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ARMANDO DE LACERDA AND EXPERIMENTAL PHONETICS IN THE INTER-WAR PERIOD: SCIENTIFIC INNOVATION AND CIRCULATION BETWEEN PORTUGAL, GERMANY AND HARVARD

Quintino Lopes - Instituto de História Contemporânea - Universidade Nova de Lisboa;
Universidade de Évora (Institute of Contemporary History - New University of Lisbon;
University of Évora)

Elisabete Pereira - Instituto de História Contemporânea - Universidade Nova de Lisboa;
Universidade de Évora (Institute of Contemporary History - New University of Lisbon;
University of Évora)

Abstract

In the history of the research on human speech, the work carried out by Armando de Lacerda, a 20th-century Portuguese phonetician, is of great importance. A specialist in Experimental Phonetics at the Phonetics Laboratory in Hamburg and the Institute of Phonetics in Bonn from 1930 to 1933, Lacerda established the first laboratory of Experimental Phonetics in Portugal, in Coimbra in 1936, whose "splendid technical facilities", along with the international prestige of its founder and director, attracted countless foreign scientists. In this paper, we highlight the discovery of some important scientific material used at the laboratory, recently unearthed in the reserve collection of the *Museu da Ciência da Universidade de Coimbra*, including documents and instruments, some of them created by Lacerda, whose inventorship deserves recognition.

Keywords

Circulation of knowledge; Experimental Phonetics; Scientific collections; Armando de Lacerda.

Introduction

In this paper we focus on the life and work of the Portuguese phonetician Armando de Lacerda (1902-84): his academic career, university and extra-curricular training, public intervention, role as the founder and head of the *Laboratório de Fonética Experimental da Faculdade de Letras de Coimbra* (LFEFLC) in Portugal, and the innovations he wrought in this field of science deriving from the pioneering instruments he developed, not to mention his neglected role as an inventor, all of which enable him to be assigned a prominent role in the global process of scientific progress at the international level. Following the recent discovery in a reserve collection in storage at the *Museu da Ciência da Universidade de Coimbra* (MCUC) of a number of instruments invented by Lacerda and used in Portugal and abroad, networks for international communication in science in which he and his Coimbra laboratory were involved will be examined, thereby deepening our understanding of a period marked by nationalist and autarchic tendencies. Ultimately, the dominant thesis which portrayed Portugal as a backward country is called into question and we rethink the stance of the Portuguese *Estado Novo* (1933-74) within the framework of the Global History of Knowledge.

Armando de Lacerda and the circulation of knowledge

Portuguese phonetician Armando de Lacerda proffered the following words in Coimbra in 1940 on the contribution of his country in the field of Experimental Phonetics: «The first piece of research work carried out in the field of experimental phonetics by a Portuguese scientist was published in 1932 in the *Archives Néerlandaises de Phonétique Expérimentale* under the title *Die Abgrenzung der Labiallaute Mittels*

Mundtrichter. [...] Although it was only a half dozen pages long, ... it brought a completely new approach, in contrast to that which had been followed by most experimental phonetics experts up until that time. Since then, other works by the same author have been published. The stance adopted as regards old techniques and doctrines - untenable in the light of the emergence of new methods - has opened up new avenues for scientific research in the field of the study of speech. The work which has been carried out during a relatively short period of eight years has resulted in an achievement of undeniable greatness...» (LACERDA, 1940: 535; translated by Michael Lewis).

Although he did not mention himself by name, he was referring to his own performance as head of the LFEFLC, which operated from 1936 to 1972, and the research he had begun in Hamburg in 1930 with Giulio Panconcelli-Calzia and developed at the Bonn Institute of Phonetics under the supervision of Paul Menzerath.

From the moment Lacerda first began to specialise as a scientist in the field of Experimental Phonetics at the Hamburg Phonetics Laboratory, where he worked from 1930 to 1931, he focused on the limitations of the kymographic method, which was the method predominantly used at phonetics laboratories at the time. His critical approach and ambition to develop new Experimental Phonetics research methods, allied with his creative ability, led to his invention of the apparatus known as the Lacerda Oral Recording Labiograph. Regarding the *Die Abgrenzung der Labiallaute Mittels Mundtrichter*, referred to above, produced by using this apparatus, which enabled the simultaneous recording of labial and oral curves, Giulio Panconcelli-Calzia commented as follows: "Dr. Lacerda has come up with a marvellous invention which allows for the exact delimitation of sounds" (Arquivo Camões, I.P. 1337.3.105; translated by Michael Lewis).

