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Supported Singing as a Phenomenon of Vocal Technique: Research and Methodological Perspective

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Abstract. This article examines the vocal phenomenon of supported sound production. In vocal teaching methodology, breath support is traditionally associated with the organization of respiratory processes in singing. While this approach is fundamentally valid, it is insufficient for identifying all components involved in the development of support in singing, which often leads to misconceptions and ineffective pedagogical practices in vocal training. The traditional approach to teaching vocal breathing is characterized by an emphasis on inhalation technique, while the role of phonatory exhalation is underestimated. Consequently, students develop only the initial component of a complex skill, which does not exert a decisive influence on the quality of sound production. Drawing on extensive practical and pedagogical experience, the article provides a more detailed analysis than is customary in methodological literature, outlining the full set of conditions required for the organization of supported phonation. Four components of the complete respiratory cycle in singing are identified: a brief inhalation; a momentary breath suspension lasting a fraction of a second; a prolonged phonatory exhalation; and, finally, a short diaphragmatic release of breath. The article also examines the principal acoustic characteristics of supported sound production.

Keywords: vocal methodology, schools of vocal technique, singing respiration, breath support, supported phonation, electropneumography, radiographic methods in the study of the physiology of singing respiration

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Певческая опора как феномен вокальной техники (научно-методические аспекты проблематики)

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Аннотация. В статье рассматривается такой певческий феномен, как опёртое звукоизвлечение. В вокальной методике опору звука принято связывать с процессом организации певческого дыхания. Данный взгляд на проблему является верным, но недостаточным, чтобы определиться со всеми компонентами в работе над опорой в пении, что нередко приводит к ошибочным установкам в классе вокала. Традиционный подход в обучении певческому дыханию характеризуется смещением акцента на технику вдоха при недооценке роли фонационного выдоха. Вследствие этого учащиеся совершенствуют лишь первичный компонент сложного навыка, не оказывающий решающего влияния на качество звукообразования. Обобщая практический и педагогический опыт более подробно, чем это принято в методических работах, в статье описываются все условия для организации опёртой фонации. Выделяются четыре составляющих формирования всего дыхательного цикла в пении: короткий вдох; задержка дыхания, которая длится доли секунды; продолжительный фонационный выдох и, в конце, короткий, так называемый сброс дыхания, производимый диафрагмой. Также рассматриваются основные акустические признаки «звукоизвлечения на опоре».

Ключевые слова: вокальная методика, вокальные школы, певческое дыхание, певческая опора звука, опёртое пение, метод электропневмографии и рентгенографии в исследованиях физиологии певческого дыхания

One could not become a capable singer without possessing the art of the control of the breath.
Manuel Garcia Jr. [1, p. 46]

Supported Singing within the System of Vocal Breathing Training

Throughout the history of vocal pedagogy, singing breathing organisation has been among the primary objectives in solo singing classes. Virtually all major methodological studies devote a special section in their research to describing the features of forming singer's breathing or analysing its typology in detail.

Every singer hears expression "the school of singing is a school of breathing" from their very first solo singing lesson. However, most vocal teachers predominantly understand this statement to mean only a certain type of a singing inhale.

Modern views on the types of signing breathing rely considerably on the data of pneumographic studies.[1] Overall,

[1] A pneumograph is a special device for imaging and recording respiratory movements.

the knowledge of the signing inhale types allows for categorising them into several groups, which have been well established in vocal pedagogy, though with some variations. The classification may be presented as follows:

1. Clavicular breathing (supercostal, upper thoracic or shallow).
2. Thoracic (lateral, costal, lower chest).
3. Abdominal (diaphragmatic).
4. Mixed (thoracoabdominal, lower rib-diaphragmatic, costal-abdominal).

The only type of breathing that is considered unacceptable for academic singing in all methodological studies is clavicular. All others have been accepted: they were even dominant and fundamental in different periods. However, experts in the field of vocal pedagogy know that no matter what tricks a singer uses while organising their inhalation, what ultimately matters is how the air comes into contact with the larynx during phonatory exhalation. In practice, it can be often observed that a singer attempts to deal with the problem of sound by playing with the breathing type, ignoring the fact that it is merely one element of a cohesive and complex sound production mechanism. The type of breathing may not be the goal. Naturally, it can activate and direct sensations during the phonation, but it cannot solve all sound production problems. Perhaps, this is the reason why many singers and teachers do not use silent breathing development exercises in their work.

