

Charcot and aphasia: contributions of his assistants

Charcot e afasia: contribuições de seus assistentes

Elias Engelhardt¹, Marleide da Mota Gomes²

ABSTRACT

The ideas and concepts regarding language and its disorders have a longstanding history. However, it was possible to consider the 19th century as the period when the main milestones on the subject begun to be settled, with Paul Broca's and Carl Wernicke's pivotal findings. Albeit language disorders (aphasia) were not, apparently, his preferential interest, Charcot engaged himself in the issue, and after thorough studies delivered a series of lectures on this theme at the Salpêtrière Hospital, transcribed by two of his assistants, Charles Féré and Gaetano Rummo, and then published. Other three assistants, inspired in Charcot's teachings, Désiré Bernard, Gilbert Ballet and Pierre Marie, contributed independently with papers or books. The lectures and the contributions of those collaborators were partially incorporated in the *Oeuvres Complètes* published by Charcot.

Keywords: Language disorders, aphasia, Charcot, Féré, Rummo, Bernard, Ballet, Marie.

RESUMO

As ideias e os conceitos sobre a linguagem e suas desordens possuem uma história de longa duração. Entretanto, é possível considerar o século XIX como o período no qual os principais marcos sobre o tema começaram a ser estabelecidos, com os achados fulcrais de Paul Broca e Carl Wernicke. Embora desordens da linguagem (afasia) não tenham sido, aparentemente, seu interesse predileto, Charcot se envolveu no assunto e, depois de aprofundados estudos, ministrou uma série de lições sobre o tema no Hospital da Salpêtrière, transcritas por dois de seus assistentes, Charles Féré e Gaetano Rummo, sendo publicados em seguida. Outros três assistentes, inspirados nos ensinamentos de Charcot, Désiré Bernard, Gilbert Ballet e Pierre Marie, contribuíram de modo independente com artigos ou livros. As lições e as contribuições desses colaboradores foram parcialmente incorporadas nas *Oeuvres Complètes* publicadas por Charcot.

Palavras-chave: Desordens da linguagem, afasia, Charcot, Féré, Rummo, Bernard, Ballet, Marie.

¹ Neurologist, full professor (retired), Cognitive and Behavioral Neurology Unit, Institute of Neurology Deolindo Couto, Alzheimer's Disease Center, Institute of Psychiatry, Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro, RJ, Brazil.

² Neurologist, associate professor, Epilepsy Program, Institute of Neurology Deolindo Couto, School of Medicine, UFRJ, Rio de Janeiro, RJ, Brazil.

Address for correspondence: Dr. Elias Engelhardt. E-mail: eliasz@centroin.com.br

INTRODUCTION

The ideas and concepts regarding language and its disorders have a longstanding history. However, it is possible to circumscribe to the 19th century the uncovering of the main milestones about the subject.¹ Modern studies, apparently, begun with Franz Joseph Gall (1758-1828), with his phrenological approach, which included memory for words and the sense of the language faculty (1808). Following, Jean-Baptiste Bouillaud (1796-1881) localized the language center in the “anterior lobe” [frontal lobe] (1825), and Marc Dax (1771-1837) located “the forgetfulness of the signs of the thought” in the left hemisphere (presented in 1836, published only in 1865). More precise and consistent studies of language-brain relationships were inaugurated by Paul Broca (1824-1880), who described a lesion in the posterior part of the 3rd left frontal gyrus associated to a disorder of “motor” language (speech) he named “aphemia” (1861). Soon, Armand Trousseau (1801-1867) introduced the term “aphasia” (1864) in substitution of Broca’s designation. Later, Carl Wernicke (1848-1905) described a “sensory” form of language disorder (1874) due to a lesion in the posterior part of the 1st left temporal gyrus.^{1,2} Further observations identified other language centers – “center for visual memory” (1869) [Henry Charlton Bastian (1837-1915)], “center for ideation” (1872) [William Henry Broadbent (1835-1907)], and “center for writing” (1881) [Sigmund Exner Ritter von Ewarten (1846-1926)].^{2,3}

