

THE GRENOBLE INSTITUTE OF PHONETICS AND ITS ROLE IN THE CONCEPTUAL TRANSFORMATION OF PHONETICS IN THE EARLY 20TH CENTURY

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Abstract: The 19th century marked a scientific evolution in linguistics with the rise of experimental phonetics. Foreign language teaching gradually integrated this new discipline, leading to the creation of the first phonetics research laboratories. At the beginning of the 20th century, Grenoble's economy was booming and the university was expanding. Thanks to the *Comité de patronage des étudiants étrangers*, phonetics began to be taught. In 1904, a chair of modern French philology was created, entrusted to Théodore Rosset, who played a central role in establishing experimental phonetics in Grenoble. Rosset founded a phonetics laboratory on his arrival, gradually transforming it into an institute combining teaching and experimental research. He developed innovative teaching methods using phonographic recordings, speech vibration inscription and voice analysis instruments.

1 Introduction: the renewal of Phonetics in Europe at the end of the 19th century

The field of linguistic studies underwent a remarkable development in the 19th century, marked by the intellectual and cultural revolution of the Enlightenment and the legacy of the work of the founders of comparative grammar, such as E. Rask, W. von Humboldt, F. Bopp, A. Schleicher and G. von der Gabelentz. Inspired by the Lamarckian hypothesis, philologists adopted a natural conception of languages as evolving organic bodies, capable of adaptation and mutation [1]. In a paradigm encompassing homology and universalism, the historical study of languages turned towards heredity and the search for the natural causes of evolution at different depths: syntax, morphology of words, and naturalness of the sounds that express them [2].

1.1 From grammar to phonetic laws

From a comparative perspective, the description of sound changes in different eras led philologists to propose regularities in mutations. Towards the end of the 19th century, neo-grammarians formulated these regularities in terms of “laws” (like laws of physics), since they apply uniformly (even if there are exceptions, as long as these remain explicable) to the succession of stages in historical evolution. “Laws” mean that language evolution is not arbitrary, and that phonetic changes are predictable (e.g. [3]). The first phonetic laws issued by [4], and then [5], revealed the importance of the sound component and the rational interpretation of changes for understanding languages and their evolution, and establishing their kinship. There followed a preoccupation that was to accompany comparatists throughout the 19th century: the unsuitability of the Latin alphabet for transcribing the sounds of languages [6].

1.2 From phonetic laws to experimentation

To retrace the history of linguistic change, reasoning based on written forms alone proves insufficient: understanding sounds and the logic of their modification becomes necessary. For

this, a thorough knowledge of the sound elements of language is required. The ideas and principles of A. Comte's philosophical positivism, which spread in the second half of the 19th century, contributed to the development of this knowledge through new methodological approaches favoring observation, measurement and experimentation. These were made possible by the invention of new techniques and the creation of new instruments, such as those used by the physician and physiologist E. J. Marey to record and graphically inscribe speech [7]. Neo-grammarians then sought the causes of phonetic changes in the physical, articulatory (mechanical actions) and acoustic (sonority analogies) characteristics of sounds [8]. Also contributing to the methodological renewal of the sciences was the dissemination of C. Bernard's experimental method, based on several key steps that alone enable us to move from the observation of a phenomenon to a causal and scientific explanation of phenomena [9].

1.3 The difficult path toward the recognition of oral language

Against this backdrop of renewed scientific knowledge, and soon after its creation in 1866, the *Société de Linguistique de Paris* (SLP) promoted the study of spoken language—oral rather than written—and, in 1874, set up an instrument commission at the initiative of its secretary, the philologist L. Havet [7]. However, at the end of the 19th century, the scientific approach to oral languages did not include regional languages and dialects (or patois), whose scientific interest in linguistics had not yet been clearly identified. The same applied to everyday language practices. As a result, although inspired by the scientific revival of the time, university institutions continued to give priority to the study of classical languages (Romance, Germanic, Slavic, etc.) from a historical and philological perspective, and to literary studies. Little attention was paid to the scientific study of dialects, which will continue to lack academic recognition for many years to come. This was despite early initiatives based on field surveys (e.g. those of J. Gilliéron, initiator with P. J. Rousselot in 1887 of the *Revue des patois gallo-romans*), of Rousselot himself [10], or a little later those of F. Brunot, instigator of the first phonographic surveys (1911-1914) and creator in 1911 of the *Archives de la parole* [11], [12], [13].

