Woodwind Breathing Techniques:

An Annotated Bibliography

by

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ABSTRACT

Until the second half of the 20th century, publications on breathing techniques for woodwinds have been scarce and often failed to adequately address this aspect of performance and pedagogy. It is through various sensory experiences and because of recent technological advances that academics recognize a gap in the existing literature and have since included studies using various methods, as well as modern technical devices and experiments into the woodwind literature and teaching. These studies have proven to be of great importance to confirm ideas and hypotheses on the matter.

The aim of this project is to collect woodwind journal publications into a meta-analysis, focusing specifically on the breathing techniques for woodwind instruments and provide a comprehensive annotated bibliography on the topic and its application. The project is limited to journal articles on breathing techniques applied for woodwinds only, and will not review literature discussing breathing from other perspectives or in a broader sense.

Major findings show that misconceptions and contradictions on the subject still exist. At the same time, they also highlight unique approaches used to help the learner overcome general and specific challenges while mastering the art of breathing.

The project highlights areas where future research on breathing would be encouraged and should be complemented by measured data. Such studies might include a woodwind specific examination of the relationship between the tongue and the soft palate, or analysis of how tension in the torso muscles influences the movement of the

diaphragm, or how rhythmical breathing affects breath control and capacity, and finally a discussion on how larynx influences the air stream.

DEDICATION

I would like to dedicate this paper to those who, similar to me in some respect, have struggled with breathing problems in the past or present and who may find the information helpful to their professional progress and advancement either as players or teachers.

Breathing is a complex subject to teach and one cannot give a definite answer to every question and concern one might encounter. I hope that this research provides the reader with practical knowledge and a collection of methods that will enhance their understanding of teaching breathing. I would like to add that changing one's habit takes time and continuous effort. The desired change might come more easily to those who have a better kinesthetic awareness or have an open mind on the subject-matter since the complete process of breathing is not perceived by the naked eye. Making such changes is not coordinated as quickly as changing a bad hand position (where we can visually observe the shape and form of our limbs). Breathing is a complex biological and physiological action whether carried out consciously or unconsciously and is affected by one's mindset, neurological readiness, poise, habits, intention, and much more. As the reader tries to find a solution for existing concerns or answers to lingering questions, they need to consider the "whole" as one overarching unit rather than as individual compartmentalized entity if a permanent fix for the better use of the technique is to be achieved.

ACKNOWLEDGMENTS

I would like to acknowledge the help of two of my current professors as co-chairs of my committee, Dr. Gardner and Dr. Spring, and their encouragement throughout my doctorate studies at Arizona State University. Their expertise is a driving factor for me to come to Arizona State University. I would also like to express my appreciation for the other two committee members, Dr. Humphreys and Dr. Suzuki, who have helped me tremendously with their specific and invaluable insights and expertise in this past two years. I express my great gratitude to those who have helped me in the past to understand and incorporate correct breathing principles and natural use of the body in any way. These people were milestones along the way and have helped me arrive at a greater understanding of my body's natural use. Last but not least, I am grateful for the continuous support, encouragement, fun, and patience I have received during my studies from my small but strong family, Liz and Eli.

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INTRODUCTION

One of the most important fundamentals every professional wind musician must master to a fine degree is breath control. However, such a task can be daunting when a person is unaware of the breathing process and of the existing auxiliary tools to achieve proper breath control. As a result, a student might want to turn to the woodwind literature published by the experts in the field. However, upon examination of said literature, it becomes evident that woodwind journals only have a few publications on breath control. Prior to 1960s, they are scarce and often fail to address this aspect of performance and pedagogy in depth. In fact, flutist Catherine Folkers points out in her article "Breath Control on the Baroque Flute" that 18th and 19th-century flute writers focus more on the lips rather than the shoulders, chest, and throat in relation to breathing.[1] Breath control for woodwinds is described in vague terms, such as "blow moderately" or "the flute requires much gentleness in respect of the air it is given and a great evenness..."[2]

Such language is being omitted to a large extent as more breathing-related articles have surfaced by woodwind professionals in the past decades, discussing the "physical, emotional, and mental capacity" in learning proper breathing techniques.[3] These publications have various approaches. First, they vary in their anatomical and pedagogical content, since different types of mindsets, imagery, psychophysiology, body

[1] Catherine Folkers, "Breath Control on the Baroque Flute" *Traverso: Baroque Flute Newsletter*, no. 1 (April 1989): 1-2.

[2] Folkers, 1.

[3] Helena Gaunt, "Breathing and the Oboe: A Musical, Educational and Clinical Study," In *The Reflective Conservatoire: Studies in Music Education*, edited by Odam, George, Bannan, Nicholas and Ife Barry, Guildhall research studies 4. Farnham: Ashgate, 2005, 36.

types and mental and emotional awareness contribute to how one uses and experiences their breathing apparatus. Though the basic functions of the body are the same—the airpath follows the same route in every human body—the combination of the aforementioned qualities (also revealed in music learning and performance) create an amalgam of complex action sets unique to each individual.

Another challenge many professionals face is in verbalizing the breathing process precisely. Musicians are first and foremost musicians and educators, not physicians. While there are cues, it is not always easy for a player to know what is happening inside the body, or for a teacher to pinpoint the root of the problem(s) in respiration. This whole process occurs internally, which contributes to the existence of so many diverse opinions. Professionals and academics rely on external observations, techniques, and auxiliary tools to understand and measure the detailed process of breathing and its proper utilization. But inaccurate observations can distort more fundamental concepts about breathing and can potentially prevent the learner from advancing to his or her full potential. With this in mind, it becomes invaluable to highlight the many well-designed studies that focus on addressing specific challenges of effective instrumental breathing and the relationship of its components. These studies are tools for helping musicians better understand and overcome specific challenges they may face in learning the technique.

The goal of this research project is two-fold. First, it conducts an annotated bibliography of all publications found solely in woodwind journals on the topic of instrumental breathing for woodwinds. The literature review covers all types of research, including studies based on empirical measurements and anatomy, as well as research-

based solely on sensory experiences, or the mixture of the two. As a result, the collection presented here allows a serious student of breath control to harness more fully the information available.

Second, following the annotated bibliography of each topic relevant to the breathing process, is a discussion and comparative analysis on findings regarding breath support and posture, inhalation and exhalation, and lips, tongue, throat, and embouchure.

Of the articles published in woodwind journals to date, ninety-three fit the scope of this paper. Review articles included those published in English, Spanish, German, French, Hungarian, and Chinese languages. Six publications in Chinese could not be translated to an understandable degree and they were not included in the paper. It is hoped that they can be used for future studies. It should be noted that the review of articles published in other journals on the topic of breathing is not conducted for this project. Therefore, this research project is limited to providing analysis and discussion for articles principally published in woodwind journals and discussing breathing techniques for the woodwind instrumentalists.

Finally, another important objective for this project is to create a glossary of technical terms, an explanation of auxiliary tools use in the review publications, and a summary of exercises present in the review articles. It is hoped that these can become valuable tools for future use by woodwind professionals, practitioners, and teachers.

CHAPTER 2

BREATHING ANATOMY

To better understand the annotated bibliography and contributions made by the literature, it is important to be familiar with the physiology and the anatomy of breathing. As a result, the focus of this chapter will be to familiarize the reader with the overall breathing process and body parts vital for its proper execution.

