If in Doubt, Breathe Out!

If in Doubt, Breathe Out!

Breathing and support for singing based on the Accent Method

Ron Morris and Linda Hutchison

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Dedication

We would like to dedicate our book to all those people who use breath, for speaking, singing or playing a musical instrument. We are nothing without breath!

Acknowledgements

There are many people who encourage, support and assist in a project like this and we are grateful to all of them. But, considering our subject, we acknowledge and thank those who set us off on the path of Accent Method in the first place: Kirsten Thyme-Frøkjær, Sara Harris, Ingrid Rugheimer and Dinah Harris. They were the people who introduced us to Accent Method, gave us the practical knowledge and encouraged us to teach and explore the method in our own work.

The idea for this book came about as a result of Ron Morris' doctoral research and he would like to acknowledge the teaching and support he received from Janice Chapman. Her pedagogy helped shape the use of Accent Method for his research.

A special thank you has to be said to Luke, Karina, Fode, Steffan, Will, Shubham and Camille, pictured in this book, for allowing Liam Harris to wander with his camera and capture them in action.

We would also like to make special mention of our colleague Ghislaine Morgan whose often heard cry "if in doubt, breathe out" to her students, workshop participants and choirs we stole (with her permission) to be the title of our book.

Finally, we acknowledge all our colleagues and students who have helped us experiment, evaluate, research and modify the use of Accent Method during the past two decades. Through you, we have arrived at a place where we feel able to share our thoughts, ideas and exercises. We hope you find them of use.

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Foreword by Janice Chapman

Accent Method has underpinned much of my vocal pedagogy. It is based securely on the body's natural respiratory patterns and clarifies and enhances a singer's ability to connect to the natural support system which is part of primal sound.

Accent Method exercises work as a means of training a singer in good effective breath management to a gold standard. Where there have been vocal problems it is a unique remedial tool. Singers are able to practise their breathing exercises separately from their repertoire to lay down healthy natural breath support.

Ron and Linda have carefully laid out the sequence of the exercises and the reasoning behind them. The teaching of Accent Method is clearly and concisely explained throughout and readers are able to choose how much of the underpinning scientific information they wish to read.

I thoroughly recommend this valuable addition to Vocal Pedagogy.

Professor Janice L. Chapman, OAM, FGS
Guildhall School of Music and Drama, London

Foreword by Sara Harris

'To breathe or not to breathe' has been the title of many a lecture over recent years. At last we have a guide: *If in Doubt, Breathe Out!* The area of breathing as applied to singing pedagogy has frequently been controversial. There have been a variety of interesting and sometimes strange theories about breathing and singing, and the topic always produces plenty of lively discussion between voice practitioners. It is therefore very refreshing to see collaboration between a singing teacher and a speech and language pathologist that approaches this shared area of interest in a pragmatic and evidence based way.

The approach the authors take is founded on the principles and practices of the 'Accent Method', a technique developed in Denmark by Phonetician Svend Smith between 1935 and 1970. The technique was further developed by Danish speech and language therapist Kirsten Thyme-Frøkjær who, along with other more recent practitioners, carried out the research that makes Accent Method one of the few voice techniques to have a sound, level 1 evidence base. In the past, Accent Method has been used successfully to treat stammerers and those with voice disorders. It has also been shown to be valuable in developing effective voicing for normal speakers and has been used regularly to train the voices of undergraduate speech and language therapists in Sweden. However, although there was considerable anecdotal evidence, there was no hard evidence to show Accent breathing was also effective for developing flexible breath control in singers. The research carried out in Ron Morris's doctoral thesis has now provided that much needed

evidence and has also validated the work of those of us already devoted to working on Accent Method with singers.

Linda Hutchison and Ron Morris are both distinguished and well known names in the worlds of singing teaching and voice therapy, each with a wealth of practical experience and expertise developed during their respective careers. This book is a coming together of that knowledge, experience and research as applied to the area of breathing. The authors show us in an engaging way, how an understanding of the anatomy and physiology of breathing can help us find our way through the plethora of ideas and exercises out there in the field so we can 'home in' on those that work the best. They provide numerous little gems of insight along with the easy to follow practical exercises that are presented and illustrated in the text. Throughout the book there is a clear, theoretical underpinning to show why these exercises work.

If in Doubt, Breath Out! will prove invaluable for those already working as singing teachers, those who are developing their skills to become singing teachers and to singers who want a better understanding of how their breathing works. It will also be immensely helpful to speech and language therapists working in the area of voice disorder, particularly when they come across performers in trouble, and to speech therapy students new to the area of voice and the needs of performers. It is hoped that *If in Doubt, Breath Out!* will demystify breathing for speakers and singers for generations to come.