1.4 The development of practical foreign language instruction

In the first half of the 19th century, in connection with industrialization and the post-French Revolution era of 1789, education became institutionalized at the state level throughout Europe. To meet the needs of international exchange, the practical teaching of foreign languages was introduced in France as early as 1829 through the reform of Modern Education (ordinance by Henri de Vatimesnil). However, in its struggle with classical education, it was only under the ministry of Victor Duruy (1863–1869), and more decisively under the Third Republic, that it truly developed, driven by strategic national priorities [12], [14], [15]. Although the primacy of spoken language was included in ministerial guidelines as early as 1840 [14], phonetics remained virtually unknown until 1886 [16]: oral learning meant mastering a normative pronunciation model based on pronunciation manuals, always tied to written language [13], [17]. With P. Passy in France—then a young agrégation holder in English and founder in 1886 of the *Dhi Fonètik Tîtcierz' Asóciécon* (which became the *Association phonétique des professeurs de langue vivante* in 1889)—alongside others such as O. Jespersen in Copenhagen and H. Sweet in London, phonetics entered universities as the science of spoken sounds.

Scientific advances allowed for the development of a modern approach to language teaching, integrating into “natural” learning methods new knowledge from the physics and physiology of speech sounds [12], [18]. The success of these new pedagogical methods—particularly in the context of growing international exchanges—soon led to the creation of university training programs in the form of workshops or summer courses for foreign students wishing to improve their French for professional or cultural purposes. The University of Grenoble was among the first to launch such programs, as early as 1896 [12], [19]. Between the late 19th and early 20th centuries, the first experimental phonetics laboratories began to spread across France [20],

[21]: Paris in 1897 (P. J. Rousselot), Grenoble in 1904 (T. Rosset), Montpellier in 1905 (M. Grammont), Lille in 1911 (F. Piquet)... and internationally: Kazan in Russia in 1895 (V. A. Bogorodickij), Hamburg in 1910 (G. Panconcelli-Calzia), London in 1912 (D. Jones), Barcelona in 1913 (P. Barnils), Perth, Australia in 1913 (E. Suddard). Despite their geographic spread, phonetics laboratories remained relatively few in number, and some evolved into full-fledged institutes. Why did the University of Grenoble become home to one of the first phonetics institutes in France and Europe [22: 24], and how did this institute position itself within the legacy of P. J. Rousselot and E. W. Scripture?

2 The emergence of Phonetics in Grenoble

2.1 Grenoble at the turn of the 20th century

At the beginning of the 20th century, Grenoble was a dynamic city whose population had been steadily increasing since the early 19th century [23]. Between 1806 and 1901, it grew from 22,000 to 69,000 inhabitants. This demographic growth can be explained by several factors. First, the economic dynamism of the city and its region, which saw the rise of hydroelectric industries—referred to as “*houille blanche*” (*white coal*)—such as paper mills, boiler-making, electrometallurgy, electrochemistry, and others. These industries attracted thousands of workers to Grenoble, both from within France and abroad (notably from neighboring Italy). In addition to this economic vitality came the development of mountain tourism. The Isère branch of the French Alpine Club was founded in 1874 by H. Duhamel and C. Lory, a professor of geology at the University of Grenoble. In 1889, the *Syndicat d’initiative de Grenoble et du Dauphiné*—the first tourist office of its kind in France—was established.

This economic and touristic dynamism in the early 20th century led to the development of the University of Grenoble. Although it is one of the oldest universities in France (founded in 1339 by Humbert II, the last ruler of the Dauphiné), the University of Grenoble had experienced a chaotic history over the centuries, constantly competing with the neighboring universities of Vienne and Valence [24]. However, it found a passionate advocate in J. Fourier—an eminent mathematician and prefect of the Isère department from 1802 to 1815—who actively supported the *Université impériale*, created in 1806. Fourier developed the three faculties of Law, Humanities, and Science. While Law had been a central discipline in Grenoble since the university’s foundation (Dauphin Humbert II had a keen interest in Roman law), the Humanities and Sciences truly began to flourish under the *Université impériale*. Figures such as J. Fourier, the Champollion brothers (including Jean-François, the decipherer of hieroglyphs), and the botanist Dominique Villard played key roles in the intellectual life of Grenoble at the time.

However, in the early 19th century—just as in the rest of the academic world—there was no mention of teaching or research in phonetics. It was only toward the end of the 19th century that interest in this new discipline, experimental phonetics, began to grow within the Faculty of Humanities. This development was initiated by the creation in 1896 of the “*Comité de patronage des étudiants étrangers*” (Committee for the Support of Foreign Students) at the University of Grenoble, led by M. Reymond [25].

