva delle varietà; Geometria proiettiva (varia); Gruppi (continui); Gruppi di trasformazioni birazionali; Integrali; Intersezioni; Involuzioni sulle superficie; Ipersuperficie algebriche; Matrici; Moduli di forme ecc.; Movimenti; Politopi; Punti multipli di varietà; Postulazione; Quadriche iperspaziali; Quadrilateri; Reciprocità; Relatività; Rigate; Rigate algebriche; Sfere (geometria delle); Spazi a infinite dimensioni; Sistemi di rette; Sistemi di spazi; Sistemi di varietà; Spazi subordinati di S_n ; Superficie speciali (geometria generale); Superficie algebriche (particolari); Superficie dei primi ordini; Trasformazioni conformi piane; Trasformazioni di superficie; Trasformazioni di varietà; Trasformazioni in S_n ; Varietà (geometria generale) speciali; Varietà luoghi di spazi; Varietà del 4° ordine.

34 Biblioteca Speciale di Matematica, Dipartimento di Matematica, Università di Torino: *Registro d'ingresso*, no. 2620 and *Schedario*, fol. 247.

35 Biblioteca Speciale di Matematica, Dipartimento di Matematica, Università di Torino: *Registro d'ingresso*, no. 2637, and *Schedario*, non-numbered fol.



FIGURES 6A–B Geography of titles recorded in the *Schedario* in the first two periods of Segre's biography ■ figures merged, minor changes to legend, ok?

7 The Use of the *Schedario*

Segre built the *Schedario* as a working device. More precisely, the concordance between the headings of the cards and those of paragraphs of his lectures notes shows that Segre organised and mobilized it in order to structure and renovate his teaching activity year after year. His use of the index massively increased over time, and examples abound. Card *Abel. Teorema di* (fol. 45) was introduced in the summer of 1903 when Segre was preparing the part of the course *Applicazioni degli integrali Abeliani alla Geometria* (1903–1904) devoted to Abel's theorem (fols. 150–178). Sheets *Cerchi I, II, III, Sfere I, II* and *Sfere I, II* (fols. 66, 67, 68, 349, 350) were all improved during the planning of lessons for the year 1922–1923 (*Geometria dei cerchi e delle sfere*, Notebook no. 36).

Although the main use of the *Schedario* was didactic, Segre also enhanced this retrieval service in view of research activity. The main example dates back to 1896. In May of this year, Segre discussed with Castelnuovo and Enriques about the scheme of a series of texts, to be published with Teubner, which could disseminate abroad the results of the Italian School. Segre undertook to write the volume dedicated to the geometry of algebraic structures in multidimen-

sional spaces. He intended the book, under the title *Vorlesungen über Geometrie der algebraischen Gebilden, mit besonderer Berücksichtigung der mehrdimensionalen Räume*, to provide a synthesis of his latest courses of Higher Geometry.³⁶ In conjunction with the edition, Segre opened several new cards in the *Schedario*.³⁷ The volume never came to fruition, but it provided the outline for the chapter *Mehrdimensionale Räume* published by Segre in the *Enzyklopädie der mathematischen Wissenschaften*. The essay, on which Segre began work in November 1896, was completed in 1912 and published nine years later.³⁸ The cross-referencing between the quotations inserted in this chapter and the titles registered in the card index exceeds 87%. High percentages of overlap can also be recorded for the chapters of the *Enzyklopädie* edited by Enriques and Castelnuovo,³⁹ which suggests that Segre made his *Schedario* available to the protégés of his School, just as he did with his Notebooks.⁴⁰

The scarce and fragmentary information available on the working practices of Turin mathematicians allows us only to formulate hypotheses on how concretely Segre used his personal filing cabinet. An exercise in imagination will possibly help where social historical documentation gives way. Imagine the summer of 1916: Segre hears that Klein (who is a constant source of inspiration for him) is publishing a series of volumes on elementary mathematics from a higher standpoint. He therefore decides to dedicate his next course to this theme. First, he forms an idea of how Klein develops it. He then picks up the wooden box containing his *Schedario* and begins to extract the cards that, *à la* Klein, fall under the umbrella of so-called elementary mathematics from a

36 Corrado Segre to Guido Castelnuovo and Federigo Enriques, 30.12.1896, in Luciano and Roero, “Corrado Segre and his Disciples,” 112.