Sara Harris, FRCSLT
Specialist Speech and Language Therapist (Voice), Lewisham Voice Clinic, Lewisham Hospital, London and Past-President, The British Voice Association

Introduction and history of the Accent Method

The Accent Method in its original form comes from the world of therapeutic voice. There has been a great deal of research done showing how effective it is for the speaking voice. Towards the end of the 20th century, Accent Method began to be embraced, absorbed and adapted into a valuable tool for the singer and the singing studio. There was, however, no research focussing specifically on the singing voice. The first scientific data came in Ron Morris' doctoral thesis which looked at the Method's effects on the singing voice. This confirmed what we were finding in practice and instinctively felt to be true: Accent Method with the necessary adjustments for singing is as effective for the singing voice as it has proved for the speaking voice over these many decades.

Accent Method started life as *Svend Smith's Method of Voice Training* (Thyme-Frøkjær and Frøkjær-Jensen, 2001, p. 6) in the 1930s. At that time Svend Smith, a voice physiologist and clinician, was director of the Experimental Phonetics Laboratory, part of the Institute of Voice Disorders at Hellerup, Denmark. He was in the position of being able to look at things scientifically as well as from the practical point of view. This underpins the strength of the Accent Method: sound in science, effective in practice.

Professor Smith felt there was a need for a practical voice training programme which could be used safely and effectively, particularly on damaged and fragile voices. The various methods of voice training around at the time were aimed more at relatively healthy voices. As

a result, they were not very successful in helping to restore an injured voice, or a pathologically disordered voice. It should be noted that Accent Method can also be used as a therapeutic tool for working with people who stutter or stammer.

Svend Smith researched extensively the voice training systems of the nineteenth and early twentieth centuries, as well as the physics of how the vocal folds work. Experiments he undertook showed the aerodynamic and myoelastic behaviour of the folds, which is still the basis for the current theory on how the vocal folds vibrate to make sound.

By 1937, he had put together his findings and drawn up a plan of action for treatment. However, there was to be an interesting add-on a year later which, perhaps, was a sign all those years ago that this was eventually going to be a good thing for the singing world! Smith attended what has been described as a 'jam' session in Copenhagen (Thyme-Frøkjær and Frøkjær-Jensen, 2001, p. 6). The performer at this particular gig was the American-born (later French citizen) dancer, singer and actress, Josephine Baker. There is no record as to what Svend thought of *her*, but he obviously was fascinated by the bongo playing of Bogano, Miss Baker's drummer. The two men got together later and from that meeting, a set of drum exercises was added to the voice training system.

From then on, all the theoretical work could be put into practice. This he did with his own patients. However, he continued to test his results through the years in order to show scientifically that the exercises were indeed achieving what was intended.

In 1967, a speech and language therapist, Kirsten Thyme-Frøkjær began to collaborate with Smith in his research. This was to lead to further development of the *Svend Smith's Method of Voice Training*. And it was at this point that it was decided to change the name. The new name would highlight the important feature of the stresses, or accents, in the rhythmic exercises. And so, from then on it became known as The Accent Method.

Svend Smith became Professor of Phonetics at Hamburg University in 1969. He continued to organise courses in The Accent Method throughout Europe, along with several professional colleagues who had learned directly from him. *Accentmetoden*, the first book to give the theory, the exercises and how these transferred into day-to-day speaking was co-authored in 1978 with Kirsten Thyme-Frøkjær.

Professor Smith died in 1985. Happily, the work he pioneered continues thanks to the many practitioners, notably Kirsten Thyme-Frøkjær and Børge Frøkjær-Jensen, who continue to research, write about and promote Accent Method.

As with all systems and methods, the work gets moulded and subtly altered in the hands of different practitioners. However, the principles remain; We cannot stress enough how vital it is to understand these principles and the philosophy behind the method

Ron Morris, Ph.D.
Linda Hutchison

if in doubt, breathe out!

2

Breathing for singing

There is a continuum in breathing

- breathing for life, tidal breathing (passive exhalation)
- breathing for everyday speech (active exhalation)
- breathing for heightened speech, such as acting, shouting, expletives (active exhalation) and
- breathing for singing (active exhalation).

As we move along the continuum, we need to manage our exhalation more precisely.

Singing is a complex process, requiring lots of interactions amongst the parts that make up the vocal instrument. There is an intimate relationship between the actions of the larynx and the respiratory system. Singing requires not only precise management, but also a component of strength, endurance and flexibility.

While the core concepts regarding breathing for singing appear simple and straightforward, rich folklore has surrounded them, some of which does not match our current scientific understanding.