The official medical term for breathing is *pulmonary ventilation*.[4] In a physiological sense, it is usually described as the movement of air between the atmosphere and the alveoli of the lungs.[5]

[4] J. Gordon Betts, Peter DeSaix, Eddie Johnson, Jody E. Johnson, Oksana Korol, Dean H. Kruse, Brandon Poe, James A. Wise, Kelly A. Young, "Process of Breathing," In *Anatomy and Physiology*, OpenStax Rice University online book, last updated 10 May, 2019, accessed 3 June 2019, https://opentextbc.ca/anatomyandphysiology/chapter/22-3-the-process-of-breathing/.

[5] Ibid.

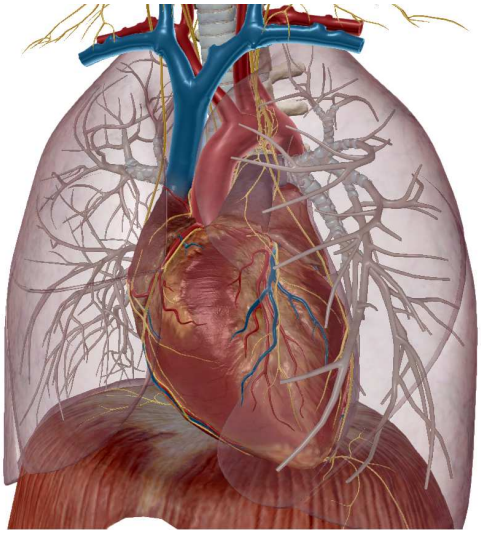

Figure 1. The lungs and the bronchi (Courtesy of Visible Body, License purchased by author)[6]

Breathing consists of two separate and interdependent actions which create a cycle: inspiration and expiration—the air drawn into the lungs and expelled from the lungs (facilitated by the difference in air pressure across space).[7] Breathing, in general, is an involuntary and life-sustaining action.[8] It is not a matter of will although it can be modified or partially controlled by voluntary actions until the life-sustaining alarm system of the body is triggered and takes over to fulfill its life-sustaining role.[9]

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[6] Visible Body, "Human Anatomy Atlas," Argosy Publishing (Version 2017.1), Computer Software, retrieved from https://play.google.com/store/apps/details?id=com.argosy.vbandroid&hl=en_US. License Rights purchased by author.

[7] Arendt Bouhuys, *The Physiology of Breathing: A Textbook for Medical Students,* (New York: Grune & Stratton, 1977): 205.

[8] Ibid.

[9] Craig Freudenrich, "How Your Lungs Work: Breathing and the Autonomic Nervous System," published 6 October 2000, accessed 4 June 2019, https://health.howstuffworks.com/human-body/systems/respiratory/lung.htm.

The process of breathing is a complex activity that involves the nervous system, the respiratory system, the brainstem, the muscular system, the circulatory system, and the skeletal system.[10] These systems work in coordination to carry out the necessary gas exchange that happens in the alveoli of the lungs.

Natural inhalation is triggered by the brain through the phrenic nerve which activates a mainly involuntary muscle—the diaphragm.[11]

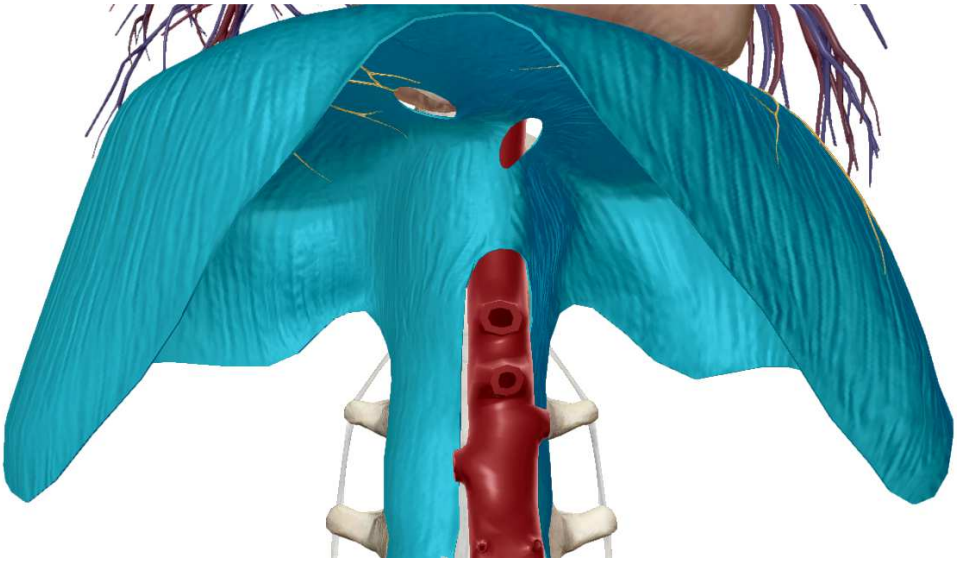

Figure 2. The diaphragm (Courtesy of Visible Body, License purchased by author)[12]

[10] Courtney Smith, "Anatomy and Physiology: The Relationships of the Respiratory System," posted 16 Nov 2012, accessed 2 June 2019, https://www.visiblebody.com/blog/anatomy-and-physiology-the-relationships-of-the-respiratory-system. See also Robert H Notter, "Lung surfactants: basic science and clinical applications," (New York: Marcel Dekker, 2000): 120.

[11] Bouhuys, *The Physiology of Breathing,* 271.

[12] Visible Body, "Human Anatomy Atlas," Argosy Publishing (Version 2017.1), Computer Software, retrieved from https://play.google.com/store/apps/details?id=com.argosy.vbandroid&hl=en_US. License Rights purchased by author.

Neil Cherniack, Professor of Medicine and Physiology at Case Western Reserve University, refers to the diaphragm, together with the intercostal muscles, as the primary muscles of inhalation.[13] Because the diaphragm is the primary inhalation muscle, it is important to better understand its function. This thin and very elastic sheet of muscle has few nerve endings[14] close to where it attaches to the ribs. These nerves do not allow for a complete voluntary control of it.[15] It is positioned about halfway in the upper body, or torso, with the intercostal muscles originating and running between the ribs, and accounts for about 75% of the work of inhalation. [16] It is dome-shaped, and while its movement cannot be observed from the outside, its effects on the thoracic and visceral cavity can be seen. The deeper the inhalation, the greater the descent of the diaphragm. The greater the descent of the diaphragm, the greater the expansion of the ribs. When the lungs reach their vital capacity, the diaphragm is simply less dome-shaped than before inhalation.[17] It separates the thoracic cavity, which contains the lungs and the heart, from the abdominal cavity.[18]

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[13] Neil S. Cherniack, David H. Elliott, Ewald R. Weibel, Donald Albert Heath, Robert A. Klocke, and Arthur A. Siebens" Human Respiratory System," Encyclopedia Britannica chapter on Control of Breathing, accessed 3 June 2019, https://www.britannica.com/science/human-respiratory-system/Control-of-breathing,

[14] Larry Guy, "The Air-Brain Connection," The Clarinet (March 2010): 29.

[15] Brian Frederiksen, *Arnold Jacobs: Song and Wind*, (Gurnee: WindSong Press, 1997): 174-175. See also Smith, "Anatomy and Physiology."