Dmitry Lyush[2] described one of the problems related to the excessive focus on the breathing mechanism in the following way: "It is common to see that even professional singers complain about poor voice quality, explaining it as a 'loss' of breathing. Yet, they can never clearly explain what exactly happened and how breathing could be 'lost.' After visiting a phoniatrist, it usually turns out that the cause of poor sound is in the sluggish closure of the vocal cords or the formation of growths on them. The singer then begins to adjust the sound by changing the intensity of the phonatory exhalation. As a rule, these experiments entail further deterioration in sound quality. All this is the result of the failure to understand physiological inseparability of the functions of the larynx and breathing." [2, p. 74]

It is much more difficult to form a singing exhale than inhale, because it is essential for singer's breathing to keep pressure under the vocal folds (Plicae vocales) throughout the entire phonation process. In academic vocal art, phonatory exhalation is the breathing mechanism associated with the inherent aesthetics of sound production: smooth, "supported" uniform timbre singing.

Currently, supported singing is most often referred to by its Italian name, *appoggio della voce* (vocal support). In German methodological literature, this concept is referred to as *Stütze* (support).[3] Singers understand this term primarily as the so-called "support of sound production," which does not accurately reflect the actual functioning of the larynx, because any phonatory exhalation is reduced to the formation of support. Hence the concept of "breathing support," frequently used in vocal pedagogy, is purely figurative, since the sound of any quality emerges exclusively due to the vibration of air passing through the vocal folds. Taking into account modern scientific ideas about phonation, it is more appropriate

[2] Dmitry Vasilievich Lyush — an alumnus of Kyiv conservatory, an Ukrainian educator and researcher in vocal pedagogy.

[3] See more on the way this concept is used in German-language pedagogy in book: Bruns P. *Minimaliuft und Stütze*. [3]

to use the concept of "support" not in relation to sound, but rather as a special sensation of an "air column" formed with respiratory muscles as the vocal folds functioning is naturally and primarily influenced by the force of pressure from underneath.

Accordingly, a renowned educator Francesco Lamperti believed that when working with students, it is necessary to ensure that when singing a note, breathing must provide support. The famous maestro suggested explaining this as follows: "…as if the process of inhalation continues ... so that the voice rests on the breath, or rather it is supported by the air column, and the sound appears to be clear and free from external noise." [4, p. 40]

It is easy to see that in the prominent European vocal schools, the concept of supported sound is primarily associated with the singer's breathing. Breathing support emerges when the air is tightly compressed in the chest as if in a sort of air bag, but certain groups of muscles press it in specific areas: the upper, middle and lower parts of the lungs, where the tension arises. The feeling of support can be achieved with any of the abovementioned types of breathing. The only remaining problem is to select respective groups of respiratory muscles to organise phonation.

Singer and teacher Sergei Yudin[4] provided the following description of the vocal support phenomenon: "…if, upon inhaling, a singer not only keeps their inhaling muscles tense, but at the moment of sound attack and throughout the entire sound duration, keeps them in tension, the breath during the flow of sound is supported." [5, p. 34]

From the physiological perspective, supported singing is a conditioned reflex, a component of singing skill. Singing voice researchers believe that support is ensured by the antagonist muscles that shape the singing exhalation: the diaphragm, external and internal chest muscles. That might be the reason why the French version of the concept of support in singing sounds like "lutte vocale," which literally means *vocal struggle*.