Information about breathing for singing, some of the science, and some of the methods is detailed below. Of course, if you are already familiar with the core concepts outlined in the box below, you may wish to move on to the next chapter.

Core concepts in breathing for singing

- Singers need to have their breathing under voluntary control.
- Trained singers breathe for speaking in the same way as untrained singers (Hixon and Watson, 1985).
- When singing, trained singers manage their breath differently to untrained singers (Hixon and Watson, 1985).
- Trained singers use greater muscular activity when managing exhalation during singing (Hixon and Watson, 1985).
- Abdominal muscles should be used appropriately to manage exhalation during singing. This muscular activity should remain flexible and dynamic.
- This muscular activity is known as 'support'.
- Support for singing is ***not*** tension.
- Singers should be able to use supported air flow as required.
- Support should be flexible and dynamic, continuing throughout the phrase.
- Breath management ideally becomes unconscious, driven by the music and text.
- Good postural alignment should be maintained throughout.
- The natural functions and actions of the muscles of inhalation and exhalation should be used.
- Inhalation should be natural and a reflexive action from breathing out.
- 'Overbreathing' ("take as big as a breath as you can") leads to tension. This tension makes it difficult to manage consistent and even airflow.

- The respiratory muscles need strength, flexibility, co-ordination and endurance.
- There are three main schools of breathing for singing related to the position of the abdominal wall:
  - 'Belly in'
  - 'Belly out'
  - Belly neither one nor the other.
- Current research suggests that the 'belly in' school has the most scientific basis.
- Pedagogical writers, such as Vennard, McKinney, White and Chapman, all espouse a form of 'belly in' breath management.
- Accent Method breathing belongs to this 'belly in' school.
- 'When in doubt, breathe out'.

Research into breathing for singing has been somewhat limited compared with the explosion of research into laryngeal mechanics, laryngeal function, acoustics and resonance. Essentially, we can divide the research into two broad types:

- Kinematic investigation
- Electromyography (EMG).

Kinematic studies measure the changes in the dimensions of the chest wall. In kinematic measurement, the chest wall is divided into two parts: the ribcage and the diaphragm/abdomen. Kinematic data can provide information on volume changes, airflow and muscle group activation.

Electromyographic studies aim to identify the presence of electrical activity in a muscle.This activity is a sign that active muscular contraction has taken place. EMGs are particularly useful for identifying which

muscles are active at any one time, although EMG responses do not always give accurate information on the *force* of the muscular contraction.

Kinematic studies have given us a significant amount of information about breathing for singing. They are non-invasive; measurements involve the use of belts around the subject's chest and abdomen, or potentiometers positioned to record movement. These measures allow the subject to sing or perform other vocal tasks with little interference.

Early kinematic studies, such as those performed by Watson and Hixon (1987), found that untrained male subjects used respiratory patterns for singing that were very similar to those used for the normal or loud speaking voice. This is consistent with the continuum of breath management; singing (at least in untrained subjects) follows on from the breathing used in loud speaking or shouting. Watson and Hixon were also interested in determining whether there were differences between the trained and the untrained when singing. Initially, only six baritones were studied, but other voice types were used in later research. Watson and Hixon used professional singers who were career soloists.

Overall, Watson and Hixon found that there were very few differences in speaking tasks between the trained and the untrained singers. However, there were significant differences between the trained and untrained singers in singing tasks.

The trained singers showed continuous adjustments to lung volume (i.e., ribcage and abdominal volumes). The changes in lung volumes were also extensive, beginning at quite high volumes and continuing through a large proportion of the vital capacity. Vital capacity refers to how much air is available for use by the lungs. Trained singers used much greater abdominal muscular effort in comparison to untrained singers when singing (Watson and Hixon, 1987, p. 361).

'Overall patterns differed a great deal across subjects, revealing a variety of individual styles of chest wall displacement for singing.' (Watson and Hixon, 1987, p. 361). Interestingly, untrained singers all used very similar patterns of respiratory activity while singing, similar to normal

or loud speaking. It appears that instruction or training has a significant effect on the respiratory behaviour of trained singers.

The singer's goal during singing is to ensure that the airflows and pressures generated are efficient for the task at hand. After breathing in, which tends to be deeper for singing than for normal speech, lung volumes are high so the air, which is now under some pressure, is very keen to leave the lungs in a rush. Under these conditions, there is evidence that the inhalatory muscles continue to be active for a significant portion of the exhalation period. They act as releasing brakes, balancing pressure and flow. When the lung volumes fall below a certain point, the exhalatory muscles are solely responsible for continuing to breathe out. These changes appear kinematically as differences in ribcage versus diaphragm/abdomen volumes. Despite individual differences, primarily in timing, research suggests that every trained singer shows gradually smaller and smaller diaphragm/abdominal volumes throughout the sung phrase. There is also some evidence of abdominal activity early in the breathing out cycle.