[16] Allyson J. Merrell, Gabrielle Kardon, "Development of the diaphragm – a skeletal muscle essential for mammalian respiration," *The FEBS Journal*, no. 280 (2013): 4027.

[17] Chernick, Encyclopedia Britannica. See also Merrell, "Development," 4028.

[18] Noam Buchman, "Breathing in L'Après midi." *Pan: The Journal of The British Flute Society*, no.3 (September 2013): 28.

The next group of primary muscles of inhalation is the intercostal muscles. They are grouped together based on their two types: internal intercostal and external intercostal muscles.

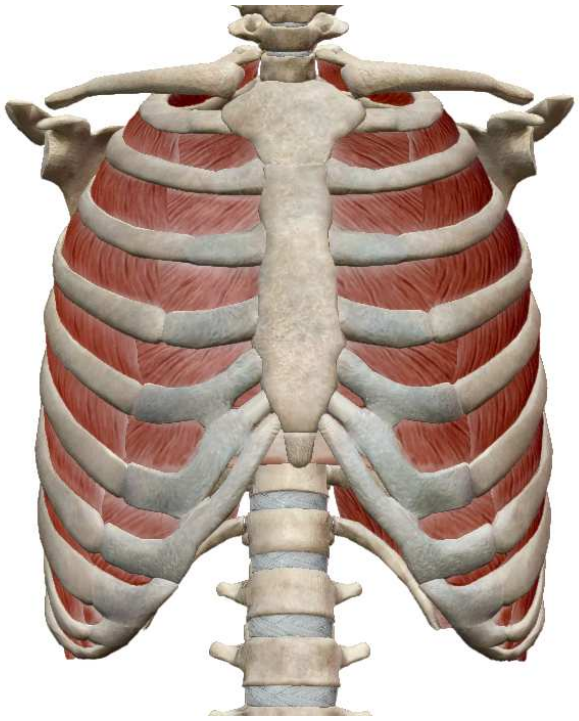

Figure 3. The intercostal muscles (Courtesy of Visible Body, License purchased by author)[19]

While internal intercostal muscles help with exhalation by enlarging the thoracic cavity, the external intercostal muscles help with inhalation by pulling the ribs back from their extended position.[20] When triggered, the diaphragm contracts and descends while the external intercostal muscles increase the thoracic volume.[21] This downward

[19] Visible Body, "Human Anatomy Atlas," Argosy Publishing (Version 2017.1), Computer Software, retrieved from https://play.google.com/store/apps/details?id=com.argosy.vbandroid&hl=en_US. License Rights purchased by author.

[20] Frederiksen, *Arnold Jacobs*, 175.

[21] Ransom Wilson, "*Breathing: The Central Issue of Flute Playing*." In *The flutist's handbook: A pedagogy anthology. A Publication in Celebration of the 25th Anniversary of The National Flute*

movement of the diaphragm and the outward movement of the ribs creates a negative air pressure relative to the atmospheric pressure.[22] To equalize this imbalance, air drawn into the lungs increases the internal pressure and fills the lungs with fresh air. The body absorbs oxygen molecules from this air which are then supplied to the brain and other parts of the body through the circulatory system.[23] At this point, the ribs and the diaphragm move back to a neutral position from their extended position, through an action which can be likened to a pendulum.[24] When at rest, gravity forces pull the pendulum down, as long as no external or internal force is exerted on it. But when a force pushes it one way or the other, it will respond to the force exerted by swinging in opposite directions until it naturally returns to its neutral resting position. The same action occurs to the ribs through the internal intercostal muscles, which contract along with the abdominal muscles, controlling the descent of the ribs and the volume decrease of the thoracic cavity.[25] It is important to note that the volume of the thoracic cavity changes constantly during respiration, while the abdominal cavity only changes in shape, and that the diaphragm is active only in inhalation but not in exhalation.[26]

The direction air travels during exhalation is the opposite of inhalation.[27] This air movement is explained by Boyle's law: the volume of a gas is inversely related to its

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Association, Inc., edited by National Flute Association (Santa Clarita, California: National Flute Association, 1998): 62.

[22] Frederiksen, *Arnold Jacobs,* 173. See also Smith, "Anatomy."

[23] Frank Powell, "How Breathing Works," *In Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006), 2.

[24] Buchman, "Breathing," 28, 31.

[25] Buchman, "Breathing," 29.

[26] Ibid.

[27] William Blahd, "How the lungs and respiratory systems work," WebMD Medical Reference, last review 14 July 2017, accessed 7 June 2019, https://www.webmd.com/lung/how-we-breathe.

absolute pressure, assuming temperature remains constant.[28] When air is inhaled and gas exchange is completed, the use air is expelled from the lungs by the passive ascent of the diaphragm, and by the contraction of the internal intercostal muscles.[29] Through exhalation, the internal air pressure in the lungs eventually decreases and the cycle begins again when the brain triggers the diaphragm.[30] What alarms the brain to trigger the diaphragm is the increased level of carbon dioxide in the blood (the chemoreceptors communicate to the brain that the body needs fresh air or a new supply of oxygen molecules) and not the lower level of oxygen as previously thought.[31]

Since the primary inhalation muscle, the diaphragm, cannot be fully controlled, breath control is influenced through the use of the secondary inspiratory muscles.[32] As a result, these muscles may or may not be actively engaged during the breathing process, based on one's breathing needs. [33]

An important respiratory organ, the lungs, are spongy and air-filled, occupies most of the thoracic space above the diaphragm and consists of five lobes in which the bronchi and the air sacs (alveoli) are located.[34]

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[28] Bouhuys, *The Physiology of Breathing,*184.

[29] Smith, "Anatomy." See also Michael Webster, "No Visible Means of Support." *The Clarinet*, no. 38 (June 2011): 6.

[30] Webster, "No Visible," 6, 7.

[31] Bouhuys, *The Physiology of Breathing*, 207.

[32] Gaunt, "Breathing and the Oboe," 42. The secondary inspiratory muscles are comprised of the following muscles: sternocleidomastoid, serratus anterior, scalene muscles, pectoralis minor, trapezius, pectoralis major, latissimus dorsi, erector spinae, iliocostalis lumborum, and the quadratus lumborum. See also Wilson, "*Breathing*," 61.

[33] Isabelle Cossette, B. Fabre, V. Fréour, N. Montgermont, P. Monaco, "From Breath to Support: Linking Respiratory Mechanics to Aeroacoustic Sound Production in Flutes," *Acta Acustica,* no. 96 (July/August 2010), 656. See also Gaunt, "Breathing and the Oboe," 42.

[34] Patricia George, "Breathing," *Flute Talk,* no. 28 (February 2009): 2. See also Webster, "No Visible," 6. See also Powell, "How Breathing Works," 3.

