

# Actuality of Labus' physiologic protocol to learn to sing

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## Abstract

1908, Milan Conservatory's congress: Carlo Labus presents a 14 steps protocol for a physiological progression of exercises to practice Singing. BelCanto methods were lost, so physiology and medicine might help pedagogy in a rational approach. Did voice science development confirm it?

**Keywords:** *singing voice, singing exercise, physiology, singers' training.*

## Introduction

On 15th December 1908, in the musical didactic congress for the first century of Milan Conservatory G. Verdi, the fourth session about Singing was opened by the Session President, Carlo Labus, Carlo Labus was the first ENT and Phoniatician in Italy who opened since 1876 a public practice for throat diseases. His frequentation with singers and musicians was well documented since 1881-1883.

Labus' opened the session and was about the "Physiological progression of exercises in the study of singing". In the session most of the famous singing teachers of Milan Conservatory and Italy, like Vincenzo Maria Vanzo, the Wagner's conductor who had a famous singing school in Milan, Enrico Rosati, future Beniamino Gigli's teacher, and all participants approved and decided to print and present to the Minister the protocol. But it did not happen as Labus died on June 1909.

This paper tries to analyze the actuality of that protocol: was it confirmed by next development of voice science up today?

## Method

In January 2020 the project "Science and Art of Voice. Evolution and current relevance of an interdisciplinary dialogue in the books of

G.Verdi Conservatory of Milan Biblioteque" was proposed to Milan Conservatory Direction and approved in next months. Project's responsible: M° Edoardo Cazzaniga and Dr. Orietta Calcinoni. The aim was to search in Milan Conservatory Biblioteque books and other publications written by phoniaticians and singing teachers from the second half of XIXth century up to the first twenty in XXth century. We found and analyzed an hundred of books but in our search we also found some sheets of notes, partly handwritten and partly by typed, about the 1908 Congress for the 1st Century of Milan Conservatory and its Singing Session - the fourth in congress programme -, written by Elisabetta Oddone Sulli Rao, a composer herself, reporting Carlo Labus lecture original transcription. The forty-two pages were studied, transcribed and digitalized by the pupils involved in the project and revised by the responsables of the project.

## Results

The results of the project, as well as the whole lecture of Carlo Labus and the proposed and approved protocol, were published in the book "Scienza e arte della voce Evoluzione e attualità di un dialogo interdisciplinare nei testi della biblioteca del Conser-

vatorio”, Collana: Quaderni del Conservatorio «Giuseppe Verdi» di Milano (10) 2022 ETS edizioni ISBN: 9788846765307. In this paper we analyze only the protocol and its actuality in relation to recent assessments in singing voice science.

## Discussion

### The 14 items of the protocol

In Tab.1 are listed the 14 items. They say:

1. Never move on to a more complex exercise if not yet easily mastered the simpler one
2. The duration of the work in voice must be short at first and slowly progressing
3. Work in voice must be alternated with frequent rests
4. Every exercise must be done in “adagio” at first
5. Exercises must be performed in mezza voce
6. The first gym is breathing . Damages from upper respiration
7. Production of laryngeal primal sound
8. Exercises in perfect pitch in tessitura
9. Exercises in pitch precision all over the extension and progression to upper range exercises
10. Exercises in intensity
11. Exercises in varying color, vocalization, separation in syllables
12. Agility exercises
13. Exercises in “incorrect” singing and uncomfortable postures
14. Exercises combining all former exercises with words, expression, interpretation of scores

The first three deal with the way we learn, the concept of “learning curve”. Hermann Ebbinghaus first described the learning curve in 1885 in the field of the psychology of learning, although the name did not come into use until 1903, when Hall described a paper about acquisition of telegraphic language (Ebbinghaus, 1913). The S-Curve or Sigmoid function is the idealized general form of all learning curves (Hall et al., 1903), with slowly accumulating small steps at first followed by larger steps and then successively smaller

ones later, as the learning activity reaches its limit. Up to now we still use it in some fields, most notably in the context of artificial neural networks, as an alias for the logistic function. Of course, considered wide differences between humans, there are many different ways to progress in learning and a teacher should learn how to tailor the curve to each single singing student.