It is important to remember that Watson and Hixon's statements relate to the activity of the chest wall when the lungs are filled to a high volume. The action of the diaphragm results in the lungs being filled with air, but then to balance the pressures and volumes for a steady stream of air, the ribcage inhalatory muscles are used predominantly, though not exclusively.

Both the inhalatory muscles of the ribcage and the exhalatory muscles of the abdomen are active when the lung volumes are high. This appears to be a contradiction: the exhalatory muscles are actively trying to push air from the body while the inhalatory muscles of the ribcage are actively trying to retain it. Watson and Hixon note that in their trained singers, there was a generalised reduction in abdominal volume, combined with ribcage volume increase. They state that the singer receives an important efficiency gain by activation of the abdomen in these high lung volume circumstances. We know from studies of respiratory physiology that the intercostal muscles are most efficient at high lung volumes. It appears

that the abdominal muscles are increasing the pressure on purpose – probably to even up the volumes in the ribcage – to help gain such an advantage.

This seems to suggest that the abdominal muscles are active, performing their exhalatory function regardless of lung volume or inhalatory muscle activity in the ribcage. This finding is important in terms of describing breathing for singing as opposed to breathing for speaking. Therefore, even when there is no obvious need for exhalatory muscle activity, the muscles of the abdominal girdle are recruited for the 'work' of singing.

At mid-lung volume level, most of the exhalatory efforts are abdominal. At low levels, the effort is in both the ribcage and abdomen.

The expiratory efforts of the abdomen serve to displace the diaphragm upwards, which increases the length of the diaphragm's fibres and the radius of its curvature. This mechanically tunes the diaphragm to enable it to function quickly and powerfully as a force generator for inspiration (Watson and Hixon, 1987, p. 364). In addition to the mechanical action on the diaphragm, the abdomen exerts a gentle upward lifting force to the ribcage which naturally elevates it. This action increases its volume and places its expiratory muscles at a greater and more optimal length for quick and forceful pressure changes (Watson and Hixon, 1987, p. 365). Watson and Hixon also point out that the abdominal activity with this group of singers was substantially greater in singing than in speaking. p This confirms the importance of the abdominal wall in breathing for singing.

For Watson and Hixon, the most prevalent style of inspiration seemed to involve both ribcage and abdominal volume increases. In some subjects there was a simultaneous, symmetrical change in both ribcage and abdominal wall volumes. In others there was an abdominal volume increase followed by a ribcage volume increase.

The singer's goal during inhalation is to breathe in quickly and efficiently. Watson and Hixon state that the diaphragm is primarily responsible for the in-breath while the abdominal muscles relax. The diaphragm can

be identified as the prime mover in inhalation due to the large outward movements of the abdomen. This is supported by the work of Bouhuys and colleagues (1966) and Proctor (1968, reported in Proctor, 1980) which demonstrated high transdiaphragmatic pressure in singers during inhalation. This is consistent with vigorous diaphragm contraction.

The diaphragm is the most powerful of all the inhalatory muscles and, through its action, displaces both the ribcage and the abdomen. The use of the diaphragm for the in-breath then leaves the ribcage free of inspiratory work. The ribcage can then begin to manage pressure and flow during expiration. The diaphragm can be continuously tuned mechanically by the abdomen, as mentioned above, regardless of lung volume, to work as quickly and as efficiently as possible for the next in-breath (Watson and Hixon, 1987, p. 366).

Watson and Hixon made some interesting observations on the transition between breathing in and breathing out. The main transition involved activation of the abdominal muscles to help pressurise the chest with air.

The transition between breathing out and breathing in is also an important part of the respiratory cycle for singing.

When viewing kinematic data the exhalation to inhalation transition appears to show a reduction in ribcage volume but a relatively large increase in abdominal volume. This is most likely due to the action of the diaphragm, which opens the lower ribs and displaces the abdominal contents down and slightly forward. At the same time the sternum will fall slightly as the diaphragm opens the ribcage from below. In many singers some increase in ribcage volume may then follow.

It is possible to summarise the results of these kinematic studies more simply. There is co-ordinated and organised activity in the diaphragm, ribcage wall and abdominal musculature throughout the breathing cycle in trained singers. It appears as though the diaphragm is primarily responsible for inhalation with the abdominal muscles active during expiration in a role that assists the pressurisation of the chest with air, so that the ribcage can more easily control pressure and flow.