Broca’s and Wernicke’s findings raised a “localizationistic” theory, initially with centers for expression (“motor aphasia”) and for reception (“sensory aphasia”). However, some neurologists acknowledged the weight of connections between the centers, an “information processing model”. Wernicke was the first of them, proposing such interconnections, and predicting “conduction aphasia” (1874), soon followed by (1877) Adolph Kussmaul (1822-1902), Jean-Martin Charcot (1825-1893) [“The bell diagram” (1884)], and by Ludwig Lichtheim (1845-1928) [“Lichtheim’s House” (1885)], among others, giving way to an “associationist” or “connectionist” theory.^{2,4} The prestigious English neurologist Henry Head (1861-1940) came

to dismiss the latter models, labeling those illustrious authors as “diagram makers”, in a depreciative manner.⁴ Other authors, like Pierre Marie, based on his clinicopathological studies, contested both theories, arguing misinterpretation of the available data.⁵ Finally, “holistic” models were also proposed, as by Sigmund Freud (1856-1939) and Constantin von Monakow (1853-1930), the latter adding his concepts of “diaschisis” and “plasticity” to explain symptoms and recovery of language disorders after brain lesions.^{5,6}

CHARCOT AND APHASIA

Aphasia was not, apparently, Charcot’s preferential interest. However, he studied in depth the subject and delivered a series of *Lessons* (lectures) on the theme at the Salpêtrière Hospital. Transcribed by one of his assistants, Charles Féré (1852-1907), they were published in *Le Progrès Médical* (1883) in five consecutive numbers⁷. These lectures, unfolded in nine chapters, apparently the only complete version of the originally delivered, were transcribed and translated to Italian by Gaetano Rummo (1852-1917), who attended Charcot’s clinic, and published (1884), the *Differenti forme d’afasia: lezioni fatte nella Salpetriere nel semestre d’estate dell’anno 1883*, as a book with many figures.^{8,9} Charcot was identified as a connectionist (diagram-maker), and authored one of the known schemata, “The bell diagram”, that appeared for the 1st time in his Italian translated conferences.^{3,8}

CHARCOT’S ASSISTANTS AND THEIR STUDIES ON APHASIA

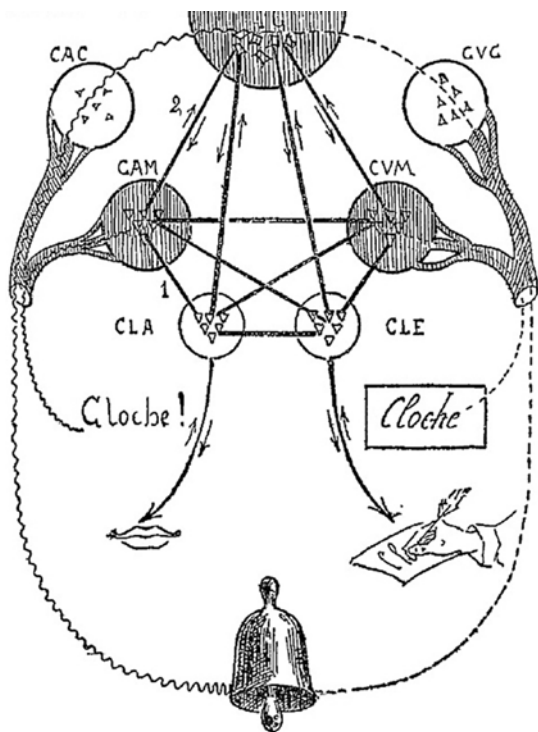
The Salpêtrière School produced important contributions to aphasia, not only by Charcot himself, with his memorable lectures, but also by his assistants, who worked, in different moments, at the Salpêtrière Hospital.¹⁰ Besides Féré and Rummo who transcribed Charcot’s lectures, Désiré-Antoine-François Bernard (1853-1888) (Box 1), Gilbert Ballet (1853-1916) (Box 2), and Pierre Marie (1853-1940) (Box 3) must be cited for their important contributions.