The German phoniatrist and voice researcher Rudolf Schilling[5] roughly described the reflexive nature of vocalists' "supported singing" as follows: "…the elastic tension is consciously held back during the sound-producing exhalation, and it is gradually released, part by part. The muscles used to inhale remain active or ready for action for a long time after the exhalation has begun and continues. Depending on whether these elastic forces retention occurs mainly in the upper or lower parts of the chest, it is possible to speak of upper or lower support (Stütze)." [6, p. 54]

A similar description of supported singing physiology was given by the well-known Soviet voice researcher Ivan Nazarenko: "The requirement for 'sound support on the diaphragm' or 'lower support' is a basic condition for controlling air pressure in the subglottic space and controlling the strength and duration of the voice tone. A new relationship between the action of the diaphragm muscles and the external chest muscles, corresponding to the singing exhalation, is established over the course of life, and it is the main conditioned reflex, which the vocal teacher has to deal with." [7, p. 441]

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[4] Sergei Petrovich Yudin (1889–1963) — an opera singer (tenor), a soloist of the Bolshoi Theatre (1911–1914 and 1919–1941), director and educator who taught at Tchaikovsky Moscow Conservatory.

[5] Rudolf Schilling (1876–1964) — a German doctor specialised in phoniatrics, a co-founder of modern phoniatrics.

An important element in the supported singing organisation is the so-called "breath hold." This is a period of less than a second following the termination of inhalation before the singer switches over to the muscles forming the phonatory exhalation. The breath hold was described in detail in the early 20th-century German methodological literature, where it was called *Stauprinzip* (literally a delay, compressed breathing). It is not only a physiological transition point from the activation of the inhaling muscles (that draw air in) to the expiratory muscles (that draw air out), but also the vocalist's psychological readiness for phonation.

The Interrelation of the Sensation of Vocal Support with the Functioning of the Larynx and the Oropharyngeal Tract

"Breath-supported" singing is required for achieving certain acoustic qualities of sound. The purpose of supported breathing is to develop "supported sound," which is understood in academic singing as a solid, light, moving-forward voice. The "unsupported" sound, on the contrary, is characterised as sluggish, uneven, flaccid, and powerless.

It is evident that in order to achieve the supported sound, one must be able to create support in breathing, but the latter does not ensure the former. The feeling of the air column support is absolutely vital, but not the only condition to achieve the "supported sound." For the latter, other vocal technique components related to the larynx functioning, articulation, and resonators in singing ought to come into play.

"The feeling of 'support' comes from a certain resistance to the force of subglottic pressure, the resistance to this pressure of the working vocal cords in relation to the constantly changing volume of the oropharyngeal cavity," wrote singer and professor at the Novosibirsk Conservatory Alexander Zdanovich. [8, p. 104]

Probably owing to this fact, a number of schools considers "supported singing" as a set of acoustic properties of the cantatory sound. Indeed, it is possible to have the feeling of support in breathing, but not that of the sound. Examples here may include musicians who play wind instruments. Having the skill of supported breathing, they cannot sing supported sounds.

In the second half of the 19th century, Italian teachers developed another interpretation of the supported singing phenomenon, which was related to the acoustic qualities of sound, expressed in certain characteristics of the voice resonance.

Russian tenor Fyodor Vitt,[6] who sang in the Neapolitan opera, laid out his vision of supported singing in Italy: "The true *appoggio* (support) is viewed by Italian teachers as a 'mask' only; and the teachers who claim that *appoggio* is the chest support confuse their students and often force the sound into their chest, making their voices sound dull, heavy and muffled. *Appoggiare la voce* means to support the sound. It is only possible to hold a sound by propping it against a single and specific place. Accordingly, the Italian school gives us this place, which is exclusively 'masked' *appoggio*." [9, p. 43]

This point of view is confirmed by Vsevolod Bagadurov, who wrote that the understanding of *appoggio* not only as breathing support (*sul fiato*), but also in the resonator. It was finally established in the Neapolitan school led by Beniamino Carelli.[7] In addition to oral-

[6] Fyodor Fyodorovich Vitt (1879–1970) — a Russian baritone, who performed in the Neapolitan theatre of San Carlo, an educator.