In the same years, psychologists dealt about attention in humans. After some decades, Vygotskij, Shannon, Cognitive Congress in Boulder (Colorado) in 1955 and finally Ulric Neisser's book *Cognitive Psychology* in 1967 gather neuroscience, cybernetic and psychological evolution to describe how we learn and how we pay attention to what we learn (Goldstein, 2016). The limits of the sensory system and information processing capacity are studied by comparing and differentiating them with those of children and through the evolution of information processing strategies. Some events are paid attention to on a conscious level, while others are still received in some way, even if no attention is paid to them: there would therefore be automatic recording procedures, which pass the information to a component of the system which establishes to which of the elements you must pay attention. For instance from Broadbent's first studies on acoustic attention, through dichotic listening, nothing of the content of the message to which one has not paid attention will be reconstructable, but only the superficial characteristics (Hugdahl, 2015).

The paramount importance of rest to better learn was demonstrated in 2021 in a paper by Buch et al (2021) where “During the early part of the learning curve we saw that wakeful rest replay was compressed in time, frequent, and a good predictor of variability in learning a new skill across individuals. This suggests that during wakeful rest the brain binds together the memories required to learn a new skill.”

So, short, simple singing exercises, performed from simpler to more complex and with frequent rest are confirmed as the more physiological way to begin to learn something new, as Labus wrote.

Fourth to sixth items in Labus protocol deal with breath control evolution in singers. To sing in adagio, to sing in mezzavoce, the student indirectly learns how to control breath-

ing mechanics apt to sing, different for those to speak or to play sports. As Salomoni (2016) and then Cunsolo (2022) demonstrated, professional singers must develop respiratory kinematics consistent when repeating a musical task, with a control of abdominal vs rib cage muscles different from non singers or amateurs. This also evidenced that “when they are asked to perform with an *unsupported* voice, they must artificially emulate a non-habitual (and otherwise never used) breathing pattern, and it is unclear whether it is possible to avoid features of their own habitual patterns” (Sand et al., 2005) and so those results might be biased if applied to professional singing. Nowadays, SOVTEs different methods in warm up and in singing pedagogy aim to reduce phonation threshold pressure (Kang et al., 2019) and enhance phonation stability (Savareh et al., 2023). But well before, a few decades after Labus talk, Bruns (1929) as well as Nuvoli and Di Pietro (1932) described *minimalluft* or *minimal availability of breath* as an essential requirement to manage breathing in singing and guarantee effective acoustic dynamics from pianissimo to fortissimo with naturalness, the primary characteristic of Italian opera singing, not just of Belcanto. The pneumophonic link underlined by Labus in these items was based on the reflex described by Hering in 1868, triggered to prevent the over-inflation of the lung, when increased sensory activity of the pulmonary-stretch lung afferents, via the vagus nerve, results in inhibition of the central inspiratory drive and thus inhibition of inspiration and initiation of expiration at a tidal volume of 0.8/1 liters. In this way underlying the non physiological sense of force a singing student to breath exercises to “expand lung volumes”: singing is a matter of acoustics while an excessive thoracic expansion is to the detriment of the freedom of the upper girdle, with stiffening of the paralaryngeal structures and reduction of vocal tract elasticity.

When we analyze seventh to tenth protocol items, becomes evident that activation of pneumophonic control cannot be detached from intense training of verboacoustic (or auditory-motor) control.

Neuroscientists demonstrated that lifelong training in singing refines and enhances a dual-stream model with higher volume in both

dorsal and ventral branches in the right hemisphere arcuate fasciculus compared to the non singers (Perron et al., 2021). The superior branch of the arcuate fasciculus, connecting the superior temporal gyrus and the inferior frontal gyrus, is correlated with the pitch discrimination threshold, while the inferior branch of the arcuate fasciculus is correlated with the size of the mismatch between pitch discrimination and pitch production thresholds.

This in singers’ brain development plays a role in feedback integration to right anterior insula (Kleber et al., 2013) and in choir singing, even non professional, extensive enhancements in commissural as well as bilateral association and projection tracts associated with lifetime experience (Moisseinen et al., 2024), while singing seems to show less detriment than speech in aging (Moisseinen et al., 2023), possibly explaining the lifelong careers of many singers in our times.

The development of these working memory sensory-motor patterns also seem to enhance classical singers versatility to sing also in different styles (Bruder et al., 2023).

These items should move all of us to suggest and promote auditory functions checks in singing students, professional singers and singing teachers, instead of only be worried about “vocal folds edges”. Is common experience in art medicine, to see a singers able to perform even with “minimal vocal lesions”, but much more hampered by acoustic asymmetries (like a flight barotrauma or a middle ear unilateral flogosis) or breathing support impairment like a unknown thoracic trauma or a tracheitis.