In their 1985 experiments, Watson and Hixon used only male singers. A similar study using female singers was carried out by Watson, Hixon, Stathopoulos and Sullivan in 1990. There were no significant differences between the male and female singers.

Proctor, in his 1980 book *Breathing, speech and song*, reports on some early experiments which evaluated ribcage and abdominal activity during singing, undertaken on himself as subject. Proctor was not only a Professor of Otolaryngology and a respiratory researcher, but also a highly trained professional singer. His conclusions regarding breathing for singing are remarkably similar to those drawn by Watson and Hixon. He believes that the diaphragm is mainly involved in inhalation, the intercostal muscles control the pressure and airflow for much of the exhalation, and the abdominal wall moves inward to assist in the control of the outward flow of air.

Thorpe *et al*. (2001) studied the difference between fully supported and less well supported singing in a group of five professional singers. They recruited singers who had been trained by a single teacher and so, presumably, followed a consistent method of breathing and support. Although this study focuses primarily on the differences between supported and less well supported singing, the kinematic data obtained is of interest.

Chapman (one of the authors) was the singing teacher who trained all the subjects used in this study. She teaches a method which '… emphasises the use of abdominal support synchronised with the onset of phonation' (Thorpe *et al*., 2001, p. 87). Chapman believes that the main muscles used for this abdominal support are the transverse abdominis and the internal and external obliques. As part of the process of learning her method of breathing and support she uses primal sounds such as cries, sobs, laughs and yells. Such sounds appear to evoke actions in the muscles mentioned naturally.

> 'Chapman teaches that all singing should be supported [with these muscles], but it is noticeable that during 'projected singing there is

> a particular increase in muscle contraction in the lateral abdominal region. This lateral abdominal support appears to provide stability to the actions of the ribcage and diaphragm during phonation' (Thorpe *et al*., 2001, p. 87).

Chapman also insists that this support is not active during inhalation and she asks the singer to release abdominal tension at the start of inspiration so that the diaphragm can descend quickly. She terms this onomatopoeically 'SPLAT'. Dinah Harris, one of her colleagues, has since turned SPLAT into the following mnemonic: 'Singers Please Loosen Abdominal Tension' (Chapman, 2006, p. 41).

Thorpe *et al*. indicate that although there are some minor differences in the recordings due to the subjects singing different repertoire, there are notable similarities between subjects' respiratory patterns. Inhalation commences with a rapid manoeuvre in which there is expansion in the abdomen occurring concurrently with a decrease in ribcage volume. This manoeuvre results in a negligible volume change and is very short – in the order of only 100 milliseconds (Thorpe *et al*., 2001, p. 90). After this, inhalation continues with expansion in both the ribcage and the abdomen. This is followed by a further realignment consisting of a simultaneous elevation of the ribcage and a drawing in of the abdomen. Vocalisation usually commences part way through this alignment. Exhalation continues with a simultaneous decrease in both ribcage and abdominal dimensions (Thorpe *et al*., 2001, pp. 90–92).

Thorpe *et al*. note that the ribcage volume changes in the ribcage and abdominal wall correspond well with the pedagogical instruction given to the singers. They also note that the paradoxical ribcage–abdomen movement described at the start of inspiration is consistent with the data generated by Watson and Hixon (1985) and described again in Hixon's 1987 book. Although Watson and Hixon reported a wider variety of respiratory patterns, the most experienced singers in their study were reported to have ribcage and abdominal volume patterns that were very similar to those shown by the subjects in the Thorpe *et al* study.

Thorpe *et al*. also note that in conditions of increased support, there is an increase in the lateral dimensions of the ribcage coupled with a decrease in abdominal volume. 'The dimension changes are suggestive of an increased abdominal pressure with the greater 'support' evoked for the projected condition' (2001, p. 102). They also postulate that 'simultaneous activation of the ribcage and abdominal muscles may result in more rapid and possibly better controlled changes in subglottal pressure' (Thorpe *et al*., 2001, p. 102).

In conclusion, Thorpe *et al*. believe that 'the use of support exhibits itself … as a movement away from the relaxation state, with abdominal muscle activation and the raising of the ribcage, coupled with a rapid release of expiratory muscle activity at the start of inspiration' (2001, p. 103).

The consistency of the data in the Thorpe *et al*. study (2001) suggests that the training offered to singers and the concepts taught about breathing can significantly affect the respiratory choices made by them in performance. The pedagogy used in this study follows the natural function of respiratory physiology. Inhalation is essentially under the control of the diaphragm. During exhalation there is active participation of the abdominal muscles to increase abdominal pressure and tune the diaphragm for the next inhalation. The pressures required for phonation appear to be under the control of the ribcage.