2.2 The *Comité de patronage des étudiants étrangers* (CPEE)

The CPEE of Grenoble was a group of academics, industrialists, and prominent local figures who came together in 1896 under the initiative of M. Reymond to promote Grenoble and its region among foreign students. The creation of a CPEE in Grenoble was not an isolated case in France; several such committees existed at the end of the 19th century. All appear to follow the model of the Paris committee, founded in 1891 and directed by P. Melon.

The statutes of the Grenoble CPEE specify in their first article¹:

*“La société qui prend le nom de comité de patronage des étudiants étrangers près l’université de Grenoble, fondée le 3 juillet 1896, a pour but d’inviter par la plus large publicité possible les étrangers à venir faire leurs études à Grenoble, de faciliter leur installation ; de leur donner un appui moral et d’organiser les enseignements les plus propres à attirer une clientèle étrangère, soit pendant les vacances, soit pendant le cours de l’année scolaire.”*²

The early days of the CPEE in Grenoble were modest. In 1896, only one foreign student—a German—enrolled at the university. But very quickly, the number of foreign students of various nationalities began to grow [19]. The CPEE notably funded university teaching positions and hosted visiting professors to give seminars during the holiday sessions. Thus, several eminent linguists came to teach phonetics during the summer courses: M. Bréal in 1899, P. J. Rousselot in 1900, and P. Passy in 1903. In 1904, in response to the growing success and increasing number of foreign students coming to Grenoble to learn French, the CPEE began discussions with the Faculty of Letters to propose the creation of a lectureship in modern French philology for the teaching of French to foreign students. The job announcement was published in 1904, and the Faculty Assembly reviewed applications on June 27, 1904. Ultimately, T. Rosset was selected from among five candidates on November 1, 1904. His responsibilities included 1 hour of modern French phonetics, 2 hours of grammar (morphology and syntax), and 1 hour of text commentary. Upon his arrival as Lecturer, Rosset set about developing his laboratory, attached to the Faculty of Letters. As he recalled in 1909, the laboratory’s initial funding came directly from the Ministry. Since the University of Grenoble was unable to provide a location for the laboratory, the CPEE turned to the city of Grenoble. In May 1905, an abandoned room in a primary school was equipped with two tables, a phonograph, and a portable recorder. This marked the beginning of the phonetics laboratory in Grenoble [26].

2.3 Théodore Rosset

At the time volumes 1 and 2 of *Principes de phonétique expérimentale* by Rousselot were published (1887, 1901), Rosset was serving in the military. He was 21 years old. His military record indicates that he was a student residing at *Lycée Michelet* in Paris and pursuing a degree in Literature, which exempted him from the final two years of national service in exchange for a ten-year reserve commitment and continued studies. From 1901 to 1904, Rosset was a full student in Section IV (Historical and Philological Sciences) at the *École des Hautes Études* (EHE), most likely admitted on the recommendation of a faculty member after a short probationary period to assess his interest in research. His professors (or research directors) in philological sciences included L. Havet in Latin Philology, M. Bréal and A. Meillet in Comparative Grammar, G. Paris, A. Thomas, and M. Roques in Romance Philology, J. Gilliéron in the Dialectology of Roman Gaul, and P. Passy in General and Comparative Phonetics. Although many philologists were interested in phonetics and supported Rousselot’s experimental method, few actually practiced it themselves [27], the experimental method was not part of the EHE’s curriculum. Even though some syllabi mentioned field visits to museums or courses held at the Louvre (e.g., Assyrian Philology, Roman Epigraphy, Literary History of the Renaissance), there is no indication that Rousselot’s laboratory was included in the phonetics program. The phonetics

¹ Statuts du Comité de Patronage des Étudiants Étrangers près l’université de Grenoble, 1902.

² The society, which adopts the name Committee for the Patronage of Foreign Students at the University of Grenoble, founded on July 3, 1896, aims to encourage foreigners to come study in Grenoble through the widest possible publicity, to facilitate their settlement, to provide them with moral support, and to organize the types of courses most likely to attract a foreign clientele, either during holidays or throughout the academic year. [our translation]

taught at the EHE followed the “classical” scientific methods of the Neogrammarians. According to [11] and [17], this absence can be explained by: i) Linguists’ scepticism toward the experimental approach, which required new technical skills that many were reluctant to acquire—as Passy himself would admit in 1932 [17]; ii) The fear of marginalization or exclusion from the academic world for deviating from the scientific methods of Neogrammarian philology [11].