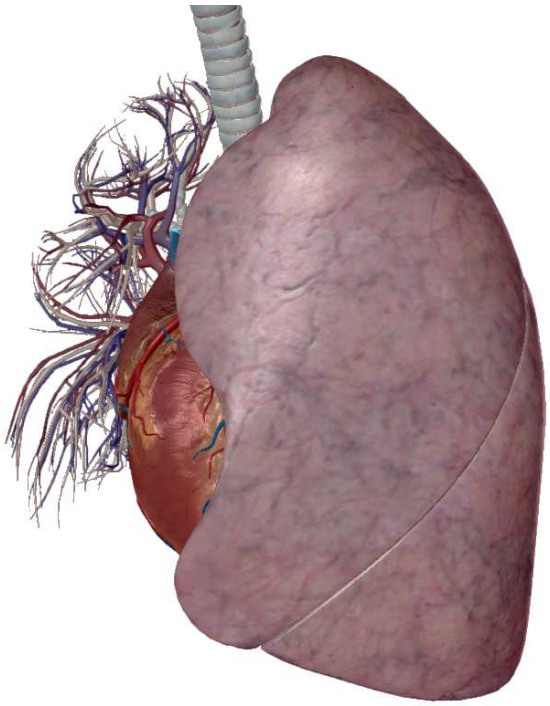

Figure 4. The surface of the lungs (Courtesy of Visible Body, License purchased by author)[35]

The lungs can never be completely empty of air.[36] As a result, when someone says to "empty the lungs," it actually means that the ribs cannot collapse further and the diaphragm cannot ascend further—the thoracic volume has reached its respiratory reserve.[37] The lungs are covered by a thin layer of tissue, the pleura, which also attaches them to the ribs, thereby giving the ribs power to "stretch" the volume of the lungs and give additional space for air.[38] This expansion of the lungs happens gradually and in all directions. If respiration is described by a direction, both inspiration and expiration could

[35] Visible Body, "Human Anatomy Atlas," Argosy Publishing (Version 2017.1), Computer Software, retrieved from https://play.google.com/store/apps/details?id=com.argosy.vbandroid&hl=en_US. License Rights purchased by author.

[36] Brooks De Wetter-Smith, "Breath Control and Tone Refinement," *The Instrumentalist,* no. 32 (March 1978): 83. See also Buchman, "Breathing," 29.

[37] Ibid. See also Wilson, "*Breathing*," 62.

[38] Cossette et al., "From Breath to Sound," 655.

be described as occurring from top to bottom. Air enters the lungs through the trachea into the bronchi and the alveoli from above and air escapes in the same order: first from the oral cavity, then the trachea, and all the way down into the alveoli. Since air is always present in the airways, the only variables are the volume and the pressure across these spaces.

The lungs are surrounded by the diaphragm, the spine, and the ribs. The movement of the ribs is called *excursion*.[39] Twelve pairs of ribs and their corresponding muscles control their excursion. This movement is essential for enlarging the volume of the thoracic cavity for inhalation and reducing it for exhalation.[40] The ribs connect anteriorly to the sternum through cartilage and posteriorly to the spine by the costovertebral joints.[41]

[39] Francisco J. González-Álvarez, , Marie C. Valenza, Irene Torres-Sánchez, Irene Cabrera-Martos, Janet Rodríguez-Torres, Yolanda Castellote-Caballero, "Effects of diaphragm stretching on posterior chain muscle kinematics and rib cage and abdominal excursion: a randomized controlled trial," *Brazilian Journal of Physical Therapy* 11, no. 5 (2016),:405, accessed 5 June 2019, http://www.scielo.br/pdf/rbfis/v20n5/1413-3555-rbfis-bjpt-rbf20140169.pdf.

[40] Wilson, "*Breathing*," 62.

[41] Ibid.

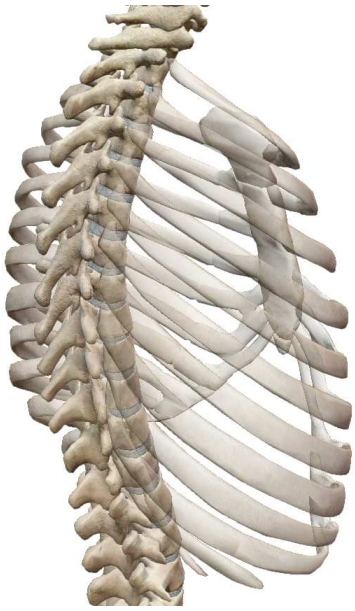

Figure 5. The spine, the ribs, and the costovertebral joints (Courtesy of Visible Body, License purchased by author)[42]

The lower two ribs are not connected anteriorly and are shorter than the rest so they float or move more freely, allowing the abdominal cavity to expand outward.[43] Since ribs are made of bone and are rigid in their form, it is the quite flexible cartilage that allows the ribs to move.[44] Because the ribs are connected to the spine directly by joints, the shape of the spine influences the movement or excursion of the ribs.[45]

Miller notes that because of its connection to the ribs, and its various skeletal functions, the spine plays a crucial role in breathing.[46] As the single pillar of the torso

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[42] Visible Body, "Human Anatomy Atlas," Argosy Publishing (Version 2017.1), Computer Software, retrieved from https://play.google.com/store/apps/details?id=com.argosy.vbandroid&hl=en_US. License Rights purchased by author.

[43] George, "Breathing," 4.

[44] Buchman, "Breathing," 29.

[45] Gaunt, "Breathing and the Oboe," 36, 37.

[46] Richard Miller, "Finding Your Correct Posture," In *Selected Breathing Masterclasses*, edited by Windplayer (Malibu: Windplayer Publications, 2006): 6. See also Jessica Wolf, "The Alexander

which bears and delivers weight downward, it houses the spinal cord and protects nerve roots and several organs in the body.[47] The spine consists of twenty-four vertebrae, which are separated by fibrocartilaginous discs that serve as a cushion against impact and give the spine great flexibility such as gathering, lengthening, rotating, twisting, and bending.[48] Its four modest curves allow it further flexibility and serve as a cushion against impact. Joined to the pelvis by the sacroiliac joint, the spine's diameter is small near the skull and becomes progressively larger as it comes closer to the pelvis to accommodate its weight-bearing function.[49]

In their discussion on breathing, Pino and BastaniNezhad explain that the pelvis and the pelvic floor also play a crucial part in the breathing process.[50]

Technique," In *Selected Breathing Masterclasses*, edited by Windplayer (Malibu: Windplayer Publications, 2006): 9.

[47] Richard Pallardy, "Vertebral column," Encyclopedia Britannica chapter on Skeleton, accessed 7 June 2019, https://www.britannica.com/science/vertebral-column.

[48] Ibid. It should be noted that the sacrum has five and the coccyx has four fuse vertebrae.

[49] Ibid.

[50] David Pino, "The Clarinet Teaching of Keith Stein IV: Breathing and Breath Control," *The Clarinet,* no 30 (September 2003): 41. See also Arya BastaniNezhad, "Automatic Breathing and Flute Performance," *Pan: The Journal of the British Flute Society*, no. 32 (September 2013): 34.