A common thread running through the research into breathing for singing is that although some common or generalised conclusions can be drawn from the scientific data, there is a degree of variability in the singer's methods. Control of the subglottic pressure is the prime focus of the breathing apparatus during phonation for singing. Despite the fact that some singers appear to have an idiosyncratic method of achieving it, they all do so to a rather high degree of proficiency.

Hixon continued his researches into the respiratory function for singing until his death in 2009. His 2006 publication, *Respiratory function in singing: A primer for singers and singing teachers*, summarises his work

and confirms the statements made in his earlier research. A number of important concepts are stressed in his book, particularly the role of the ribcage and abdominal wall in singing:

> 'The ribcage wall and abdominal wall are active during most continuous singing phrases. … Both the ribcage wall and abdominal wall squeeze during continuous singing phrases but the squeeze of the abdominal wall is more forceful than that of the ribcage wall'. (Hixon, 2006, p. 97) [We are quoting directly here; 'squeeze' would not be our choice of word!].

> 'Thus, the preferred muscular strategy for continuous singing increases the efficiency of chest wall function. By forcefully and continuously activating the abdominal wall, the background shape of the chest wall is mechanically tuned to favour the inspiratory function of the diaphragm and expiratory function of the ribcage wall'. (Hixon, 2006, p. 99).

Hixon has made it clear that the abdominal wall is vitally important in singing. Based on the work of Thorpe *et al*. (2001), it would also appear that the abdominal wall is vital to the notion of 'support' in classical singing.

EMG studies have been used to evaluate the respiratory system for singers. Leanderson and Sundberg reported on needle EMG findings from the diaphragm in their summary article on breathing for singing, published in *Journal of Voice* in 1988. They found that the four singers studied showed two different patterns of diaphragm activity: the diaphragm was either continuously contracting throughout the phrase, or it was entirely inactive throughout the phrase, activating for inhalation only (Leanderson and Sundberg, 1988, p. 4).

Watson *et al*. (1989) used surface EMG to evaluate the activity of the abdominal muscles during singing. They used four male singers, all professionals, who had undergone at least 10 years of singing training. EMG was recorded from four sites on the abdomen: upper and lower lateral, and upper and lower middle. Kinematic data were recorded at

the same time (Watson *et al*., 1989, p. 25). In addition to a number of respiratory manoeuvres, singers were recorded speaking and reading, as well as singing two stylistically contrasting Italian songs: *Amarilli mia Bella*, by Caccini, and *Che Fiero Costume,* by Legrenzi. These two songs were also used by Watson and Hixon in their 1985 kinematic study.

Watson *et al*. found that there was almost no observable activity in the mid-line sites during tidal breathing. Some activity was noted at the lateral sites, with more activity recorded at the lower than the upper site (1989, p. 26). During speaking tasks, there was clearly observable activity at the lateral sites, combined with slight or no observable activity in the middle sites. For three of the four subjects, there was more activity in the lower lateral than upper lateral sites (Watson *et al*., 1989, p. 27). 'This pattern is suggestive of activation of the external oblique abdominis, internal oblique abdominis, transverse abdominis, or some combination of these muscles, with little or no activation of the rectus abdominis' (Watson *et al*., 1989, p. 28). Watson *et al*. (1989) also indicated that this pattern of results was not significantly different from the results obtained from a group. of subjects without professional training or experience. The EMG data are in agreement with the kinematic data in suggesting that there are no significant differences between trained singers and untrained speakers on speaking tasks.

During singing there was a substantial increase in the EMG activity of the abdomen. Once again there was more activity recorded at the lower lateral site than at the upper lateral site, and there was substantially more activity in the lateral sites than in the mid-line sites (Watson *et al*., 1989, p. 28). Subjects demonstrated high amplitude EMG activity in both middle and lateral regions during the production of a loud, sustained, high-pitched note, such as that which occurred at the end of *Che Fiero Costume,* by Legrenzi (Watson *et al*., 1989, p. 28). Once again, kinematic data were in agreement with the EMG traces, and were very similar to those obtained by Watson and Hixon in their 1895 study. During exhalation, the results can be summarised as follows:

> 'The lowest overall levels of activation were associated with relaxing and the highest with singing. For breathing, speaking and singing, abdominal activity was greater in the lateral region than the middle region. Differential activation within the lateral region was observed with activity in the lower portion exceeding that of the upper portion'. (Watson *et al*., 1989, p. 29)

It is important to note that EMG activity in the abdominal wall was quite specific, which renders dubious the findings of other studies that have relied on single electrode site recordings. Absence of EMG activity from a single site on the abdomen cannot be equated with absence of activity of the abdominal wall as a whole (Watson *et al*., 1989, p. 30).