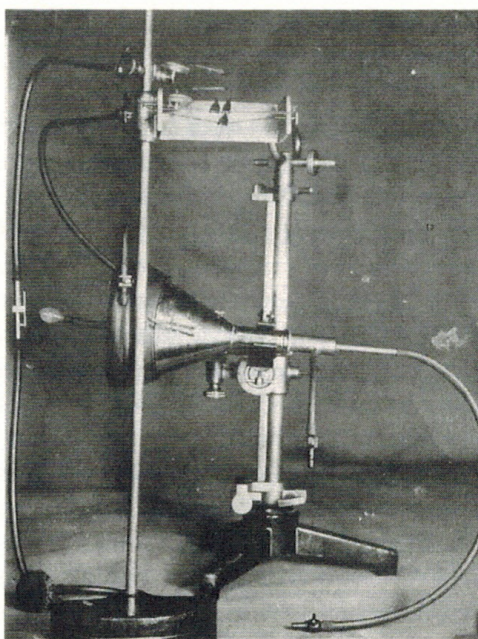


Figure 1. The Lacerda Oral Recording Labiograph (prototype). The inventor used the device for the first time at the University of Hamburg to demonstrate what was wrong with analysis carried out using oral kymographs (LACERDA, 1940).

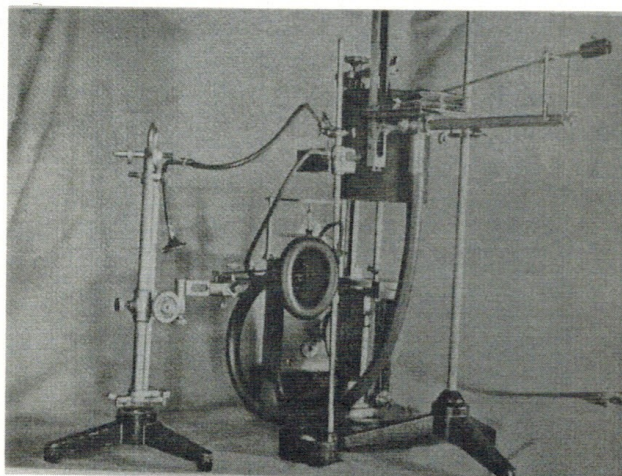


Figure 2. The Lacerda Oral Recording Labiograph connected to an air volume recorder in phonation for the confirmation of initial results obtained by means of the simultaneous recording of lip and oral activity. (Experiments carried out at the Hamburg Experimental Phonetics Laboratory) (LACERDA, 1940).

The recognition by peers during his specialist training in Hamburg is evidenced by the invitation extended by Paul Menzerath, the head of the Institute of Phonetics at the University of Bonn, to carry out collaborative studies at the institution. Having taken up the offer, as early as February 1932 Lacerda commented on the results he had achieved as follows:

«I beg to inform you [Luís Simões Raposo] that I am carrying out research on the problem of delimiting sounds with the esteemed collaboration of Professor Paul Menzerath, head of the Phonetics Laboratory of this university. Our findings will be published in several issues of a specialist journal, *Zeitschrift für Experimentelle Phonetik*. Much of the analysis has been carried out using my Oral Recording Labiograph, an apparatus that the laboratory has built in accordance with my instructions. I owe Professor Menzerath a debt of gratitude for having put my name forward for membership of the International Society of Experimental Phonetics (ISEP), and he intends to nominate me as the society's representative in Portugal» (Arquivo Camões, I. P. 1337.3.44; translated by Michael Lewis).

The proposal that Lacerda should act as the representative in Portugal of the ISEP was accepted, and a study entitled *Koartikulation, Steuerung und Lautabgrenzung* was produced as a result of joint efforts of the Portuguese and German phoneticians using the Lacerda Oral Recording Labiograph at the Bonn Institute of Phonetics (MENZERATH; LACERDA, 1933; Arquivo Camões, I. P. 1337.3).