[7] Beniamino Carelli (1833–1921) — one of the most prominent Italian solo singing teachers at the end of the 19th – early 20th centuries, a composer, for many years he worked in the Neapolitan Conservatory of San Pietro a Majella.

pharyngeal support (*appoggio bucco-farinjieo*), there are descriptions of special sensations of support at the level of registers: the larynx in the chest register (*appoggio laringeo*) and the supraglottic in the head register (*sopra-laryngeo*). [10, p. 215]

Thus, we can conclude that supported sound is a component of the vocal skill characterised by the involvement of the muscles that organise vocal breathing and their connection with the larynx and the resonator system in singing. This definition brings the concept of supported singing to another, broader level of understanding its formation, related to the sound flow acoustics and aesthetics.[8] This is also pointed out by vocal teachers and researchers of the singing voice, who note that supported sound production leads to phonation that can be defined as professional academic singing, as it has specific acoustic characteristics. Consequently, the supported sound thus has a recognisable timbre, which is an indicator of professional singing. Any singing style requires support: acting, pop-jazz, or folk. However, each of them sounds noticeably different from the others. The reason lies in the nature of the contact between the air column and the larynx, which occurs as a result of support, and then in the specificity of the resistance to the subglottal pressure in the vocal tract.

In the case of academic phonation, support participates in shaping its inherent overtone spectrum of singing harmonics, owing to which all vowels are levelled in vocalisation. Voice researchers have found that each vowel sound has its own subglottal pressure. Laryngologist Leonid Rabotnov,[9] having measured the pressure under the vocal folds, provides the following figures for the main vowels, for example, in the Russian language speech: on average for A — during speech about 10 mm of mercury,[10] E — 12, O — 11, I — 13.5, U — 12.5. [12, p. 52]

That said, we may conclude that the subglottal pressure decreases in the following sequence of vowels: I–U–E–O–A. A similar situation of "unevenness" is regulated by the singer's flexibility of support sensations in the subglottic region, as well as in the supraglottic system, where impedance is formed.[11]

It is also common knowledge that the acoustic spectra of vowel sounds differ in their ratios of high and low formants. It is this acoustic feature that allows the ear to distinguish between vowels. However, this condition is unacceptable for singing, as it leads to a mottled sound. This problem is solved in solo singing classes by organising the support of the sound flow. The supported singing enables one to level vowels in singing, largely owing to establishing high-frequency singing formants.

Acoustic Characteristics of Supported Sound Production

Back in 1956, while analysing the voice spectra of various singers, Soviet acoustician Sergei Rzhevkin[12] noticed that professional singers' high singing formant zone is stable

[8] The close interrelationship between laryngeal function and breathing is also emphasized by specialists in the field of actor's speech training. [11, p. 15]

[9] Leonid Dmitrievich Rabotnov (1879–1934) — a Russian, Soviet laryngologist, Doctor of Medicine (1916).

[10] Millimeters of mercury column (mm m. c.) — 1 mm of mercury ≈ 133,322 Pascal.

[11] In acoustics, impedance is understood as measure, reflecting the level of the environment resistance to the sound-wave propagation.

[12] Sergei Nikolayevich Rzhevkin (1891–1981) — a physicist, Professor at the Faculty of Physics, Lomonosov Moscow State University, a founder of the Russian school of acoustics.

even when vowel sounds change. The scientist also tried to "verify harmony with algebra" and gave the voice spectrum of a non-professional baritone (Figs. 1 and 2). Then it was mentioned that the test subject's voice timbre seemed to be sharp.