During inhalation, there was a decrease in the EMG activity of the abdominal wall associated with the in-breath. 'Such decrements began either coincident with, or slightly prior to the onset of inspiration and were present in both lateral sites, or in the lower lateral site only' (Watson *et al*., 1989, p. 30). When the kinematic data were also analysed, it became obvious that 'for both speaking and singing, decrements often were associated with outward displacement of the abdomen.' (Watson *et al*., 1989, p. 30). The decreases showed activity that was often as minimal as that recorded in the relaxation manoeuvres. It is thought that the decreases in abdominal activity associated with the in-breath reduce the resistance of the abdomen to the descending diaphragm. This allows diaphragmatic contraction to be seen as outward abdominal wall displacement. This lack of resistance to the descending diaphragm would allow a more efficient and effective in-breath (Watson *et al*., 1989, p. 30). These decreases were brief in duration and there was a natural rapid return of abdominal activity before the inhalation was completed.

In conclusion, abdominal activity is clearly present during singing, with the lateral sites more active than the medial ones. Deactivation of the abdominal wall is seen on inhalation, and this appears to assist the mechanical action of the diaphragm. However, the abdominal wall reactivates quickly to resume its role of posturing the entire chest wall for singing (Watson *et al*., 1989, p. 31).

Sundberg *et al.* (1991) also carried out EMG studies of the respiratory muscles used in singing. They remind us that singers have finely tuned control over the subglottal pressures produced while singing. Subglottal pressure controls vocal loudness as well as exerting an influence on the pitch (p. 283). '… singers have to tailor subglottal pressure individually for each note, taking into account both its loudness and pitch. As subglottal pressure affects the fundamental frequency, the intended target pressures must be matched quite accurately for the singer to stay on pitch' (Sundberg *et al*., 1991, p. 283–284).

Sundberg *et al*. (1991) took EMG recordings from the internal and external intercostals, the diaphragm, and from the abdominal oblique muscle. The singers involved were asked to perform a number of vocal tasks but sang neither an aria nor song.

The results of this study were quite similar to those obtained by Watson *et al*. (1989), and confirm that the abdominal wall is actively engaged in configuring the chest wall during singing. Relaxation, or at least inhibition of its activity, also occurs during inhalation. The diaphragm is active during inhalation and there is activity in the intercostal muscles throughout much of the breath cycle.

Given these findings concerning breathing for singing gleaned from the scientific literature it is possible to draw some conclusions about an appropriate method of breathing for singing. When exhalation is active and the intra-abdominal pressure assists in the control of the outward flow of air, some interaction of the inhalatory and exhalatory muscles is required. It appears that this interaction of the muscles forms the basis of breath support. As the muscles of respiration are mostly striated muscles and thus, under voluntary control, systematic training should enable the singer to develop fine breath control. We believe that an effective breath support system for singing therefore consists of:

- Voluntary control of respiratory muscles, allowing the singer to increase or decrease support and breath flow at will
- Efficient, flexible use of the respiratory physiology

- Freedom from tension in the upper chest and neck
- Maintenance of good postural alignment
- A system of breath management that follows the natural functions of the inhalatory and exhalatory muscles
- Training of the respiratory muscles in terms of strength, co-ordination and endurance.

Breathing and breath management in the vocal pedagogical literature

There is perhaps no part of vocal pedagogy that has been so hotly contested over the years as breathing. Many different schools of breathing have developed, each claiming to be the one true and correct method. These schools of breathing can be broadly divided into three. Those that expound a 'belly in' method of supporting the voice, those that are completely opposite in approach and propose a 'belly out' method of support and, finally, those pedagogues who choose neither. There are differences in exact technique amongst the different adherents to each school, but the direction of movement of the abdomen (the prime mover in expiration) remains the same for all.

Almost all pedagogues believe that breathing, breath support, or breath management is part of a solid vocal technique. The degree to which breathing is felt to be important varies greatly from one pedagogue to another.