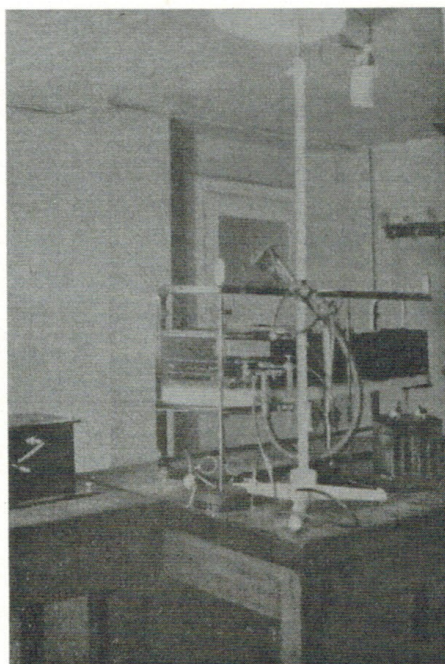


Figure 3. Presented as Menzerath's kymograph (HESS, 2001: 14), this apparatus is actually harnessed to the Lacerda Oral Recording Labiograph. "It was with this device, installed at the University of Bonn Phonetics Institute, which enabled the simultaneous recording of lip, laryngeal, oral and nasal activity, that fundamentally important laboratory work on 'coarticulation', 'orientation' and 'sound delimitation' was carried out (*Koartikulation, Steuerung und Lautabgrenzung*, P. Menzerath and A. de Lacerda)" (LACERDA, 1940; translated by Michael Lewis).

This pioneering work on the coarticulation and segmentation of speech sounds carried out by Menzerath and Lacerda was funded by the Notgemeinschaft der Deutschen Wissenschaft. The president of the ISEP, E.W. Scripture, addressed the former in the following terms:

«I have just gone through your and Mr Lacerda's excellent work. I can only say that in terms of the apparatus and methods you have achieved a standard of excellence which has been attained nowhere else today. I can not help but admire your genius and ability. The results are extremely accurate and I must say set a standard of perfection that has no equal. Your explanation of the curves drawn is masterful. The conclusions that are drawn are of the utmost importance. This piece of work is definitely one of the best things that have been published in the field of experimental phonetics so far» (Arquivo Camões, I. P. 1337.3.86. See also LÖFQVIST, 2013: 353-377; translated by Michael Lewis).

This was echoed later by phonetician António Almeida, writing Lacerda's obituary, who noted:

«In the first three years of his scientific work Armando de Lacerda gained international reputation as a phonetician. His book (in collaboration with Menzerath) on phonetic segments and segmentation marks the beginning of modern phonetics: it is one of the first attempts to give a theoretical account of experimental data on the dynamics of speech production» (ALMEIDA, 1985: 48-49).

Having been invited to attend the 1st International Congress of Phonetic Sciences in Amsterdam in 1932, Lacerda was authorised by the organising committee to present a paper at the meeting and demonstrate another instrument he had invented: the polychromograph. This scientific instrument, regarded as "the forerunner of the ink-jet

oscillograph, some 15 years previously" (TRUBY, 1972: 237), was produced at the workshops of the Bonn Institute of Phonetics. Because it was a Portuguese scientist who would be credited with producing the chromograph, a new means of conducting research, its construction was funded by the state in Portugal (Arquivo Camões, I. P. 1337.3.47).

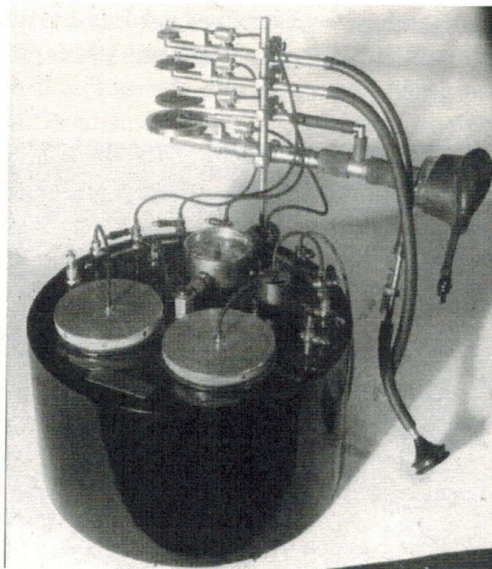


Figure 4. The Lacerda Polychromograph, first used to demonstrate the chromographic method at the International Congress of Phonetic Sciences in Amsterdam (LACERDA, 1940). This invention led to the kymograph, hitherto the apparatus of choice used at Experimental Phonetics laboratories, becoming obsolete.



Figure 5. Detail of a polychromograph recently discovered at the *Museu da Ciência da Universidade de Coimbra*, whose inscription reads "Lacerda's Polychromograph. DRP [Deutsches Reichs-Patent] K.N. 3235 [Katalog-Nummer? 3235]". I am grateful to the curator of the museum's science collections, Dr. Gilberto Pereira, and Professor Dr. Ruediger Hoffmann for information provided.

The advantages of "chromographic projectors" *vis-à-vis* "kymograph recorders" are summarised by the inventor of the former in 1940 as follows:

«1. They do not require a smoked black surface for the recording of data, as was the case with the general kymograph method and Ketterer's electro-kymograph method.