37 *Connessi, Contatti, Curve algebriche, Deformazione delle superficie, Forme di Hermite (a variabili complesse coniugate), Geometria sopra una curva, Geometria sopra una superficie, Intersezioni di superficie e varietà, Simmetrie, Superficie algebriche degl'iperspazi, Varietà algebriche, Varietà algebriche di ordini superiori al 4°, Varietà di rette negl'iperspazi.*

38 Corrado Segre, “Mehrdimensionale Räume,” in *Enzyklopädie der mathematischen Wissenschaften*, III.2A.7 (Leipzig: Teubner, 1921), 769–972.

39 Guido Castelnuovo and Federigo Enriques, “6a Grundeigenschaften der algebraischen Flächen,” and “6b Die algebraischen Flächen von geschnitten aus,” in *Enzyklopädie der mathematischen Wissenschaften*, III.2.1 (Leipzig: Teubner, 1915), 635–673, 675–767.

40 For example, the paper by Erika Luciano, “Turin, 1916, G. Fubini: une expérience de patrimonialisation en théorie des nombres,” *Philosophia Scientiae* 26, 2 (2022): 1–15 demonstrates a scenario of the *Filing cabinet* by Guido Fubini, Segre's colleague in Turin from 1910 to 1924. When, in 1916, Fubini decided to dedicate his course of Higher Analysis to number theory, he turned to Segre. He showed him the two cards concerning number theory present then in his *Schedario* (fols. 413, 27). Most of the bibliographical references that were noted there were used by Fubini and were cited in the lithograph copy of his *Lezioni*.

higher standpoint: *Fondamenti della Geometria I, II, III, IV, Costruzioni geometriche I, II, III*, etc. (fols. 173–176, 107–109, etc.). On the sheet *Fondamenti*, the link to non-euclidean geometries is noted, then he extracts the corresponding billets: *Geometria non euclidea I, II, III e IV, V* (fols. 212–217). Once the structure of the course has been designed, Segre proceeds to the drafting of his lectures (*Vedute superiori sulla Geometria elementare*, Notebook no. 30). It is at that moment that, writing about the finite nature of space, he has an impasse. He remembers having read a commendable work containing a critical reflection on the nature of space. The author's name escapes him, but he is sure of having mentioned it in one of his past classes. Which one? It may have been in the course of modern geometry (*Rassegna di concetti e metodi della Geometria moderna 1908–1909* (Notebook no. 22) or in the *Lezioni di Geometria non euclidea* of 1902–1903 (Notebook no. 16). He peruses the two Notebooks and, in the second one, he finds the name he was looking for: Newcomb (Notebook no. 16, p. 15). At that point, he returns to the card index and scrolling through the references to non-Euclidean geometry, Segre goes back to the work he had appreciated: G.B. Halsted, *Newcomb's Philosophy of Hyper-space* (Science, 7, 1898, p. 212).⁴¹ Browsing these cards, however, he ascertains that he has recorded another paper potentially interesting: P. Harzer, *Die Sterne und der Raum* (Jahresbericht der Deutschen Mathematiker-Vereinigung, 17, 1908, pp. 237–267). He read it in 1908 and found it convincing, even better than Halsted's paper. In the lectures notes on elementary mathematics from a higher standpoint, Segre then inserts the correct and complete quotations from both Newcomb's and Harzer's papers.⁴² The Harzer reference is also added to the old Notebook of non-Euclidean geometry.⁴³ Now, in reporting Harzer's title, Segre realises that, in 1902, he had spoken of non-Euclidean geometry also in relation to mathematical physics. He therefore returns to pick up his card index and extracts a new fiche: *Meccanica non euclidea* (c. 276), and so forth.

41 Fondo Corrado Segre, Biblioteca Speciale di Matematica, Università di Torino: *Schedario*, fol. 214.

42 Fondo Corrado Segre, Biblioteca Speciale di Matematica, Università di Torino: *Vedute superiori sulla Geometria elementare (1916–1917)*, Notebook no. 30, pp. 15, 16.

