Introduction

Over the centuries, singers and pioneers of singing pedagogy have been focusing on vocal technique strategies to achieve the best tone quality, with balanced effort and easy management of vocal ranges. The breathing process as a main concern for singers during performance has been thoroughly investigated, becoming one of the foundations of teaching singing. The concepts of ‘voice support’ or ‘sing with the diaphragm’ as well as the Italian ‘cantar sul fiato’ [to sing on breath] has filled pages of vocal technique books thus making up the history of Vocal Pedagogy.

What is, exactly, the meaning of these sentences? How does breath management affect the use of the singing voice? Is it possible to identify the concepts of ‘support’ or ‘appoggio’ with a precise vocal technique?

More recently, scientific research on voice and the breathing mechanism have been trying to clarify what singers feel and what they actually do during singing. Although there are confirmations about differences in voice production between supported and unsupported voices, particularly on tone quality and SPL (Subglottal Pressure Level), researchers disagree on the role of respiratory muscles during singing and only preliminary results are reported (Griffin, Woo et al. 1995). Also, it seems there is no significant evidences on the ability to control breath pressure between trained and untrained singers (Brown, Hunt, et al. 1988). A number of further studies, with more subjects involved, are still needed to understand what we can’t see inside a ‘singing body’.
Why breathing for singing

Phonation is not the primary function of breathing; we all know that to exist we need oxygen and this process of ventilation occurs in the lungs. Inhalation occurs when the air pressure inside the lungs is less than the atmospheric pressure outside the body; so the elastic and porous tissues of lungs are filled by oxygen that is carried throughout the body removing the CO2. In order to produce a sound, to sing or speak, vocal folds need to vibrate and this requires an air pressure below the vocal folds. The contraction of the expiratory muscles reduces the space in the thorax and this causes the expiration of air from the lungs. It is proven that subglottal pressure is a major parameter for controlling the voice source. Pressure changes during singing not only affect loudness but also air flow, glottal adductive force and, as a secondary effect, pitch control; however laryngeal muscles are essentially used for pitch regulation (Leanderson, Sundberg 1988). The breathing system is a complex of forces that interacts: gravity, elastic recoil and muscles work together to create the necessary pressure to generate the vocal sound. Different conditions and needs like pitch changes, dynamics or musical styles demands may have an effect on the amount and degree of muscles that singers have to coordinate in the singing process (Cleveland 1998).

Keeping all this in mind it is not difficult to understand why teachers and singers spend hours and years of explaining, investigating and practice on how to manage the breathing mechanism needed for singing.

The Evolution of Vocal pedagogy

As aptly described by Stark (1999) ‘voice teaching has always been largely based upon oral tradition’, and also, ‘vocal method books often lacked specific instructions on how to use the voice’. In fact, many of the first authors report only simple instructions about taking a breath and managing it throughout the singing phrase; suppositions and contradictions follow one another in various eras.

Maffei (1562) advises ‘to gradually press the breath with the voice, and pay great attention that it does not go out through the nose or by palate’. Caccini (1602) talks about breath control to realise ‘all the gradations between soft and loud’. Tosi (1743) pays attention to a good use of breath, ‘taking it quietly and being sure to have it enough’. Martini (1792) write ‘(...) it is necessary to hold back the air with greatest care. This manner of breathing (...) increases the volume of the voice (...) and provides facility and lightness in difficult passages’.

Garcia’s scientific approach was a breakthrough in how vocal technique (and subsequently breath management) was perceived. With the introduction of the laryngoscope a new way to investigate and describe vocal pedagogy was born. Garcia’s method (1841) does not focus on breathing though and his only advice is to breath with both a raised chest and a lowered diaphragm, to obtain a full breath and maintain a steady pressure throughout the singing
phrase. In his treaty Garcia, as well as his successors, talk incessantly about the larynx, vocal folds and registers. His work was aimed at understanding interactions between the vocal tract and the glottis in creating different vocal qualities. We surely can designate this new possibility to investigate the voice source as an incredible pedagogic advancement. With the evolution of solo singing, as seen from the late sixteenth century, singers and teachers start to shift their attention to the development of the vocal tone qualities needed for this new vocal solo music.