2. They do not require a surface made of special light-sensitive material, as with the oscillographic method. Results are recorded on a single strip of paper.
3. The projector is located away from the recording surface so that there is no friction caused by the said surface.
4. The projected jet is directed onto the recording surface by means of a plane perpendicular to it; the chromograph does not involve rectification of the curve.
5. A high degree of sensitivity» (LACERDA, 1940: 544; translated by Michael Lewis).



Figure 6. Photograph of the Bonn Institute of Phonetics (1932) showing Armando de Lacerda (right) and Paul Menzerath (left) conducting research using the Lacerda Polychromograph (Arquivo do *Museu da Ciência da Universidade de Coimbra*).

At the dawn of the 21st century, summing up the importance of the instruments invented by Armando de Lacerda and the pioneering nature of his research, Brian F. Head is peremptory:

«Early in his career as a phonetician, [Armando de Lacerda] focused on the resolution of one of the crucial problems of General Phonetics at the time (which is one of the most important issues in the history of this branch of Linguistics): the influence contiguous sounds exerted on each other in the chain of speech. While several phoneticians had theorised that a reciprocal influence was involved in the relationship between consecutive sounds, they lacked the means (the instruments, and the processes enabled by such) to scientifically evaluate hypotheses regarding the nature of such influence, due to the limitations inherent in kymography, the principal experimental process at the time. Lacerda's understanding of the nature of the problem and his creativity in developing instruments for experimentation resulted in the invention of two devices for use in the phonetics laboratory: the oral recording labiograph and in particular the chromograph, which were the first instruments to enable the recording of the reciprocal effects of sequential sounds in speech, thus overcoming the limitations of the kymographic method then in vogue» (HEAD, 2000: 219; translated by Michael Lewis).

Despite this recognition, Armando de Lacerda's lack of visibility as a pioneer in the development of these phonetics instruments, and their appropriation by others, is also evidenced in the same testimony, when Head states that "... the chromograph was the prototype of the mingograph, a device which was produced and marketed in Sweden, ignoring the rights of the inventor of the former" (HEAD, 2000: 219. See also LÜDERITZ, 2002: 224; translated by Michael Lewis). Lacerda himself alluded to this in 1956 when he stated that on visiting the factory of the Stockholm firm Elema he saw a sound recorder based on the "Lacerda chromograph" being produced, which had been wrongfully patented as a Swedish invention, "... considering the said chromograph was widely commented upon in publications in Portugal and abroad" (Arquivo Camões, I. P. 1320.16.20. See also LACERDA, 1933; 1934; translated by Michael Lewis).

At the time, Armando de Lacerda, who had completed his specialist training in Bonn in mid-1933, had been head of the LFEUC for twenty years. Created in 1936, it was the first laboratory of its kind in Portugal. Regarded from the outset as a laboratory with "splendid technical facilities" (CARTER, 1941: 412-413), its reputation, together with the international prestige of its founder and head, led to numerous scientists from abroad being attracted to work at the laboratory.

Confirming the view that it was at the Coimbra laboratory where the "most modern chromographic systems" were to be found (LACERDA, 1940: 543; translated by Michael Lewis), Paul Menzerath, who used the Lacerda Polychromograph at the Bonn Institute of Phonetics, sent Paul Pohl to Coimbra in 1937 with a view to his student receiving specialised training under the supervision of Lacerda (Arquivo Camões, I. P. 0550.1). Similarly, in 1939, following a recommendation by George Zipf, a great admirer of Lacerda's work, Francis Millet Rogers of Harvard University embarked on a period of specialised training at the Coimbra laboratory (ROGERS, 1992: 78, 142, 146, 160. LOPES, 2017: 193).

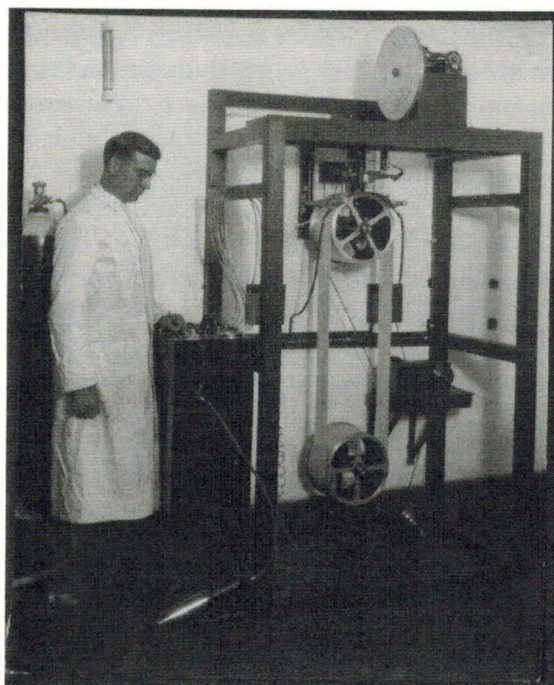


Figure 7. Francis Millet Rogers, Sheldon Travelling Fellow - Harvard University, working with the Lacerda's Chromograph at the LFEUC. Photograph dated 1939 (Biblioteca Alonso Zamora Vicente).