In the same year he earned his licence ès Lettres, Rosset passed the *agrégation* in grammar in 1904, ranking 4th. The director of *agrégation* training at the Sorbonne at that time was F. Brunot, under whose supervision Rosset conducted the research that would result in his first publications [28], [29]. But his real entry into the field of experimental phonetics for French language teaching came with the publication of *Exercices pratiques d'articulation et de diction composés pour l'enseignement de la langue française aux étrangers* [30]. He threw himself energetically into developing this course while becoming increasingly involved in the CPEE’s activities, eventually becoming its secretary in 1907.

2.4 The birth of the Phonetics Institute of Grenoble

Benefiting from an increasingly substantial budget—mainly from the registration fees paid by foreign students and royalties from the sales of Rosset’s *Exercices pratiques*—the phonetics laboratory gradually expanded. An inventory written by Rosset in 1911 of the equipment, furniture, and books he had acquired since the laboratory’s inception allows us to trace its development. By 1911, we find a heterogeneous list including instruments such as a Koenig analyzer, a Lumière cinematograph, Edison phonographs, etc.; as well as laboratory supplies (oil, kerosene, gasoline, alcohol), test tubes, rubber tubing. With its growing equipment and increasing activity, the laboratory moved in May 1908 to a more “respectable” room than the outdated space of its early days (figure 1). At this point, it gained the status of *Institute of Phonetics*, combining research and university teaching. This new status gave the phonetics program in Grenoble a unique place in the French and European academic landscapes [22].

“Il y a dans la plupart des Facultés des Lettres un cours de phonétique historique ; il y a à l'École des Hautes Études, à Paris, et dans diverses Universités étrangères des séminaires de phonétique descriptive où l'on décrit et enseigne aux futurs professeurs de langues vivantes les sons de ces langues ; il y a enfin, au Collège de France et dans cinq ou six Universités françaises et étrangères, des laboratoires de phonétique expérimentale ; mais nulle part on n'a songé à réunir en un seul corps ces tronçons épars des études phonétiques. C'est une création originale de l'Université de Grenoble que d'avoir groupé en un Institut particulier toutes ces recherches pratiques, historiques, dialectales et expérimentales, et attesté par là leur intime solidarité.”³ [30: 445]

As for the research activities mentioned by Rosset, while the practical, historical, and experimental aspects are clearly attested, it is more difficult to find evidence of dialectal research in his publications. Yet, Rosset noted—in 1909—that “*L'Institut est membre fondateur de la Société internationale de dialectologie romane et il sera officiellement chargé de faire l'étude*

³ Most Faculties of Letters have a course in historical phonetics; there are descriptive phonetics seminars at the *École des Hautes Études* in Paris and in various foreign universities, where the sounds of Modern languages are taught to future language teachers; there are, finally, experimental phonetics laboratories at the *Collège de France* and in five or six French and foreign universities. But nowhere has anyone thought to bring together these separate branches of phonetic studies into a single body. It is an original creation of the University of Grenoble to have grouped all these practical, historical, dialectal, and experimental studies into a distinct Institute, thereby attesting to their intimate interconnection. [our translation]

des patois et dialectes du Dauphiné”⁴ [30: 449]. In contrast, Rosset’s activity as an engineer and educator is strikingly illustrated by his complementary thesis [31].



Figure 1. The language laboratory (left) and the phonetics laboratory (right) of the Grenoble Institute of Phonetics around 1908

3 The Theodore Rosset’s methodology and its dissemination

As Rosset reports in the preface of [30], there were already many French language teaching manuals that presented the theoretical foundations of French pronunciation (he cites Passy, 1899; Rousselot and Laclotte, 1902; Zünd-Burguet, 1902; Nyrop, 1902). These works, though at the forefront of phonetic knowledge, according to him “merely apply it through the reading of random texts simply strung together” [30: 2]. In his view, however, a new method was needed—one that extended the work of Rousselot and Zünd-Burguet and applied it directly to the learning of French:

*“C’est de leurs conclusions que s’inspire cette méthode. À côté de l’enseignement théorique, on veut mettre désormais la démonstration expérimentale des articulations; le palais artificiel, les ampoules exploratrices, le cadran indicateur, le cylindre inscripteur, le tambour enregistreur, le manomètre à eau, le signal du larynx, etc., permettent désormais de connaître et de montrer exactement quels organes interviennent dans la production du son, dans quelle mesure, à quel moment ; ils peuvent aussi révéler quelles erreurs commet un étranger dans la mise en action des organes phonateurs ; ils lui permettent de se rendre compte lui-même, par la vue, que a allemand ne s’articule pas comme a français, de vérifier expérimentalement si les corrections qu’il essaye sont heureuses, de s’assurer enfin qu’il met bien en mouvement les organes nécessaires, ceux-là seulement et dans la mesure exacte qui convient.”*⁵ [30: 2–3]

In this way, experimental phonetics could—in Rosset’s view—serve learners by allowing

⁴ The Institute is a founding member of the International Society for Romance Dialectology and will be officially tasked with studying the patois and dialects of the Dauphiné. [our translation]

⁵ This method is inspired by their conclusions. Alongside theoretical instruction, we now aim to provide the experimental demonstration of articulations; the artificial palate, exploring bulbs, indicator dial, recording cylinder, kymograph drum, water manometer, larynx signal, etc., now make it possible to determine and demonstrate precisely which organs are involved in producing a sound, to what extent, and at what moment; they can also reveal what errors a foreigner makes in activating the phonatory organs; they allow the learner to see for themselves, visually, that the German *a* is not articulated like the French *a*, to experimentally verify whether their corrections are successful, and to ensure that they are using the appropriate organs, and only those, with the correct degree of activation. [our translation]

them to measure and visualize their own speech production. But learning a language does not only consist in articulating isolated words; one must also grasp its prosody:

*“De plus, parler une langue correctement, ce n’est pas articuler sans fautes des mots isolés, c’est prononcer des phrases avec l’accent, les accommodations, le rythme, l’intonation qu’un indigène leur donne spontanément, et qu’un étranger doit apprendre, avec peine parfois. Le plus souvent on confie cet enseignement à la vie quotidienne ; et l’on pense qu’à force d’entendre parler et lire, on arrivera à parler et à lire correctement. Cet espoir est parfois réalisé mais une telle méthode demande beaucoup de temps, et le succès en est toujours incertain”*⁶ [30: 2–3]

To address this, nothing beats a dedicated teacher, “constantly available to students to tirelessly repeat the same ten lines of prose” in a consistent manner. To that end, Rosset proposed the mechanical reproduction of sounds recorded on phonograph cylinders. His *Exercices pratiques* were thus accompanied by recordings of Rosset himself pronouncing the texts included in the manual. The phonograph in the phonetics laboratory thus served as a “tireless teacher,” and Rosset set out to develop a device capable of duplicating phonograph cylinders—which quickly wore out with use—and added to it a mechanism for visualizing recorded speech signals. This was his principal contribution to experimental phonetics:

*“Aussi, dès le début, ai-je été préoccupé de posséder un moyen d’obtenir mécaniquement la copie d’un cylindre enregistré sur un cylindre vierge, qui remédierait à tous ces inconvénients et qui, de plus, permettrait à mes élèves étrangers d’emporter chez eux en même temps un livre pour avoir la transcription phonologique des sons français et une collection de cylindres pour avoir la transcription phonographique de la diction française”*⁷ [31: 63]

The technical challenges were many, and it was with the help of a “mechanic” that he finally managed to build the duplicating device, after numerous trials detailed in his manuscript. The task became even more difficult when Rosset sought to add to his setup a means of recording the signal onto paper for precise measurement and analysis. Taking inspiration from L. Hermann, he proposed an optical system based on a small mirror connected to the phonograph’s playback head, which reflected a beam of light onto a cylinder wrapped in photographic paper and housed in a darkroom. This system allowed him to amplify the recorded signal without the distortions caused by a mechanical lever [32] (figure 2). The signals produced by this device—presented in the appendix to Rosset’s thesis—were remarkably clear, but their relevance was quickly questioned by leading phoneticists of the time, including Rousselot or Poirot [33], [34]. However, Chlumský’s opinion about the reliability of Rosset’s new technical proposal was less critical [35], [36]. Rosset also had Brunot’s unwavering support:

“Mais F. Brunot était fermement convaincu de cette supériorité [de la méthode Rosset]. Lors de l’inauguration des Archives de la parole (Paris, 3