Box 1. Contribution of Désiré Bernard (with condensed excerpts)

Désiré Bernard, one of Charcot's *Interne* (House Officer) (1883), remained relatively unknown.¹⁰ Bernard approached his studies on aphasia after deeply immersing in Charcot's teachings, and stated that without those it would not be possible to escape of getting lost in the maze of information accumulated since 1861 (year of Broca's finding).³ He defended his inaugural thesis *De l'aphasie et de ses diverses formes* (1885), published as a commercial book in the same year,^{10,11} soon followed by a new edition (1889), considering its positive reception, with the collaboration of Féré. The book comprised definition and history, relation of language and aphasia, anatomical localizations, the several language disorders (verbal blindness, verbal deafness, aphemia, agraphia, complex aphasias, and forensic medicine) known at the time, anatomical and pathological drawings. Charcot's bell diagram, already presented in his thesis, is displayed in Chapter III (*Le langage et l'aphasie*) (Figure 1). Apparently, it was published there for the 1st time in French. He sustained that the diagram eased the understanding of the mechanisms of language and their changes and degradations that occurred in aphasia. The convexity of the left hemisphere with the localization of the language centers was also displayed (Figure 2). Bernard explained that he made nothing else than to implement Charcot's notes, including the diagram that the master kindly permitted to be published.¹¹ Désiré Bernard, in his short time of life, was an important contributor to the development of knowledge on aphasia of the Salpêtrière School.

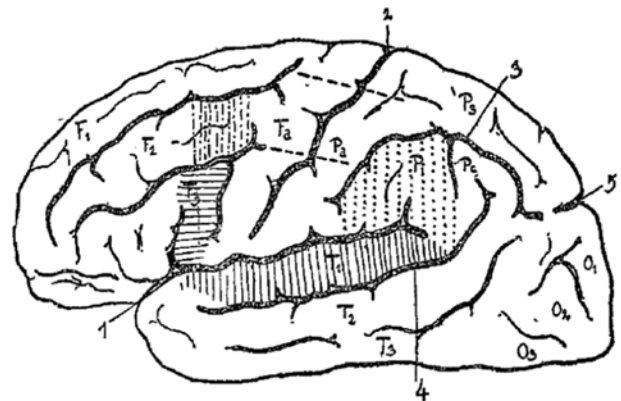
Box 2. Contribution of Gilbert Ballet (with condensed excerpts)

Gilbert Ballet was one of Charcot's *Interne* (1880) and *Chef de Clinique* (Head of Clinic) (1882).¹⁰ The book *Le langage intérieur et les diverses formes de l'aphasie* was his main contribution to the theme (1886).¹² He discussed the development of language since infancy. To understand the mental operations for the acquisition of understanding and speaking he reminded two laws of thought, sensation (visual, auditory, etc.) and association (sensations and the derived ideas). He stated that words, spoken or written, were ancillary to ideas, not inseparable – the idea may exist without the representative word, and might be formed without or before the word. Charcot's bell diagram was utilized for better explaining the matter. He considered the word as constituted by the association of four kinds of images – auditory (heard word), visual (read word), motor of articulation (spoken word) and motor graphic (written word), interplaying internally. Such images emerge during ones reflection (thinking), constituting an internal phenomenon, a veritable "interior language". Ballet intended to show that aphasia was an incomplete or complete deterioration of one or several modalities of the interior language. Further, he discussed aphasia in general, examined the known forms (verbal blindness, verbal deafness, motor aphasia, agraphia, combined aphasias, and conduction aphasia), and localized the centers of language, similar to Bernard's, and concluded with diagnostic considerations of the different forms of aphasia.¹² Gilbert Ballet's "interior language" concept was a major contribution to aphasia studies of the Salpêtrière School.



The bell (*cloche*) rings, it is heard and seen. The centers were defined by clinicopathological analysis. **Input** – auditory input: CAC: center of shared hearing, and CAM: auditory center for words; visual input: CVC: center of shared vision, and CVM: visual center for words. **Output** – spoken output: CLA: center of articulated language; written output: CLE: center of written language. IC: ideation center. Arrows show the direction of the nervous paths connecting the centers.

Figure 1. Charcot's bell diagram, in Bernard's book.¹¹

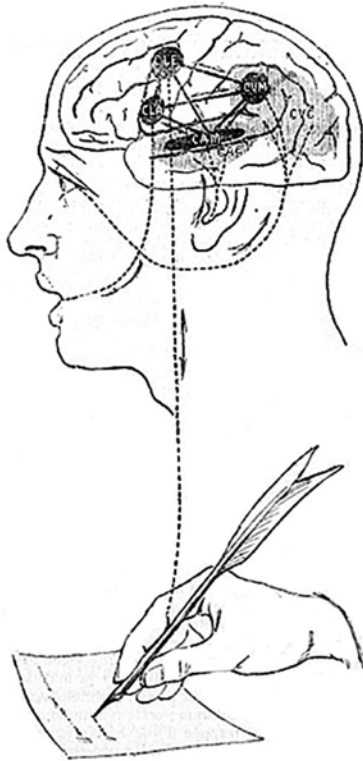


[1] Sylvius fissure; [2] Rolando sulcus; [3] interparietal sulcus; [4] parallel [1st temporal] sulcus; [5] external perpendicular fissure.