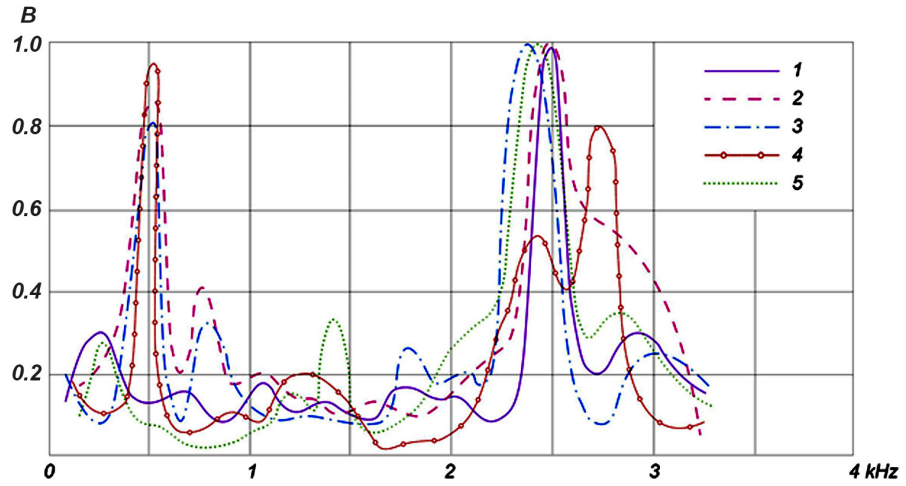

Fig. 1. Schematic representation of the frequency spectrum envelope of a professional bass singer performing the *Do* sound in the tenor octave (*c*) (129 Hz) with the following vowels: 1 – U, 2 – O, 3 – A, 4 – E, 5 – I (according to Sergei Rzhevkin) [13, p. 207][13]

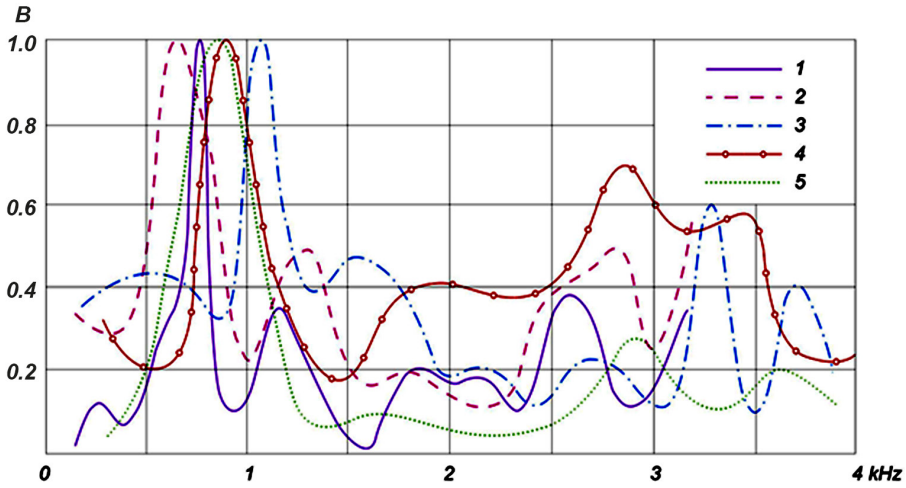

Fig. 2. Schematic representation of the frequency spectrum envelope of the vowel *A* Zsung by an inexperienced singer (baritone) producing the following sounds: 1 – 129 Hz, 2 – 167 Hz, 3 – 217 Hz, 4 – 288 Hz, 5 – 325 Hz (according to Sergei Rzhevkin) [13, p. 209][14]

[13] The envelope curve shows that the low and high singing formants repeat in the same place regardless of the vowel.

[14] The lower formant was unstable when changing vowels. The fluctuations ranged from 600 to 900 Hz. There was no clearly manifested upper formant. It was only possible to notice a slight increase in the range from 2500 to 3000 Hz can be observed.

As a result of his research, Rzhevkin came to the following conclusion: "In the voice of a highly skilled singer, there are sharply pronounced 'singing formants' in the range of about 500 and about 2500 Hz, which are the same for all vowels and throughout the entire range from the lowest to the highest notes. A comparison with the voice of an inexperienced singer shows that in the latter case, the singing formants are not clearly pronounced and stable..." [13, p. 205]

Later, another Soviet scientist Vladimir Morozov, discovered that levelling the vowel spectra in academic singers occurs due to the presence of amplification in the area of the so-called high singing formant (HSF), which slightly increases depending on the type of voice. For example, for bass and baritone it is 2100–2500 Hz, for tenor 2500–2800 Hz, for soprano 3000–3500 Hz, and for children it reaches 4000 Hz (Fig. 3).