In the early twentieth century Lamperti makes a big contribution to the ideas on breath management.

‘To sustain a given note the air should be expelled slowly; to attain this end, the respiratory muscles, by continuing their action, strive to retain the air in the lungs, and oppose their action to that of the expiratory muscles, which is called the lutte vocale, or vocal struggle. On the retention of this equilibrium depends the just emission of the voice and by means of it alone, can true expression be given to the sound produced’ (Lamperti 1916)

This ‘lutte vocale’ was, and still now is, cited by voice researchers and teachers in many books on vocal technique, and is used to make statements of countless different theories and singing methods. Again, Lamperti describes the diaphragmatic breathing as the only viable breathing mechanism for singers, ‘allowing the larynx to remain in a natural position’. We can partially agree with this idea but at the same time his statements are inaccurate and incomplete. His pupil William Shakespeare refers to the breathing system as balancing the abdominal and the diaphragm action.

Both Miller (1986) and Stark consider Lamperti as the founding father of the ‘appoggio’ concept. Also, they consider this concept as an all-embracing singing system including breath management and resonance factors.

Why in fact, do they go as far at this conclusion? We know that Garcia was a pioneer in the voice investigations and of course Lamperti, with many others, benefits from the evolution of the first voice researchers. These researches were trying to provide a wide range of answers on questions raised in the singing process, applying all the knowledge they achieved through their own experience. At the same time there were no scientific evidence that the ‘appoggio’ involved the breathing and the laryngeal mechanisms in one technique.

Probably the idea of an ‘all-encompassing singing technique’ were, and still currently is, too captivating not to be pursued by any means.

About ‘appoggio’: Miller translates it as: ‘support’ (appoggiarsi a, “to lean upon”). This is not the exact translation from italian and the following needs to be added to make the term more comprehensive. In the Italian Language the verb ‘appoggiare’ refers to something or someone
that 'appoggia' him/her/itself to something or someone else that acts as the counter-support [=sostegno]. These two actions are complementary, thus, there is no 'appoggio' without 'sostegno'. I will reconsider this clarification below.

**Science and Voice**

Nowadays, scientific evidence can clarify most of the vocal training knowledge based on experience, helping singers and teachers to find the best and most useful practices possible. Anatomy and physiology give us a deep understanding of the breathing mechanism and we know exactly which muscles are involved in the breathing process and the vocal production. We have to recall, even if not investigated in this essay, that in addition to the musculature used for respiration laryngeal muscles also control the voice source. Nevertheless there is still no universal agreement on how to 'support' voices.

**The breathing system**

The dominant respiratory muscles are: the thorax muscles, the abdominal muscles and the diaphragm muscles. Accessory respiratory muscles seem also to play a role for singers: in particular the Latissimus Dorsi is engaged to maintain expansion of the rib cage (Watson, William et al. 2012). The thorax muscles consist of the external and internal intercostal muscles. The external are primarily active during inhalation; the contraction of these muscles expands both the transverse and antero-posterior diameters of the thorax by lifting the ribs. The internal intercostal muscles are their antagonists and by contractions they pull the ribs down, thus expelling air from the lungs. Abdominal muscles, primarily muscles of expiration, are the transverse, the external and the internal obliques muscles. Less involved in respiration process is the abdominal rectus (Doscher 1994).

*In my experience I found that some singing students who also are athletes have the tendency to constrain the rectus abdominis during inhalation. This results in laryngeal contraction, probably linked to the closing function of the larynx in maintaining pneumatic pressure within the thorax during extreme use of the upper body muscles. This tendency may be taken into consideration during training, to achieve a better perception and control of muscles.*

The floor of the rib cage is the dome-shaped diaphragm muscle, which divides the thorax from the abdomen. The diaphragm is the most important breathing muscle for inhalation. When the diaphragm is contracted it flattens lowering the floor of the rib cage and compressing the viscera. This causes an increase of lung volume and an outward movement of the abdominal wall. By contracting the abdominal muscles, the viscera moves back and the diaphragm moves upward decreasing the volume of the lungs (Sundberg 1987).
Refering to Lamperti, Miller writes: ‘(…) there is a feeling of muscular connection from sternum to pelvis. However to move out the lower abdomen (…) is foreign to appoggio technique’.