The growth of scientific knowledge about the respiratory system has tended to marginalise the 'belly out' school in more recent times, particularly as kinematic studies, such as those reported by Hixon in his 1987 book, make it clear that inward movement of the abdomen was recorded in all singers during the expiration phase, regardless of how they conceptualised their breathing for singing (p. 362). While very little has been written in the last 20 to 30 years to suggest the use of the

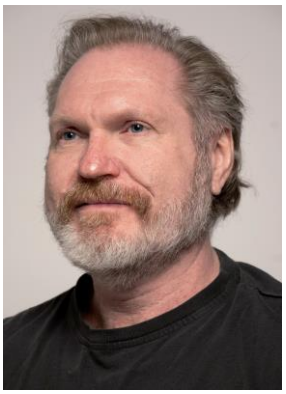
'belly out' strategy for singing, it is still taught by some teachers despite all the scientific developments in respiration that are now available in the literature. Interestingly, other than for voice, the 'belly out' method of breath support is still a common method of breathing among wind instrumentalists, and references to its use are often found in wind and brass pedagogies (Reynolds, 2005).

McKinney points out that all methods of breathing, be they correct or incorrect, usually have some element of truth in them. Students who are taught belly breathing are instructed to 'take a deep breath and then push out against your belt while you sing. This has the effect of locking the diaphragm in the lowest position to which it has descended and not allowing it to make its return as air is expended' (McKinney, 1994, p. 60). It is true that the diaphragm must be allowed to descend as fully as is possible, the element of truth in the belly breathing school, but the diaphragm must also be allowed to return to its un-contracted state during the breath cycle. The abdominal muscles must also remain free to move inward in order to maintain the balance of air pressure required for singing. The 'belly out' theory has been essentially laid to waste by the research findings from respiratory kinematics. The 'belly in' and 'neither one nor the other' schools of breathing can be assessed by examining some of the other writings on vocal pedagogy.

Many of today's pedagogues base their beliefs about breathing and breath management for singing on the writings or teachings from the so called 'Golden Age' of Bel Canto singing. It is important to remember that pedagogues in historical times had no access to scientific tools for investigating how their breathing systems worked and relied solely on their own sensations as singers, and on the information available to them from the anatomy laboratory. We know that the singer's own perception of how the breath management or breath support system works often bears little resemblance to what actually happens physiologically (Watson and Hixon, 1987, p. 370). Anatomy laboratories are excellent places to observe structures and to trace the origins and insertions of muscles but, due to the complex interactions that occur between

About the Authors

Ron Morris, PhD



Ron Morris graduated from the University of Queensland in 1985 with a Bachelor of Speech Therapy degree. Honours in Audiology were awarded in 1986. He obtained a Masters of Music Studies degree in vocal performance in 2000 and was awarded a Doctor of Philosophy degree in Music in 2013. Ron has combined a long career (over 30 years) in Speech Therapy and Audiology with work as a professional singer.

Dr Morris is Practice Director and Senior Speech Pathologist and Audiologist at Brisbane Speech and Hearing Clinic and has special interest in working with deaf and hearing impaired clients, and with head and neck surgery and voice patients. A recognized expert in the Accent Method of breathing which is used in both voice therapy and singing, Ron is also Lecturer in Vocal Pedagogy and Vocal Health at the Queensland Conservatorium, Griffith University, Brisbane, and at the Guildhall School of Music and Drama in London.

Ron has contributed to a number of published works, including *Singing and Teaching Singing: A Holistic Approach to Classical Voice* by Janice Chapman (Plural, 3ed, 2017) and *Teaching Singing in the 21st Century* by Scott Harrison and Jessica O'Bryan (Springer, 2014).

Linda Hutchison

Linda Hutchison is a singing teacher, lecturer and vocal rehabilitation coach involved in the multi-disciplinary world of voice.

In her teaching practice, she works with a wide range of professionals from the classical, music theatre and jazz worlds. She is a member of the Vocal Staff at her Alma Mater, the Guildhall School of Music and Drama in London where she works with both singers and actors. She is an international guest tutor for the Irish College of Music Theatre, Dublin.

Her work in voice clinics began in 1997, which is when she first started working with the Accent Method. For five years she was a member of the Sidcup Voice Clinic at Queen Mary's Hospital in the UK and now is the Vocal Rehabilitation Coach at the Lewisham Voice Clinic, University Hospital Lewisham, London.

Alongside workshops and masterclasses, Linda gives many presentations dealing with the anatomy, physiology and care of the voice. She has created and directed professional development courses which balance the science of the voice with artistic freedom.

As a performer, her operatic career started at the age of fourteen when she sang the role of Belinda in an open air production of Purcell's Dido and Aeneas. She began her professional career as a principal soprano of the D'Oyly Carte Opera Company, later freelancing in solo operatic, concert and oratorio work. A biography of her, *Enchantment, Surely*, was published in 2010 in Tony Joseph's D'Oyly Carte Personalities series (Bunthorne Books, 2010).

Linda has been President of the British Voice Association, having been for many years a member of its Education Working Party and has served on the Council of the UK's Association of Teachers of Singing.