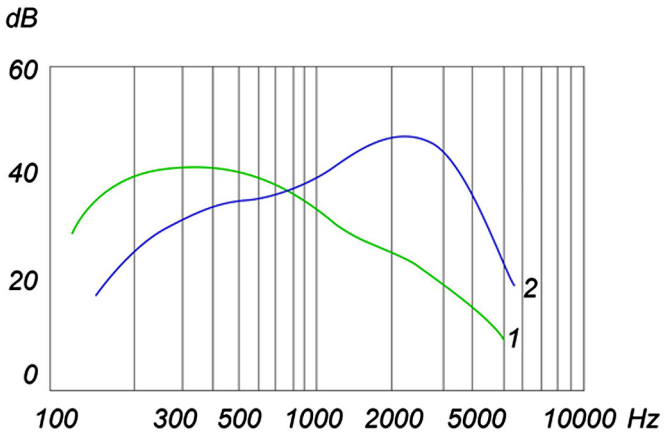

Fig. 3. The comparison between speech (1) and vocal (2) vowel spectra (according to Vladimir Morozov) [14, p. 99][15]

Researchers engaged in the studies of the singing voice usually fail to pay attention to the connection between the voice timbre and the nature of supported singing, except for specific cases. It might be explained by the fact that the term "voice support" itself is figurative and is exclusively related to singing. Its use is determined more by the need to somehow describe the phenomenon, which is considered a fundamental principle of singing in vocal pedagogy. This may be the reason why supported voice sound came to be described from the physiological rather than the acoustic perspective.

For example, singer and teacher Pavel Tikhonov[16] compared the human voice with a reed pipe to provide to clarify the interaction between breathing and the larynx. He wrote that only two conditions allow for proper support in the voice: the correctly attached reed and well-inflated bellows. "However, suppose, there is a hole in the bellows," continued Tikhonov, "and they are poorly inflated, the sound will no longer be supported because there will not be enough air pressure under the reed. Similarly, the sound will not be supported if, for some reason, the reed is poorly attached; the air in the pipe will not be sufficiently compressed and channelled due to leakage through the gap, formed by the deviation of the reed, thus resulting in a hissing and, naturally, weak sound." [15, p. 53]

Professor Tikhonov's vivid comparison speaks to the need for the comprehensive approach to the understanding of support, which is primarily involved in establishing the contact, a sort of "coupling" between

[15] The diagram shows the way a vocal vowel expands the high formant area and brings it into the area of the increased auditory sensitivity.

[16] Pavel Ilyich Tikhonov (1877–1944) — a singer (bass), who performed in the opera houses in Kyiv and Odessa. He was the soloist of the Bolshoi Theatre in Moscow. He taught in the conservatories of Moscow, Minsk and Saratov.

the larynx and breathing. Deficiencies in the organisation of the latter, underestimation of the excessive tension in the vocal folds caused by the incorrectly organised support beneath them might entail very serious consequences. It is also worth mentioning that vocalists who are fascinated by the feeling of support but do not pay attention to its connection with the larynx often slip into "over-supported singing," which leads to the feeling of constriction, suffocation, and a heavy, sluggish voice. In such cases, the sound appears "crackling."

In this regard, we could cite an example of a defective voice caused by the "over-supported" singing. A student of the renowned teacher Camille Everard,[17] the famous opera singer Nadezhda Salina,[18] stated that her professor's school was hard and therefore it was not suitable for everyone. She noted the following: "After his lessons, I was hoarse and would lose my voice for several days, while others' voices began to sound exhausted over time" (Cit. ex: [10, p. 331]).[19] In this case, the exhaustion most likely arose from the incorrectly distributed pressure under the vocal folds. As Leo Weinstein notes in the book about his teacher Everard, "support, support" was often heard in the classroom, especially when the voice began to tremble. "I must say that the students often did not understand this simple requirement, did not understand what the sound should actually be supported by, and this annoyed the maestro greatly." [16, p. 3]

The Role of the Diaphragm in the Organization of Vocal Phonation

The problem of the interaction between exhalation and the work of the larynx is rarely discussed in the methodological literature. However, the most common mistake made by teachers when forming sound support is a lack of understanding of the flexible change in the feeling of support in the context of the voice register (see below more on the influence of subglottal pressure on the formation of the register mechanism). Each register mechanism, used by a singer for phonation, has its own kinesthesia. Consequently, a single technique to build up support will be insufficient. Subjectively, the feeling of support changes depending on the register of the note.