⁶ Moreover, speaking a language correctly is not merely about pronouncing isolated words without error—it is about speaking in phrases with the stress, adjustments, rhythm, and intonation that a native speaker naturally employs, and that a foreigner must learn, sometimes with difficulty. Most often, this instruction is left to daily life; it is assumed that by hearing enough spoken and read language, one will eventually speak and read correctly. This hope is sometimes fulfilled, but such a method takes a great deal of time, and its success is always uncertain [our translation]

⁷ From the very beginning, I was intent on obtaining a way to mechanically copy a recorded cylinder onto a blank one, which would remedy all these inconveniences and, moreover, allow my foreign students to take home with them both a book with the phonological transcription of French sounds and a collection of cylinders with the phonographic transcription of French speech [our translation]

juin 1911), Brunot indiqua comme l'un des buts poursuivis par cette initiative « la création définitive d'une nouvelle science : la phonétique » et ajoutait « Je suis de ceux qui espèrent depuis vingt ans qu'elle va enfin se constituer ». A cette occasion, il illustra par des projections lumineuses la supériorité incontestable de l'appareil et des tracés de Rosset qui enfermaient en eux, au dire de Brunot, l'avenir de la phonétique.”⁸ [18: 51]

Despite the criticism expressed by some of the recognized experts of the time, the concept of a language laboratory according to the Rosset method combining theoretical research in phonetics with advanced experimental technologies for the analysis and remediation of foreign language production and audio-visual perception, has spread beyond the borders of France: in England [37], Italia [38], United States [19] and Abou Haidar (this volume)... There is no doubt that he trained or influenced several generations of teachers of French as a foreign language, including abroad, through his lectures, publications and training. Its publications, mainly in French, may have been a hindrance to the dissemination of his method outside the circle of phoneticians who teach French as a foreign language.

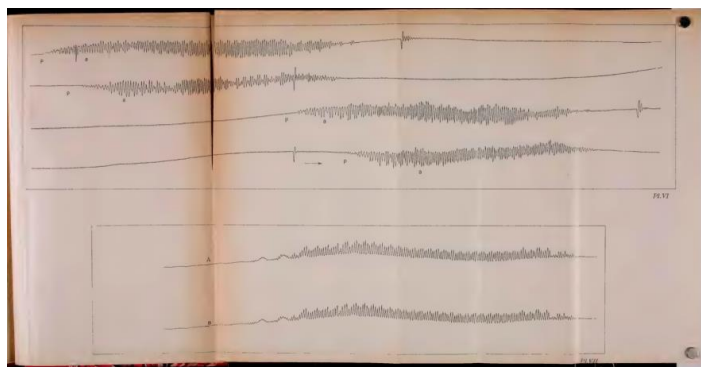


Figure 2. T. Rosset and its apparatus around 1910 (left), and an example of amplified recorded signal (right)

4 Conclusion

Undoubtedly, Rosset contributed to including language learning in the new phonetic science in the sense of A. Comte, C. Bernard and E. W. Scripture in which experiments constitute the only possible approach to objectify explanations of what is observed.

*“La phonétique expérimentale permettra dans l'avenir d'avoir des idées précises sur les transformations des articulations, sur les altérations des sons qui en résultent et probablement de préciser les causes et les moyens de ces transformations”*⁹ [31: 18 footnote 1]

⁸ Nonetheless, F. Brunot was firmly convinced of the superiority of Rosset's method. At the inauguration of the *Archives de la Parole* in Paris on June 3, 1911, Brunot identified among the aims of the initiative “the definitive establishment of a new science: phonetics,” further declaring, “I am one of those who have hoped for twenty years that it would finally come into being.” On this occasion, he employed lantern projections to demonstrate the undeniable superiority of Rosset's device and graphical tracings, which, in Brunot's view, embodied the very future of phonetic science. [our translation]

⁹ Experimental phonetics will in the future allow us to have precise ideas on the transformations of articulations, on the resulting alterations of sounds and probably to specify the causes and means of these transformations [our translation]

In particular, from the very beginning of the Grenoble phonetics laboratory, Rosset was keen to demonstrate the importance of inscription methods of speech curves in order to be able to carry out detailed analyses of the productions of foreign language learners [39].

From one perspective, language learning gained scientifically grounded methodologies through Rosset and the development of his Institute of Phonetics. From another, phonetic theory itself benefited from the quasi-experimental implementation of phonetic instruction, anticipating—only a few years later—the emergence of key theoretical constructs such as phonological representation and the complex cognitive mechanisms involved in the processing of non-native speech sounds. This includes, in particular, the notion of phonological deafness in foreign language acquisition [40: 79–80] and the concept of the phonological sieve [41: 54].

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