The collaboration between the Harvard University researcher and the head of the LFEUC resulted in the publication of a study entitled *Sons dependentes da fricativa palatal áfona, em Português* (LACERDA; ROGERS, 1939). The following are examples of how, following his return to Portugal in 1933, the scientist who was responsible for introducing the study of Experimental Phonetics in the country maintained close links with the international scientific community: from 1937 to 1939 Lacerda visited the new facilities of the University of Bonn Phonetics Institute and the University of London Department of Phonetics; he was invited by Professors Diedrich Westermann and Eberhard Zwirner of the University of Berlin to serve on the scientific committee of the journal *Archiv für Vergleichende Phonetik*; he sent recordings of texts to the Bonn Phonetics Institute, the British Institute and Harvard University; he established contact with the university, enabling work carried out at the Coimbra laboratory to be published in English at Harvard; and he was invited to undertake a piece of scientific work at University College London (LABORATÓRIO DE FONÉTICA EXPERIMENTAL DA FACULDADE DE LETRAS DA UNIVERSIDADE DE COIMBRA, 1939: 14-15).

As part of historiographic agendas based on the idea of the circulation of knowledge and the debate surrounding scientific "centres" and "peripheries" (SECORD, 2004: 654-672. DASTON, 2015: 85-98), we may conclude that the life and work of Armando de Lacerda shows how Portugal, a country which during the *Estado Novo* has traditionally been portrayed as being picturesque, isolated and "peripheral" (MENESES, 2009. ROSAS, 1994), in fact demonstrates a remarkable degree of scientific "centrality". Taking into account that the Global History of Knowledge is inclusive and thus embraces outsiders (DRAYTON; MOTADEL, 2018: 1-21. LIVINGSTONE, 2003), we therefore propose that the memory of Lacerda and his intellectual property rights over the instruments that he invented should be restored.

Conclusion

Portugal during the *Estado Novo* has been predominantly understood by historiographers as a rural country, which was picturesque and essentially uninterested in issues across Europe, and a place where little scientific research was carried out. However, the action of Armando de Lacerda and the Coimbra laboratory he founded and led make the picture more complex; thus, the prevailing idea of a country which was scientifically backward does not square with the existence in the late 1930s of a laboratory at the University of Coimbra which was capable of attracting researchers from leading universities around the world, such as Harvard, among others.

The scientific instruments developed by Armando de Lacerda, some of which have recently been rediscovered in reserve collections at the MCUC, have now become a heritage resource which should have a huge impact in the field of museology and historiography (KOPYTOFF, 1986, 64-91). The polychromograph and the Lacerda Oral Recording Labiograph have the potential for enabling awareness to be raised as to the important role played in the international arena by a Portuguese scientific body during the *Estado Novo* and the significance of its work to be recognised. The scientist responsible for developing these instruments was a phonetician who recognised the need for such apparatus in achieving progress as regards knowledge in the field of Experimental Phonetics. These items of scientific apparatus provided the catalyst for links to be forged between researchers from different countries, their influence only dimming decades later as they became obsolete with the emergence of new instruments, which nevertheless could not have been developed if Lacerda had not produced such inventions.

The discovery of items of scientific heritage associated with Lacerda in storage at the MCUC signifies the start or perhaps the regeneration of an important scientific

collection (BYRNE *et al.*, 2011. DAUGERON; LE GOFF, 2014). It is important to highlight this scientific heritage and to disseminate it internationally, by reconstituting its trajectory, identifying the different contexts and changes in the value of the objects that comprise it, and recognising the crucial links between individuals and instruments in space and time (ALBERTI, 2005: 559-571). In the period between the wars, this scientific heritage, which links Coimbra, Hamburg, Bonn and Harvard, represents yet another “forgotten case of ‘scientific excellence on the periphery’” (GOOTENBERG, 2007: 202-232. CUETO, 1989), showing how science, even in the context of economic autarchy and nationalism, flourishes within the framework of international communication networks.

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