Viktor Yushmanov[20] wrote that the feeling of support is largely related to the choice of the so-called singing manner. The scientist noted that, a covered (closed) sound, for instance, is perceived by the singer as more supported than an open one. "High supraglottal resistance of the covered singing manner requires active holding of the sufficient subglottal pressure. It creates a muscular sensation of resistance to the singing exhalation, which singers and vocal teachers have defined as 'breathing support.'" [17, p. 56]

Thus, it can be said that the subjectivity of the support feeling arises from the perception of register mechanisms. This is also confirmed by singers in practice. For example, the sounds

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[17] Camille François Everard (Everardi) (1825–1899) — a Belgian baritone, alumnus of the Paris Conservatoire, who sang in Russia for many years. In 1870–1889, he worked as a professor at the conservatory in St. Petersburg, in 1890–1897, he worked in Kyiv Music College, and in 1897–1899, he was a professor of Moscow Conservatory.

[18] Nadezhda Vasilievna Salina (1864–1956) — a Russian singer (soprano), an honoured artist of the Imperial Theatres (1908).

[19] Information is based on the report delivered at the plenum of the Vocal-methodological department of the State Institute of Music.

[20] Viktor Ivanovich Yushmanov (1941–2009) — a singer (bass), a voice researcher and vocal educator.

of the female chest register are internally less perceived as supported compared to the middle mixed register.

Therefore, in their early career female singers might not easily switch to the mixed mechanism on middle notes, and some teachers mistake it for a disruption of the connection with breathing and support, although in reality the problem lies in a disruption of the ratio between the closing and opening functions of the vocal folds, which leads to a harsh sound in the middle register. A similar issue arises in men who, when covering the upper register notes, internally perceive them as more supported in relation to the lower register.

Vocal methodology studies still differ in their opinion the diaphragm movements during the formation of supported phonation. On the one hand, the role of the diaphragm flattening when using abdominal or lower rib-diaphragmatic (costal-abdominal) breathing is emphasised, while on the other hand, there are differing views as to whether the diaphragm should gradually return to its original dome-shaped position during phonation or whether the singer should try and resist this, thereby organising the sound support.

Antonio Juvarra[21] noted that different views on the role of the diaphragm movement have resulted in "some vocal schools performing high notes by supporting them with a raised diaphragm, while others lower it." [18, p. 77] The Italian teacher himself believes that the result is the same in both cases.

As noted above, the role of the diaphragm in the organisation of phonatory exhalation is to build subglottal pressure so that the voice can perform not only tasks related to the dynamics of sound, but also to the formation of the voice "register constitution," which will be discussed below. From this point of view, raising the diaphragm during phonation will not allow it to perform its balancing function. It has already been noted above that professionally sounding voices are distinguished by the complex movements of the diaphragm during phonation.

For example, Professor Liudmila Yaroslavtseva,[22] studying the regulation of professional singers' singing breathing using electro-pneumography and X-ray imaging,[23] found that skilful singers regulate their phonation during exhalation. The pneumogram of these vocalists showed complex and small breathing zigzags associated with sound production (Fig. 4).

In her lectures, Professor Yaroslavtseva[24] said that the pneumographic data were confirmed by X-ray studies of the diaphragm. In particular, in experienced singers skilled in sound refinement and other dynamic nuances, X-rays of the diaphragm showed specific minor movements that they performed depending on the set task. The diaphragm was not just a muscle for phonatory exhalation, but a thin, sensitive membrane that organised the dynamics of the voice, flexibly influencing the subglottic pressure.

From the perspective of professionally regulated singing breathing, the diaphragm is not a merely inhalation muscle, but an organ that performs small inhalation and exhalation

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[21] Antonio Juvarra — an Italian singer (baritone) and educator.

[22] Liudmila Kostantinovna Yaroslavtseva (1922–2017) — a singer (soprano), a scientist and researcher of the singing voice, professor of Solo Singing Department at the Gnesin Russian Academy of Music in Moscow.

[23] Roentgenography, or X-ray is an imaging method that uses roentgen rays to create images of human internal organs and tissues.