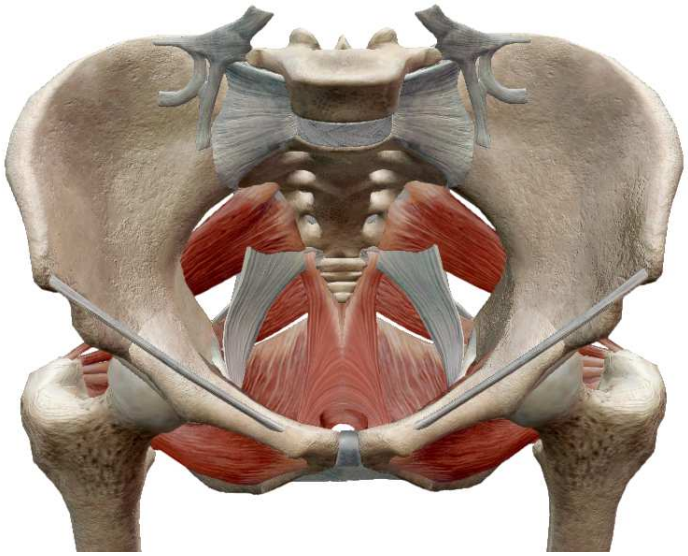

Figure 6. The pelvic floor (Courtesy of Visible Body, License purchased by author)[51]

Serving as the muscular base of the abdomen, the pelvis is often called the second diaphragm, because it mimics the movement of the diaphragm by descending upon inhalation and rising upon exhalation (although these movements are not as pronounced as the diaphragm's movements).[52] While rigid in its structure compares to the spine, the pelvis has four joints (lumbosacral, sacrococcygeal, sacroiliac, and the pubic symphysis) which allow it to adapt to movements to a certain extent.[53]

[51] Visible Body, "Human Anatomy Atlas," Argosy Publishing (Version 2017.1), Computer Software, retrieved from https://play.google.com/store/apps/details?id=com.argosy.vbandroid&hl=en_US. License Rights purchased by author.

[52] Hankyu Park, Dongwook Han, "The effect of the correlation between the contraction of the pelvic floor muscles and diaphragmatic motion during breathing," *Journal of Physical Therapy Science* 27, no. 7 (2015), 2114. Published online 22 July 2015, accessed 4 June 2019, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4540829/.

[53] Adam Augustyn, "Pelvis," Encyclopedia Britannica, accessed 5 June 2019, https://www.britannica.com/science/pelvic-girdle.

Finally, the breathing anatomy would be incomplete without mentioning the upper end of respiration, which includes the nose, mouth, pharynx, larynx, and the trachea.

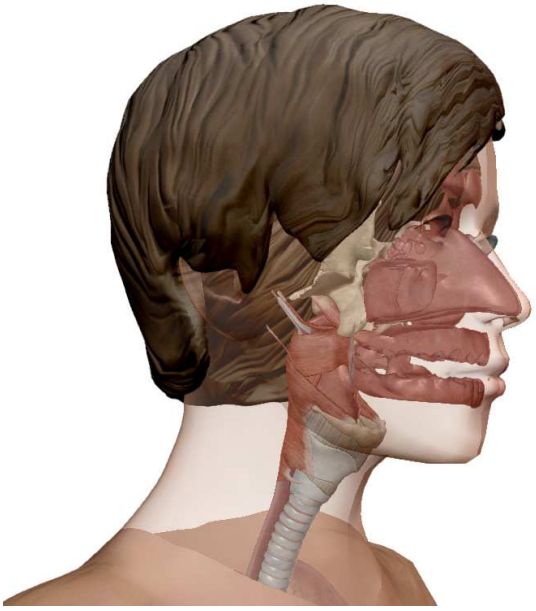

Figure 7. The upper windways (Courtesy of Visible Body, License purchased by author)[54]

Before entering the lungs, air enters through the mouth or nose. The nose and mouth both have sense receptors so one can feel the air movement.[55] They are separated by the hard and soft palates, comprising the roof of the mouth. Air then continues through the pharynx, the larynx, and the trachea, which are surrounded by the neck muscles, and to the bronchi, and finally into the lungs.[56]

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[54]Visible Body, "Human Anatomy Atlas," Argosy Publishing (Version 2017.1), Computer Software, retrieved from https://play.google.com/store/apps/details?id=com.argosy.vbandroid&hl=en_US. License Rights purchased by author.

[55] Carl Pfaffmann, "Human Sensory Reception," Encyclopedia Britannica, accessed 2 June 2019, https://www.britannica.com/science/human-sensory-reception.

[56] Eric F. Reichman, "Essential Anatomy of the Airway", In *Emergency Medicine Procedures*, 2nd edition (New York: McGraw-Hill, 2013): 35.

CHAPTER 3

LITERATURE REVIEW

The aim of this chapter is to review the ninety-three (93) articles addressing breath control for woodwinds musicians. Following the annotated review of each section relevant to the breathing process, the author will also briefly comment on and discuss the findings.

The review of the articles is conducted from a pedagogical and anatomical perspective. Twenty (20) of the articles review use measuring devices to validate and quantify internal processes, which helped them discern a very close relationship between posture or poise and the natural use of the body for efficient breathing. While some writings focus more on personal experiences in relation to how the authors applied breathing techniques and how they acquired them, twenty (20) articles make a connection to interdisciplinary fields such as somatic education as in the Alexander Technique,[57] Yoga, Andover Educators,[58] and Feldenkrais Method.[59] Other somatic disciplines are not mentioned in reference to their teaching applicability. These other disciplines could have included Structural Integration, Rolling, Trager, Laban Movement Analysis, and

[57] The Alexander Technique is an educational method teaching through verbal and manual guidance to approach movement differently and change faulty postural habits, with the aim of improving mobility, posture, performance and alertness along with relief of chronic stiffness, tension and stress. For more information see https://www.amsatonline.org/aws/AMSAT/pt/sp/what_is (accessed 25 June 2019).

[58] Andover Educators is a not for profit organization of music educators committed to teaching body mapping by providing accurate information about the body in movement. The goal is to teach musicians and educators how to accurately support and enhance movement in practice and performance in effort to prevent injury. For more information see http://bodymap.org/main/

[59] The Feldenkrais Method, developed by Dr. Moshe Feldenkrais, is a somatic approach that uses principles of physics, biomechanics, and an empirical understanding of learning and human development. The method uses gentle, mindful movement to bring awareness and directed attention to how one uses his body. For more information see https://feldenkrais.com/

Hellerwork or Bonnie Bainbridge Cohen. Thirty-five (35) articles discuss terms such as *aware*, *awareness*, or *self-awareness*, while sixty-five (65) use the term *breath control* and fifty-four (54) use the term *support*.

Articles which have either a very detailed exercise section, anatomical explanation, or pedagogical implications for the instrumentalist are "Clarinet Realities" by Geraldine Allan,[60] "The Primacy of Breath" by Larry Guy,[61] "Basic Respiration for Wind instrument Playing" by James Lakin,[62] "The Clarinet Teachings of Keith Stein" series by David Pino,[63] and "No Visible Means of Support" by Michael Webster.[64] Other articles reviewed tend to focus on one or more crucial aspects of breathing problems or utilize sophisticated measuring equipment to provide quantitative data to processes not visible in natural circumstances. Articles which employ multiple auxiliary measurements are "From Breath to Sound: Linking Respiratory Mechanics to Aeroacoustic Sound Production in Flutes" by Isabelle Cossette et al.,[65] "Devices and how to use them" by William Scarlet,[66] "Air pressure and rate of flow for double reeds" by Stephen Schellenberger and Oregon Eugene,[67] "Wind Instrument Tone Quality: A Visual

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[60] Geraldine Allen, "Clarinet Realities. I," *Clarinet & Saxophone* 37 (Spring 2012): 10-14.

[61] Guy Larry, "The Primacy of Breath," *The Clarinet* 36 (December 2009): 32-36.

[62] James Lakin, "Basic Respiration for Wind-instrument Playing," *The Instrumentalist* 23, no. 9 (1969): 48-50.