Only with eleventh and twelfth points Labus introduces postures and dynamics in “bucco-pharyngeal resonances cavity” (our vocal tract) where in agilities “it is not a new job to be added but rather speed of movement and since things done quickly can end up messy or incomplete, it requires the utmost precision and speed in carrying them out”, while only at the end “we arrive at the supreme point of studies, that is, singing with words.” Labus said in his lecture.

The proper conformation of the vocal tract , comprising mouth opening, facial movements and body postures, will instant by instant permit not only to sing that pitch, not

only to pronounce that vowel or consonant, but to place the right accent in the singing phrase to permit the best acoustic effect with the less physical effort and abuse risk (Körner et al., 2023). But Labus, even if only observing with a laryngeal mirror, already described the importance of the intraglottal space to control vocal emission stability, described in last years with vocal tract models by Titze (2016) and other Authors, "First care will be getting accustomed to keep position, to keep a sound even in pitch and intensity which means a stable tension in vocal edges' as well as breathing and buccopharyngeal muscles" (Calcinoni et al., 2022).

About the two last items, let's read what Labus said "As a complement to the study, there would be defective singing exercises, i.e. with a dull, coarse, nasal, guttural, whining, croaking, hoarse, harsh tone, and there would be mumbling, trailing,...sing in various body positions or with clothing that more or less hinders breathing and the auxiliary muscles of phonation... These exercises should only be done when you are sure of the good emission, so that it is not possible to fall into the habit of performing them unconsciously and they always remain under the dominion of the will. Like grimaces in mimicry, these exercises are a gymnastics of all the possible movements which can then find their applica-

tion in expressions of irony, doubt, indignation, fury, revenge etc."

Only finally we arrive to interpretation. Assessed breathing, pitch, emission, articulation and dynamics control, the singer must now add emotion and expression to his/her singing. This is not a quick or intuitive acquisition, as demonstrated also by Hakanpää (2023) among the last papers, where a singing voice quality training took some seven weeks (Calcinoni et al., 2022).

## Conclusions

Labus will die some six months later, on 1st June 1909, but his protocol still respects and predicts many of later developments of voice science, neuroscience and singing pedagogy. With recent recognition of The practice of Opera singing in Italy in the list of UNESCO intangible cultural heritage elements, Labus protocol may still represent a common code between singing pedagogy, artistic audiology and phoniatrics and singing neuroscience and physiology. As to physicians, the protocol remembers to periodically check all organs and functions related to singing training and performance, not only limited to vocal folds visualization and voice analysis, and to educate singers to prevention as to those functions.

## References

- Bruder C, Larrouy-Maestri P. Classical singers are also proficient in non-classical singing. *Front Psychol.* 2023 Oct 25;14:1215370. doi: 10.3389/fpsyg.2023.1215370. PMID: 38023013; PMCID: PMC10630913.
- Bruns P., *Minimalluft und Stütze*, Berlin-Charlottenburg, Göritz Verlag, 1929.
- Buch et al., Consolidation of human skill linked to waking hippocampo-neocortical replay, *Cell Reports*, June 8, 2021, DOI: 10.1016/j.celrep.2021.10919.
- Calcinoni O., Cazzaniga E. (a cura di) *Scienza e arte della voce Evoluzione e attualità di un dialogo interdisciplinare nei testi della biblioteca del Conservatorio*, Collana: Quaderni del Conservatorio «Giuseppe Verdi» di Milano (10) 2022 ETS edizioni ISBN: 9788846765307 p.222.
- Cunsolo F, Ottaviani V, Capobianco S, Calcinoni O, Dellacà RL. Simultaneous monitoring of vocal doses and breathing patterns in professional singers. *Comput Biol Med.* 2022 May;144:105352. doi: 10.1016/j.compbio.2022.105352. Epub 2022 Feb 26. PMID: 35286892.
- Ebbinghaus, Hermann (1913). *Memory: A Contribution to Experimental Psychology*. Vol. 20. Teachers College, Columbia University. pp. 155–6. doi:10.5214/ans.0972.7531.200408. ISBN 978-0-7222-2928-6. PMC 4117135. PMID 25206041.
- Goldstein E B, *Psicologia cognitiva: Connettere mente, ricerca, ed esperienza comune* (a cura di P. L. Bandinelli, A. Zangrilli, S. Vitali), Piccin Nuova Libreria S.p.A., Padova 2016 (4ª edizione), ISBN 978-88-299-2756-2.