[24] A co-author of this paper Dmitry Grinikh was Yaroslavtseva's student during his studies at the Gnesin Russian Academy of Music in Moscow.

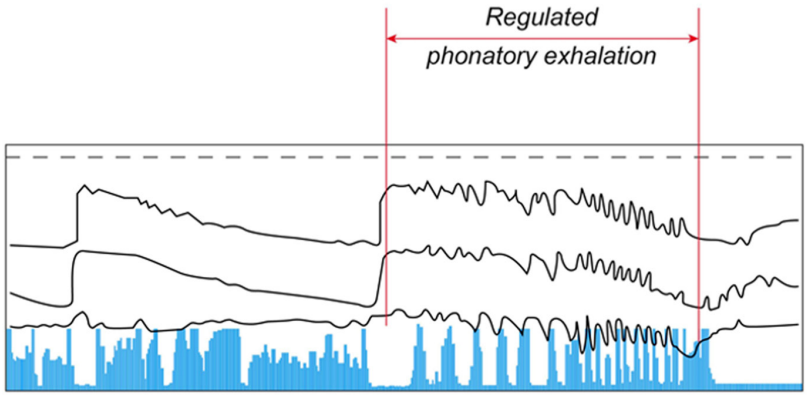

Fig. 4. Pneumogram of regulated phonatory exhalation (from the work of Liudmila Yaroslavtseva) [19, p. 182][25]

movements during the phonatory exhalation phase, thereby influencing the change in the subglottic pressure.

Accordingly, we can conclude that the feeling of support has a significant effect on the organisation of the singing voice register structure. The respiratory muscles, and above all the diaphragm, distribute the subglottic pressure in such a way that a balance is created between the pitch level, the density of the vocal folds on it and the counterpressure (impedance) system in the oropharynx.

In view of the aforesaid, it is difficult to agree with those teachers who, during phonation, for example, try to push their fist against their student's stomach in order to more actively "support" the note[26] as well as with those who forcefully hold the diaphragm in a flattened state.

The diaphragm and its antagonists, the abdominal muscles, are also involved in organising the final stage of vocal support, the so-called breath release. This is an important technical component that is often overlooked by vocal teachers. It involves the release of the residual air and the termination of the feeling of an air column inside the body. Perhaps this is why the release often allows the singer to "reset their senses" at the moment when fatigue builds up or the singer feels discomfort during the phonation.

Mastering the release mechanism is not rather hard for many students, as it requires certain coordination of the diaphragm and vocal folds. The key point in organising this movement is to ensure that there is no additional "pressure" on the vocal folds, which leads to the folds tightening and fatigue. At the moment of a technically correct release, the voice produces a minor, light "moan" at the end of the sound, which indicates the presence of the required support.

[25] It is a part of a pneumogram reflecting the regulation of subglottic pressure: inhalation movements while singing — pressure decrease, exhalation movements — pressure increase. All three oscillographic curves show that coordination occurs at the chest level, lower ribs and abdomen.

[26] That was the technique used by Montserrat Caballé at one of the classes: How to breath while singing was shown by Montserrat Caballé. https://www.youtube.com/watch?v=8xtBb9h7VIY&t=20s (accessed: 11.05.2025).

Components in the Formation of Vocal Support Sensations

Thus, when working on breathing in singing, particularly, in a solo singing class, it is important to remember that there are not two phases, as many teachers believe (i.e., vocal inhalation and phonatory exhalation), but four. The sequence of these phases is as follows: a short inhale; a hold lasting a fraction of a second; a long phonatory exhale and, in the end, a short *release* of breath (produced by the diaphragm). In this sequence, the entire breathing cycle may be characterised as singing.

Being the only energy source for a singer to ensure the subglottic pressure, the "sound support" participates in shaping certain acoustic qualities that are constantly present throughout the entire voice range. These qualities enable to identify the academic sound of the voice by ear. The supported phonation is an exclusively singing phenomenon. It allows uniting the essential components of the vocal technique, such as singing breathing, larynx position, register mechanisms, impedance in the vocal tract, and the function of the articulatory apparatus into a single professional skill.

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