[63] David Pino, "The Clarinet Teaching of Keith Stein IV: Breathing and Breath Control," *The Clarinet* 30 (September 2003): 38-41.

[64] Michael Webster, "No Visible Means of Support," *The Clarinet* 38 (June 2011): 6-11.

[65] Isabelle Cossette, B. Fabre, V. Fréour, N. Montgermont, and P. Monaco. "From Breath to Sound: Linking Respiratory Mechanics to Aeroacoustic Sound Production in Flutes," *Acta Acustica* 96 (July/August 2010): 654-67.

[66] William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006): 24-25.

[67] Stephen Schellenberg, Oregon Eugene, "Air Pressure and Rate of Flow for Double Reeds," *The Double Reed* 5, no. 1 (1982): 5-7

Approach" by Terence Small,[68] and "Laryngeal Movements in Saxophone Playing" by Matthias Weikert.[69]

The articles that address challenges of playing the respective instruments discuss bad posture, proper control, lack of awareness, improper airflow rate, tension in diverse areas of body, bad habits, lack of abdominal support, embouchure related problems, mental state, lack of anatomical knowledge, lack of technical control, false imagery, misconceptions about breathing, and lack of control over the following body parts: hypopharynxes, larynx, tongue, swallowing muscles, and the size of the oral cavity. As all these are valuable aspects to proper breathing process and will be reviewed under one of the three sections, breath support and posture, inhalation and exhalation, and lips, tongue, throat, and embouchure. Ideas or concepts repeated across multiple articles are highlights since they provide a more solid validation of that principle. By that same token, fundamental concepts mentioned across multiple articles, without additional information on the topic (for example, confirmation that the gas exchange takes place in the alveoli of the lungs, or by enlarging the thoracic volume), main article will be discussed in greater detail and others only referenced as they contribute to the discussion.

[68] Terence Small, "Wind Instrument Tone Quality: A Visual Perception Approach," *The Instrumentalist* 23, no. 9 (1969): 56-59.

[69] Matthias Weikert, "Laryngeal Movements in Saxophone Playing: Video-endoscopic Investigations with Saxophone Players - A Pilot Study," *Journal of Voice - Official Journal of the Voice Foundation* 13 no. 2 (1999): 265-73.

Breath Support and Posture

Breath support is the single and most fundamental technique for a vocal or wind instrument musician.[70] It affects all aspects of playing or singing. It is also of great importance to performers who do not convert their breath to sound production, such as dancers, violinists, pianists, or athletes since it affects the quality of their output and performance.

What is breath support? Breath support, or also refers to as *breath control*, is the voluntary control of the muscles of exhalation (i.e., abdominal muscles and the internal intercostal muscles) by which the rate of exhalation is elongated and the necessary speed and volume of airflow secured.[71] It can be defined by the quality of control over the respiratory muscles. These muscles can work naturally and with well-placed intention or in a limited function,[72] which can have multiple causes. For example, limited breath control could be caused by inefficient posture, muscular tension, negative mental state, insufficient physical conditions, false commands from the brain, or falsely executed actions, among others.[73]

Since musicians are mainly concerned with posture, tension, the volume of the air intake, and the evenness of exhalation over a defines length of time, these four variables will be the main areas of review related to breath support in this section.

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[70] William David Stufft, "Hands-off Approaches to Teaching Breath Support," *Teaching Music* 5 (June 1998): 30.

[71] Ransom Wilson, "*Breathing: The Central Issue of Flute Playing*," In *The flutist's handbook: A pedagogy anthology. A Publication in Celebration of the 25th Anniversary of The National Flute Association, Inc.*, edited by National Flute Association, (Santa Clarita, California: National Flute Association, 1998): 63.

[72] Niall O'Riordan, "An organic approach to breathing. I" *Pan: The Journal of the British Flute Society* 34 (June 2015): 48.

[73] Alexa Still, "Breathing: Arnold Jacob's approach," *Flute Focus* 1 (July 2008): 18.

Review of Articles

At the beginning of his article, "No Visible Means of Support," Webster introduces two very important concepts that are scarcely mentioned in any other article and show how breathing could be approached from teacher's perspective. He writes

> This may be sacrilegious to say, but sometimes it doesn't matter whether something a teacher says is correct as long as it has the proper result…In wind playing the phrase 'blow from your diaphragm' is a case in point. When I was young and told to blow from my diaphragm, I thought that the diaphragm is lower than it really is and accessed my abdominal muscles. [74]

This statement addresses a pedagogical question of whether a teacher should teach correct principles and explains the anatomy of a certain problem, or rather give a short and simple command that might be incorrect, but help the student to successfully solve a challenge. It also refers to awareness and the mapping of the structure of self correctly. Finally, it includes the concept of teaching incorrect principles with good results. Webster feels that while it works for certain people, such practices cannot gauge the outcome and fail to provide the desired results each time teaching occurs.[75] As O'Riordan put it, one man's medicine is another man's poison.[76] Webster uses the remainder of the article to discuss the breathing mechanism, detailing the role of muscles and organs. He explains how tension of certain body parts might hinder proper airflow, thereby hindering the support mechanism of wind instrument playing.[77]

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[74] Webster, "No Visible Means of Support," 6.
[75] Ibid.
[76] O'Riordan, "An organic approach to breathing. I," 48.
[77] Webster, "No Visible Means of Support," 7.

Alongside the valuable information on mechanisms for correct breathing, Webster introduces the term *Psychophysiology* (which is included in only one other article).[78] What is psychophysiology and why should this be a concern? It is a branch of physiology that deals with the mind-body relationship. Mind and body are inseparably connected and are attuned,[79] and positive effects on one influence the other. The mental state of a player has bearing on the physical output as well. Stress, anxiety, and nervousness, as well as relaxation, balanced diet, and recreational activities all influence the mind and the body for better or for worse. Since every person is unique psycho-physiologically,[80] these variables allow for countless ways to solve individual challenges (or to create new ones). He supports the notion also addressed by Helene Gaunt, that if a teacher is attuned and has a thorough understanding of the principles behind the term, he or she is able to better assist the student in pinpointing the problem and arriving at a permanent solution.[81]

Webster explains how he defines support: the diaphragm leaning down on the abdominal viscera to control the rate of airflow. He also writes that the diaphragm resists the abdominal muscles during exhalation which creates the required support or *appoggio*.[82] He further explains that *appoggio* means to lean on something and support is "the act or process of supporting**:** the condition of being supports."[83] These descriptions

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[78] Wolf, Jessica. "The Alexander Technique." In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006): 9.

[79] Robert Rickover, Mind-Body Approach – "A Practical Approach," https://www.alexandertechnique.com/articles/mindbody/ (accessed May 20, 2019)

[80] Constance Clare-Newman, "Most of Us Live on Autopilot…," https://www.alexandertechnique.com/articles2/autopilot/ (accessed May 21, 2019)

[81] Webster, "No Visible Means of Support," 7. See also Gaunt, "Breathing and the Oboe," 56.

[82] Webster, "No Visible Means of Support," 7.