[F1] 1st frontal gyrus; [F2] 2nd frontal gyrus; [F3] 3rd frontal gyrus; [Fa] ascending frontal gyrus; [Pa] ascending parietal gyrus; [Ps] superior parietal lobule; [Pi] inferior parietal lobule; Pc, angular gyrus [*lobule du pli courbe*]; [T1] 1st temporal gyrus; [T2] 2nd temporal gyrus; [T3] 3rd temporal gyrus; [O1] 1st occipital gyrus; [O2] 2nd occipital gyrus; [O3] 3rd occipital gyrus.

[F2] Agraphy; [F3] Motor aphasia (Bouillaud-Broca type); [T1] Verbal deafness; [Pi] Verbal blindness.

Figure 2. Left hemisphere convexity and the localization of the language centers, in Bernard's book (after Dr. P. Richer's autopsy sheets).¹¹



CVC: center of shared vision; CVM: visual center for words; CAC: center of shared hearing; CAM: auditory center for words; CLA: center of articulated language; CLE: motor center for written language.

Figure 3. Pierre Marie's diagram displaying the language centers, and the inputs (visual, auditory) and outputs (spoken, written).¹³ (Arrows show the direction of the nervous pathways).

COMMENTARIES

The historical thoughts regarding language and its disorders paved the way to the modern concepts, which emerged in the 19th century, when the main milestones began to be settled, between 1861 and 1881, initially with Broca's and Wernicke's findings, soon followed by Bastian's, Broadbent's, and Exner's contributions, who established the localization of specific language "centers". The initial concepts of centers, favored by the "localizationists", were complemented by the acknowledgement of the value of their interconnections, privileged by the "associationists" or "connexionists", represented mainly by Wernicke, Lichtheim, and Kussmaul. The latter were depreciated by Head, labeling these authors as "diagram makers", followed by Marie, who criticized both models, and then Freud and von Monakow, who proposed, alternatively, a "holistic" model.

Box 3. Contribution of Pierre Marie (with condensed excerpts)

Pierre Marie was Charcot's *Interne* (1882) and *Chef de Clinique* (1883-1884), and later his successor.^{9,10}

He published a review on aphasia (1883) and then the paper *De l'Aphasie en general et de l'Agraphie en particulier d'après l'enseignement de M. le professeur Charcot* (1888),¹⁴ where he reported a case of a female who, after a stroke, presented incapacity to write, despite able to hold a pen, and knowing what she wanted to write. However, "the scheme of the characters did not come back" – she forgot their form. The abilities to read and to speak were maintained. After three more strokes she lost her speech. There was not verbal deafness or blindness, she was able to draw named or written objects, copy characters and numbers, staying unable to write spontaneously or on command. Thus, she retained the visual and auditory images, and possibly the motor image of articulation, but has lost the mechanism to express herself by written language – a true agraphia. Marie discussed the condition, reminding that the term was introduced (1869) by John William Ogle (1824-1905). He described and draw a schema of the paths related to written language (Figure 3) implemented from Charcot's diagram, as he specified, and explained the consequences after lesions, always citing Charcot's ideas.¹³

However, his concepts on aphasia, diametrically opposed to those of Broca and Wernicke, were only disclosed in 1906, raising polemics ("Marie the Iconoclast", according Head).¹⁴ Developments on this issue might deserve, in another opportunity, further consideration.

Pierre Marie was one of the main contributors on aphasia of the Salpêtrière School, and also one of the most outstanding neurologist of his time.

In such a scenario stepped in Charcot. Albeit language disorders (aphasia) were not, apparently, his preferential interest, he engaged himself in the issue, and after thorough studies delivered a series of lectures on this theme at the Salpêtrière Hospital, transcribed by two of his assistants, Féré and Rummo, and then published. Other three assistants, Bernard, Ballet and Marie contributed independently with papers or books, inspired in Charcot's teachings. It is worthwhile to remind that the master's lectures together with contributions of his collaborators, who worked on this theme, were partially incorporated in Charcot's *Oeuvres complètes*, volume III (pp 154-192, 513-523) of the 1890 edition,¹⁵ transcribed and published by Babinski, Bernard, Féré, Guinon, Marie and Gilles de la Tourette, his close assistants.