43 Fondo Corrado Segre, Biblioteca Speciale di Matematica, Università di Torino: *Lezioni di Geometria non euclidea (1902–1903)*, Notebook no. 16, p. 13.

8 Conclusions: a Patrimonialisation Project of Geometric Knowledge

Segre's card index is not a catalogue of a library, and its marshalling is not a purely material operation, like that of compiling the inventory of a library. In inaugurating and updating the cards, Segre made cultural choices. Which ones? It would be unrealistic to try to answer for each of the cards, and for many it would be absurd to even attempt.

However, it is possible to draw some general conclusions, considering the ratio between the number of references and that of cards to be a dynamic indicator of the level of content patrimonialisation at a fixed time. Where Segre's geometric culture is more 'refined,' the number of references per card increases and the granularity of the division into cards increases. So, for example, in 1904 against a single sheet *Analysis situs* with 17 items (fol. 50), there are 5 cards *Superficie algebriche* with 34 items each (fols. 385, 387, 487, 383, 389).

As far as algebraic structures in S^n are concerned, the selection made by Segre generally tended to reward German and Italian production. However, compared to his peers, Segre appeared more interested in the developments of English-speaking geometry. However, essential caution is required in this kind of comparison. In the first place, it is praxeological that Segre's readings be different from those of the second and third generation of his protégés (Fano, Severi, Terracini, etc.). Secondly, the *Schedario* cannot be considered a high-definition picture of Segre's culture because it has no encyclopaedic or historical purpose, being a working tool conceived in the perspective of the present and the future. Finally, although there surely existed a set of readings shared by all the members of the School of Segre, knowledge of their assets is too fragmentary to draw inferences with a suitable degree of accuracy. Little or nothing is known, for example, of the libraries of Castelnuovo, Enriques, Severi and Fubini.

Segre's card index is a sort of 'mind palace.' It is a mind/concept map, organised according to highly personal criteria (and therefore a mainly self-serving device), created to store and retrieve information. Its construction presents many similarities with indexing processes conducted by automated tagging service systems. Segre had a natural talent for this type of activity and arrived at an indexing method characterised by remarkable sobriety, efficiency, and stability. Sobriety because Segre did not store all the information he possessed, perceiving that filing dozens of works by one author would involve going to check dozens of references before identifying where the researched content was. Efficiency, because the items were recorded only where needed. Segre realized that the insertion of a same title in many different cards would make the archived information less traceable. As a matter of fact, among more than 6,000

items, only some forty were duplicated. Stability, because Segre attributed the headings definitively and changed them very rarely. Changing tags is not a trivial act, indeed, since every change has an impact on the overall structure of the mind palace; it would be like moving a wall in a building. Out of 500 cards, just 8 were retitled.

Tagging and indexing were initiated and implemented by Segre alone, without negotiation with his protégés, and both depended on a working practice that was peculiar to him (i.e., organising and archiving his readings by subject). Despite the subjective character of the final output, the *Schedario* reflects the virtual library, i.e., the cultural heritage of a community (the Italian geometers), more faithfully than their material patrimonies could do. In fact, assets are, at least in part, the result of random acquisitions (legacies, works presented in homage, etc.), while the *Schedario* archives only selected information. In this sense, Segre's card index arrives at superbly returning four cultural characters typical of the Italian geometers of the Belle Epoque: the internationalist but very German-oriented style; the sound culture in projective geometry of n -dimensional spaces (a culture then dispersed with the students of the next generations, like B. Segre, E. Togliatti, G. Zappa, A. Andreotti, etc.); the fragility in three domains (abstract algebra, topology and number theory), and an important linguistic bias, i.e. the ignorance of English.

Therefore, Segre's *Schedario* is a truly suggestive source, endowed with a strong heuristic potential to approach the historical questions concerning mathematical heritage(-s). The rediscovery of this tool has made it possible to build a more complete and nuanced narrative of Segre and his work. It was not simply serendipity, but a first fortunate episode of encounter between the culture of the book and the social history of mathematics.