[83] https://www.merriam-webster.com/dictionary/support (accessed May 21, 2019)

are somewhat controversial since they approach breath support from opposing points of view. Webster explains further

> …breath management is best achieved by maintaining Lamperti's 'noble position,' which elicits cooperation between the chest muscles, the ribcage muscles, and the muscles of the sidewalls of the abdomen—that is to say, by maintaining an *appoggio*.....Relatively high sternum = rib cage greatly expanded, diaphragm at its lowest. The *appoggio* makes it possible to keep the inhalation posture of the sternum and ribcage, which, in turn, does not allow the diaphragm to ascend so rapidly.[84]

If keeping the inhalation posture of the sternum and ribcage are to be taken literally, then elastic recoil of the musculature cannot happen since the ribs do not come back to a neutral position and the rib excursion needs to be a voluntary action (it should be noted, that elastic recoil refers to the natural upward and outside movement of the ribs to draw in air). Cossette et al. make a point that

> …if all muscles are relaxed and the glottis is kept open, the passive inspiratory recoil makes the air come in until functional residual capacity is reached. This elastic behavior is commonly referred to in the literature as the elastic recoil of the respiratory system. This elastic recoil is due to the distinctive behaviors of the lungs and chest wall…[85]

This inrush of air is characterized by an easy and automatic movement of the ribs which physiologists call "elastic recoil."[86] She outlines that the automated movement—the recoil—is only possible if the muscles do not overwork or do not hold out the ribs as some authors describe it.[87]

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[84] Webster, "No Visible Means of Support," 8.
[85] Cossette et al., "From Breath to Support," 656.
[86] Ibid.
[87] Ibid.

All authors agree that proper breath control is the key to a desired tone production and technique. They outline two main components that influence it, the muscle activity and the skeletal poise. Sellen writes that standing erect while maintaining a relaxed posture allows the ribs to move as much as needs and that the abdominal muscles were the most important muscles of exhalation.[88] He highlights that a usual mistake one might make is to think of the abdominal muscle as a frontal muscle only, disregarding the fact that it surrounds the trunk underneath the ribs.[89] When the *abdominal muscle* term is involved in the description it should be thought of as a muscle all around the lower torso.[90]

Jessica Wolf writes that "breath is always in motion, flowing through you, and you want that flow to be free and unrestricted. Since your breathing is intimately linked with your posture and nervous system, freeing up your airflow means developing coordination and relieving unnecessary strain and tension throughout the body."[91] Tension is defines as rigidity, strain, or extra work of the muscle—when a muscle is tense or at work, it shortens, while a muscle in relaxation is most flexible and stretchable.[92]

Wolf affirms that if the ribs are squeezed or collapsed, the diaphragm does not have a full range of movement, therefore breath cannot flow freely.[93] She uses the

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[88] Mark Sellen, "Optimum Production and Control of Clarinet Tone," *The Clarinet* 25, no. 4 (1998): 28.

[89] Ibid. 29.

[90] Ibid.

[91] Jessica Wolf, "The Alexander Technique." In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006): 8.

[92] Michael Stenning, "Posture and Pain: Does Your Back Hurt?," https://www.alexandertechnique.com/articles/posturepain/ (accessed May 19, 2019)

[93] Wolf, "The Alexander Technique," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006): 8.

Alexander Technique to support the idea of deep breathing in a different way other than "holding out" the abdominal muscles.[94] She advocates lengthening the spine while exhaling so that both the spine and the framework of the body are mutually supported.[95]

Grace Welch expands the discussion by stating that the longer the exhalation occurs when practicing deep breathing, deeper is the relaxation.[96] Field, a coach in California, takes breathing support to a different level by equating it with movement—according to her, breathing should happen at the same time that movement is executed since breathing and movement are not separate but supportive actions.[97] She uses imagination exercises to match the energy flow of the body to the breath, stating that since energy flows continually and holistically, breathing is a non-mechanical action.[98]

O'Riordan makes a point that the "*floating ribs* move backward on inhalation and air expands into the back."[99] He writes further that this theoretically available to an individual but if that person is unaware of the influence the pelvis has on the rest of the torso (by tilting the pelvis in a way that the area of the floating ribs and the extensor muscles at the back are heavily contracted), it is unlikely that they would be able to achieve the effect of the floating ribs.[100] He stresses that learning how to hold the body erect without any conscious effort becomes easier and more rhythmic with time.[101]

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[94] Ibid.
[95] Ibid.
[96] Grace Welch, "Deep Breathing," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006): 10.
[97] Valorie Kondos Field, "Coordinating Breath with Performance," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006): 18.
[98] Ibid, 19.
[99] O'Riordan, "An organic approach to breathing. I," 48.
[100] Ibid.
[101] Ibid.

Larry Guy echoes David Callaway, saying that the first step to good support is the awareness of the muscles of inhalation and exhalation, and using them actively, or "keeping in touch with them" through exercises.[102] He adds that the root of the support problem is the weakness of the supporting muscles from the bottom of the torso, and provides an explanation as to what he saw as a good support

> When the air is well-supports, it feels as if it is effortlessly released through the mouth, almost as if someone is taking the edge of the air stream and pulling it quickly through the lips, similarly to the way the end of the tape is quickly pulled through the housing by the fingers of your hand.[103]

Arya BastaniNezhad also argues that good posture supports breathing and generates the best tone and control.[104] He explains that the interconnectedness between posture and breathing exists because the majority of the respiratory system's muscles are connected to the spine, neck, and small of the back. He further discusses the pitch-resistance relationship, explaining that different pitches require a different amount of support and abdominal work.[105]

Karen Demsey confirms the importance of the spine as a point of support in one of her exercises.[106] She concludes that breath support is frequently used as a vague phrase and not fully explained, and only becomes a concrete idea when the student is taken through the whole breathing process step by step.[107] Tying breath support to the quality

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[102] Larry Guy, "The Primacy of Breath," *The Clarinet* 36 (December 2009): 36.
[103] Ibid.
[104] Arya BastaniNezhad, "Automatic Breathing and Flute Performance." *Pan: The Journal of the British Flute Society* 32 (September 2013): 32.
[105] Ibid. 32.
[106] Karen Demsey, "Breath Control and the Beginning Flute Student: A Practical Approach for the Instructor I," *Woodwind, Brass & Percussion* 23 (January 1984): 5.
[107] Ibid. 6.

of the exhaled air is another viable definition and viewpoint since her definition of breath support translates to "maintaining a constant air pressure with the speed and the volume so that the tone of the instrument" does not vary.[108]

O'Riordan cautions the reader, stating that one can overly exert muscular effort in order to support instrumental playing.[109] He further explains that such practice leads to unnecessary effort and is detrimental to the breathing apparatus. He states that if the player "overly" uses one component, such action "inhibits" the other.[110] Such overuse of the abdominal muscles would prevent rib movement and advances chest collapse which, in turn, does not allow full expansion of the thoracic cavity and restricts arm movement and nerve paths which leads to pain and injury.[111]

Leone Buyse reminds the reader that equating tightness with abdominal support has negative implications, and results in disastrous consequences because the tension in the abdominal muscles could constrict the diaphragm's action and reduces the amount of air inhaled.[112] She directs the reader to focus on the intercostal muscles as well so the abdominal region does not take over important functions from other muscle groups while maintaining relaxation in the shoulders, neck, back, arms, and hand muscles.[113]

James Lakin writes about support as supporting the air column.[114] Although the air is not organized in a columnar shape, it is not an unclear phrase to use since it might

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[108] Karen Demsey, "Breath Control and the Beginning Flute Student: A Practical Approach for the Instructor II." *Woodwind, Brass & Percussion* 23 (February 1984): 7.