In my opinion this statement seem to show an incongruity; what is exactly the feeling of muscular connection? And, for the reasons above, how the diaphragm could lowering without producing an outward movement of the abdominals muscles?

According to De Troyer (1982; 1986) it would be correct to talk about two diaphragms.

**Posterior diaphragm:** mainly made out of ‘Slow fibres’; more resistsants fibres that work over a long period of time. It works simultaneously with the external intercostal muscles, operating a bulge of the abdominal wall. Posterior diaphragm is not connected to the rib cage, but it originates from the upper lumbar vertebrae and inserts into the central tendon.

**Anterior diaphragm:** mainly made out of ‘Fast fibres’ with a rapid engagement time.

It works in series with external intercostal muscles co-operating the expansion of the rib cage. It originates from the central tendon and it is connected to the last six ribs. It is interlocked with the transverse abdominals (expiratory muscle).

The kinetics study of abdominal muscles speculates about the interdependence between the contraction of abdominal expiratory muscles and the consecutive inhale (Genovese 2011).

What does this means for singers? Referring back to Lamperti we can now pose that ‘the respiratory muscles (…) oppose their action to that of the expiratory muscles’ is not an idea of holding back or ‘locking the airflow’ as reported by Chapman (2011).

Rather, according to Doscher, the best breathing method for singers might be a synergic cycle process in which diaphragm and ribs, intercostals and abdominal muscles are working together and are complementary.

From this point of view, to breath [inhale] and sing [exhale] could be the result of a high-maintenance balance between antagonist muscles and opposite forces; between outside and inside the body, between upward and downward.

‘Appoggio’ and ‘Support’ not only a definition problem.

In my experience we can shortly claim that breath management is composed of two muscular elements, at the same time inseparables and functionally distinct: ‘appoggio’ and ‘support’.

Properly named ‘appoggio’ is the condition that occurs at the end of inhalation; it enables the muscles to maintain a steady lowering of the diaphragm and its enlargement by using external intercostal muscles. The ‘appoggio’ condition helps to control the instinctive return of the diaphragm, achieving a balanced subglottal pressure mainly experienced in the voice onset and during the first part of expiration. This ensures that the upward movement of the diaphragm is not sudden but connected to the singing needs like dynamics and pitch.
As we can’t lean on something without the counter-support of that same thing, we can conclude that since the vocal onset, in addition to the prevalent ‘appoggio’ conditions, there is probably a minimum degree of support. Breathing ‘support’ is the component of the expiration control where singers, by contractions of the abdominal wall and particularly the transverse muscles conduct the return of the diaphragm, thus increasing the subglottal pressure particularly at the end of expiration (Fussi, Magnani 1994).

Conclusion
One of the most important thing for me, as a singing teacher, is to develop the student’s own perception. I use brief anatomical explanation and some key texts; I invite students to explore the breathing mechanisms and to be connected to their own body, I encourage them to try different strategies to feel where, what, and in which way there are changes in their voice sound. To teach singing requires a complex set of abilities: to sing and act, listen, feel, observe, exemplify, express, understand and foresee. It is a delicate equilibrium of both the inside and the outside of a person, between technique and spontaneity, intellect and instinct.

The human voice, from an artistic point of view, is the fusion between instrument and instrumentalist and this complex system is subject to many variables (genders, voice registers, age, languages, morphological characteristics).

We can affirm that the concept of ‘voice support’ is a complex and integrated system in which different body mechanisms and voice functions are co-operating to achieve the best cost-effective ratio in the singing voice production with the best tone quality and abilities needed in different styles and repertoire.
References