- Hakanpää T, Waaramaa T, Laukkanen AM. Training the Vocal Expression of Emotions in Singing: Effects of Including Acoustic Research-Based Elements in the Regular Singing Training of Acting Students. *J Voice*. 2023 Mar;37(2):293.e7-293.e23. doi: 10.1016/j.jvoice.2020.12.032. Epub 2021 Jan 23. PMID: 33495033.
- Hall, G. S.; Titchener, E. B.; Dallenbach, K. M. (1903). *The American Journal of Psychology*. Vol. 14. University of Illinois Press.
- Hugdahl, K. (2015), "Dichotic Listening and Language: Overview", *International Encyclopedia of the Social & Behavioral Sciences*, Elsevier, pp. 357–367, doi:10.1016/b978-0-08-097086-8.54030-6, ISBN 978-0-08-097087-5.
- Kang J, Xue C, Chou A, Scholp A, Gong T, Zhang Y, Chen Z, Jiang JJ. Comparing the Exposure-Response Relationships of Physiological and Traditional Vocal Warm-ups on Aerodynamic and Acoustic Parameters in Untrained Singers. *J Voice*. 2019 Jul;33(4):420-428. doi: 10.1016/j.jvoice.2017.12.019. Epub 2018 Feb 13. PMID: 29422371.
- Kleber B, Zeitouni AG, Friberg A, Zatorre RJ. Experience-dependent modulation of feedback integration during singing: role of the right anterior insula. *J Neurosci*. 2013 Apr 3;33(14):6070-80. doi: 10.1523/JNEUROSCI.4418-12.2013. PMID: 23554488; PMCID: PMC6618920.
- Körner A, Strack F. Articulation posture influences pitch during singing imagery. *Psychon Bull Rev*. 2023 Dec;30(6):2187-2195. doi: 10.3758/s13423-023-02306-1. Epub 2023 May 23. PMID: 37221280; PMCID: PMC10728233.
- Moisseinen N, Ahveninen L, Martínez-Molina N, Sairanen V, Melkas S, Kleber B, Sihvonen AJ, Särkämö T. Choir singing is associated with enhanced structural connectivity across the adult lifespan. *Hum Brain Mapp*. 2024 May;45(7):e26705. doi: 10.1002/hbm.26705. PMID: 38716698; PMCID: PMC11077432.
- Moisseinen N, Särkämö T, Kauramäki J, Kleber B, Sihvonen AJ, Martínez-Molina N. Differential effects of ageing on the neural processing of speech and singing production. *Front Aging Neurosci*. 2023 Sep 4;15:1236971. doi: 10.3389/fnagi.2023.1236971. PMID: 37731954; PMCID: PMC10507273.
- Nuvoli G, Di Pietro P., *Janua Cantus: Fisiologia preparatoria all'insegnamento del canto*, Milano, Ricordi, 1932.
- Perron M, Theaud G, Descoteaux M, Tremblay P. The frontotemporal organization of the arcuate fasciculus and its relationship with speech perception in young and older amateur singers and non-singers. *Hum Brain Mapp*. 2021 Jul;42(10):3058-3076. doi: 10.1002/hbm.25416. Epub 2021 Apr 9. PMID: 33835629; PMCID: PMC8193549.
- Salomoni S, van den Hoorn W, Hodges P (2016) Breathing and Singing: Objective Characterization of Breathing Patterns in Classical Singers. *PLoS ONE* 11(5): e0155084. doi:10.1371/journal.pone.0155084.
- Sand S, Sundberg J. Reliability of the term "support" in singing. *Logoped Phoniatr Vocol*. 2005 Jan; 30 (2):51–4. PMID: 16147223.
- Savareh S, Moradi N, Yazdi MJS, Soltani M, Latifi M. Immediate Effects of Semi-occluded Vocal Tract Exercises as a Vocal Warm-Up in Singers. *J Voice*. 2023 Nov;37(6):875-880. doi: 10.1016/j.jvoice.2021.05.014. Epub 2021 Jul 10. PMID: 34256979.
- Titze IR, Palaparthi A. Sensitivity of Source-Filter Interaction to Specific Vocal Tract Shapes. *IEEE/ACM Trans Audio Speech Lang Process*. 2016 Dec;24(12):2507-2515. doi: 10.1109/taslp.2016.2616543. Epub 2016 Oct 11. PMID: 35990794; PMCID: PMC9390861.