Conflict of interest

None for this paper.

REFERENCES

1. Prins R, Bastiaanse R. The early history of aphasiology: from the Egyptian surgeons (c. 1700 BC) to Broca (1861). *Aphasiology*. 2006;20(8):762-91.
2. Chomel-Guillaume S, Leloup G, Bernard I. De l'histoire des aphasies à une réflexion clinique modern. In: Chomel-Guillaume

- S, Leloup G, Bernard I. Les aphasies. évaluation et reeducation. Pays-Bas: Elsevier Masson, 2010. p. 3-10. Available at: <<http://livres.ptcinnovationforum.ru/les-aphasies-tlcharger.pdf>>.
3. Brais B. Jean Martin Charcot and aphasia: treading the line between experimental physiology and pathological anatomy. *Brain Lang.* 1993;45(4):511-30.
 4. Heilman KM. Aphasia and the diagram makers revisited: an update of information processing models. *J Clin Neurol.* 2006;2(3):149-62.
 5. Krestel H. Language and brain: historical introduction to models of language and afasia. *Swiss Arch Neurol Psychiatry.* 2013;164(8):262-5.
 6. Engelhardt E, Gomes Mda M. Shock, diaschisis and von Monakow. *Arq. Neuropsiquiatr.* 2013;71(7):487-9.
 7. Charcot JM. Des différentes formes de l'aphasie. (Leçon recueillie par Ch. Féré). *Progrès Médical.* 1883;11(23):441-444;11(24):469-471; 11(25):487-488;11(27):521-523;11(44): 859-861. Available at: <<https://sites.google.com/site/jeanmartincharcot18251893/aphasie-aphasia>>.
 8. Charcot JM. Differenti forme d'afasia: lezioni fatte nella Salpetriere nel semestre d'estate dell'anno 1883. Redatte col consenso dell'autore dal Dr G Rummo. Milano: Vallardi, 1884. Available at: <[http://www.accademiadimedicina.unito.it/e-books/differenti_forme_afasia_\[1883\].htm](http://www.accademiadimedicina.unito.it/e-books/differenti_forme_afasia_[1883].htm)>.
 9. Johnson JK, Lorch M, Nicolas S, Graziano A. Jean-Martin Charcot's role in the 19th century study of music aphasia. *Brain.* 2013;136(Pt 5):1662-70.
 10. Walusinski O. Jean-Martin Charcot's house officers at la Salpêtrière Hospital. In: Bogousslavsky J (ed). *Following Charcot: a forgotten history of neurology and psychiatry.* Front Neurol Neurosci. Basel: Karger, 2011. v. 29, p. 9-35.
 11. Bernard D. De l'aphasie et de ses diverses formes. Paris: Progrès Médical, Lecronier et Babé, 1885. [Retrieved from: Available at: <ftp://ftp.bnf.fr/546/N5461187_PDF_1_-1DM.pdf>.
 12. Ballet G. Le langage intérieurement et les diverses formes de l'aphasie. Paris: Alcan; 1886. Available at: <<http://gallica.bnf.fr/ark:/12148/bpt6k74597z>>.
 13. Marie P. De l'aphasie en générale et de l'agraphie en particuliere, d'après l'enseignement de M. le professeur Charcot. *Progrès Médical.* 1888;7(5):81-4.
 14. Cohen H. Pierre Marie 1853-1940. *Proc Royal Soc Med.* 1953;46:1047-54.
 15. Charcot, Jean Martin. Oeuvres complètes. Leçons sur les maladies du système nerveux, recueillies et publiées par MM. Babinski, Bernard, Féré, Guignon, Marie et Gilles de la Tourette. Tome III. Paris: Progrès médical – Lecrosnier et Babé, 1890. Available at: <[http://jubilotheque.upmc.fr/ead.html?id=CH_00000072#!{\"content\":\"CH_00000072_e0000002\",true,\"\"}](http://jubilotheque.upmc.fr/ead.html?id=CH_00000072#!{\)>.