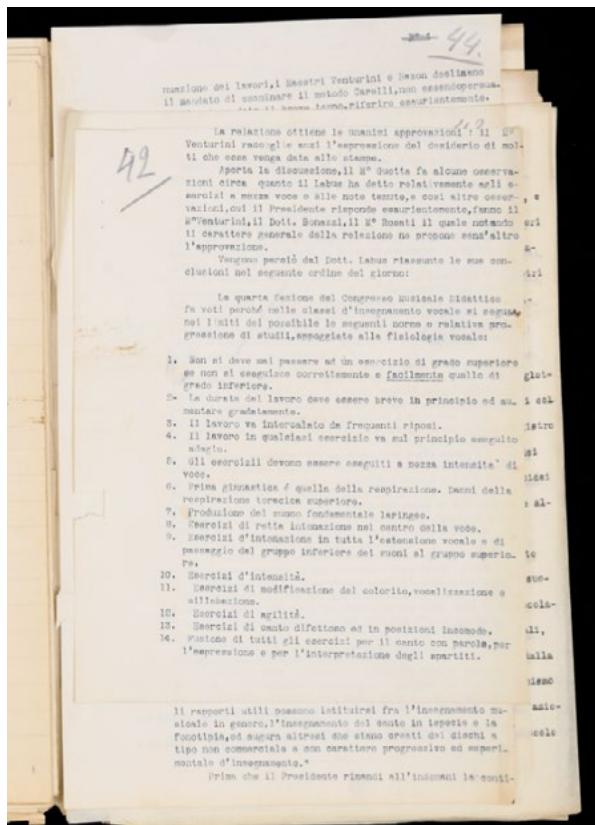


Figure 1: Labus protocol

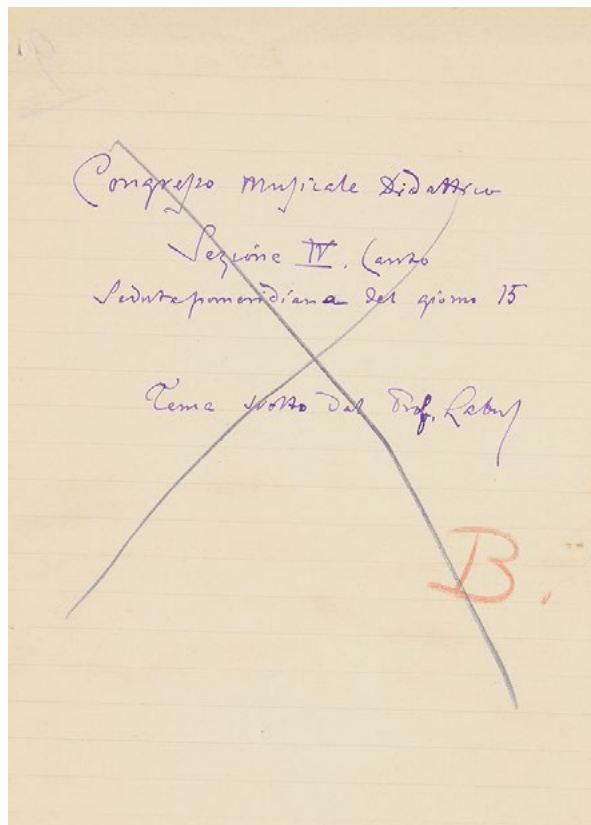


Figure 2: Front page hand notes 1st Congress 1908

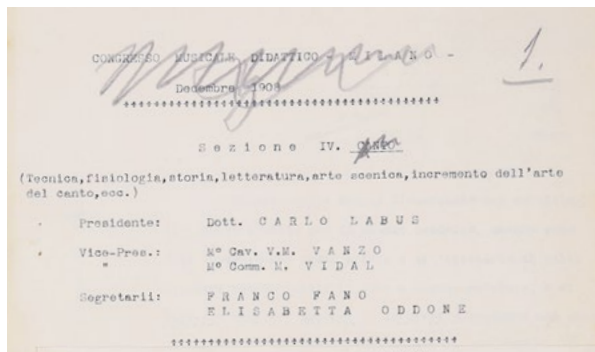


Figure 3: Front page typed notes



Figure 4: 1908 Congress members (Carlo Labus, 1st row, 5th from right)