[109] O'Riordan, "An organic approach to breathing. I," 48.

[110] Ibid.

[111] Ibid.

[112] Leone Buyse, *Breathing Demystified: A Recipe for success*, (Galesville: Meredith Music Publications, 2008), 16.

[113] Ibid.

[114] Lakin, "Basic Respiration," 58.

help to simplify the concept of the windways. He attaches increased breath support solely to the abdominal muscles and that to improved tone quality. [115] He adds that certain areas of playing are under-researched, including breath control and support, and intonation, and that more could be gained from further studies.

Roger Mather explains that the term *support from the diaphragm* should be renamed *supporting with the abdominal wall*.[116] He assesses that exhalation is entirely controlled from below the ribcage and that the upper front part of the chest needs to stay open, meaning that one should not let muscle contraction limit the increased thoracic volume and should strive to keep these upper ribs raised.[117] A phrase, "changing the shape of your lungs," might be unfamiliar to the reader. [118] One explanation of the meaning could be that by controlling the descent of the ribs, the lungs retain a certain shape than otherwise since the lungs are directly connected to the ribs by the pleura (see chapter 2).

Sarah Baird Fouse suggests exercises to strengthen the muscles around the waist which support the breath. She explains that the supporting muscles should push the air up and out rather than stay stationary and apply contrary motion to natural exhalation.[119] Cynthia Ellis adds to that by equating support with pushing down and out with the

[115] Ibid, 59.
[116] Ibid.
[117] Ibid.
[118] Roger Mather, "Breath Control for Baroque Flutists," Traverso (October 1989): 1.
[119] Sarah Baird Fouse, "Breath Control Exercises," *The Instrumentalist* (January 1980): 36.

abdominal muscles while exhalation occurs,[120] similar to Steve Wilkerson, who adds imagery to that by imagining that the mouthpiece is put into the navel.[121]

Uwe Grodd adds that the higher the pitch, the greater the abdominal push needs to be.[122] He then compares the support to building a skyscraper. The higher the building, the deeper the foundation under the ground. He describes "joyous breathing," explaining it is a well-balanced breathing frame, with "open lungs, good and strong expansion, controlled collapse, and a fine interaction of muscle tension between lower abdomen support and embouchure flexes."[123] Paul Harris also advocates a balance between breathing muscles and the embouchure.[124] For Gaunt, breath support is the flexible and integrated combination of diaphragmatic, abdominal, and intercostal muscle use.[125] In addition to that, she states that inhalation and exhalation should not have a "holding point," but rather be continuous to keep the cycle going.[126] Edward Palanker recognizes that controlling exhalation is possible with the throat as well as the lips when playing a wind instrument.[127] He encourages using only the abdominal muscles to control breath and allowing the throat muscles to remain open at all times by not contracting while playing the instrument.[128]

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[120] Cynthia Ellis, "*Breath Control on Piccolo,*" Flute Talk (January 2009): 32.
[121] Steve Wilkerson, "Sound Advice: Breath Control for Saxophonists," *Downbeat* 68 (April 2001): 82.
[122] Uwe Grodd, "Breathing: Irony, contradiction or joy?," *Flute Focus* 1 (July 2008): 29.
[123] Ibid.
[124] Ibid.
[125] Gaunt, "Breathing and the oboe," 55.
[126] Ibid.
[127] Edward Palanker, "Clarinet Basics," *The Clarinet* (March 2009): 66.
[128] Ibid.

Geraldine Allen also advocates a relaxed and expanding abdomen for inhalation to release tension and prepare for diaphragmatic breathing.[129] She further states that a "consistent flow of air controlled by the diaphragm has energy and power."[130] In his article, Steve W. Allen contradicts her statement by reminding the reader that "the diaphragm does not support the tone; it is incapable of exerting that type of supporting action during the process of expiration."[131] He also describes some positive effects of the abdominal support such as timbral clarity, pitch stability, lack of throat tension and throat constriction, a greater supply of air, and quick inhalation.[132]

In the proper breathing section, George E. Waln equates breath support with breath speed.[133] In the previous articles, breath support is more or less equated with antagonistic muscle movements of the abdominal muscles and the diaphragm to create a steady airflow. The term *breath speed* by Waln could suggest that taking a breath at varying speeds might not constitute adequate support from the diaphragm. Isabelle Cossette et al. admit that it is difficult to describe breath support accurately because of its complex nature and the fact that it involves muscles that were difficult to feel directly.[134] They give a description based on previous studies to highlight that point, stating that

> Flute breath support entails antagonistic contraction of non-diaphragmatic inspiratory muscles that tend to hold the rib cage at a higher lung volume. This allows relaxation to provide expiratory pressures over a longer phrase that is being played. Inspiratory muscle activation may require some increase in the

[129] Geraldine Allen, "Clarinet Realities. I.," *Clarinet & Saxophone* 37 (Spring 2012): 13.
[130] Ibid.
[131] Steven W Allen, "Breath Control," *The Instrumentalist* 28 (October 1973): 52.
[132] Ibid.
[133] George E. Waln, "Clarinet Teaching Tips for Better Fundamentals," *The Instrumentalist* 11 (September 1956): 40.
[134] Cossette et al., "From Breath to Support," 657.

activation of expiratory muscles to counteract the antagonistic inspiratory action.[135]

David Pino finds it of the utmost importance to "clear the windway" before teaching breath support, meaning releasing tension in the oral cavity and the throat, since they restrict the breathing mechanism.[136] He is the first author to discuss the challenges of playing when applying too much air pressure or drive behind the airstream which abounded among young players.[137] Placing the location of breath support at the lowest point of the spinal structure, just above the sitting bones, he calls it "the base of structural upness."[138] He then offers ten exercises to strengthen the abdominal muscles and increase lung capacity and defines the difference between breath control and breath support the same way as Helena Gaunt (as the breath use during playing and the extra energy adds to the breath flow).[139] Finally, he refers to the upper and the lower muscles of the torso as having two separate functions and activity levels when supporting breathing. He teaches that the lower abdominal muscles should be firm, and the upper torso muscles should stay relaxed to not give way to tension since it would restrict the whole breathing apparatus.[140]

Kristi Sturgeon builds on the four types of breath. Breath type, here, is defined by the area of muscle expansions resulting in the high, low, total, and middle breath.[141] Low

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[135] Ibid.

[136] David Pino, "The Clarinet Teaching of Keith Stein IV: Breathing and Breath Control," *The Clarinet* 30 (September 2003): 38.

[137] Ibid.

[138] Ibid., 39.

[139] Ibid., 41.

[140] David Pino, "The Clarinet Teaching of Keith Stein V: Breathing and Breath Control," *The Clarinet* 30 (December 2003): 41.

[141] Kristi Sturgeon, "Breathing and Breath Support: The Four Types of Breath," *The Clarinet* 27 (March 2000): 10.

breath is recommended for wind playing, while she recommends using total breath for exercises. She defines the last type, middle breath, as chest breathing that did not utilize the whole torso; therefore, it should also be avoided in instrumental playing.[142]

Scott Reiss places great emphasis on the balance of the body before relaxed breathing can take place. His idea of building support means filling the lungs from bottom to top—the opposite order for exhalation.[143] This way, he elaborates, expansion is the greatest. Similar to Gaunt, Reiss also advocates an imagined continuous support system even though the flow of breath may stop or start.[144]

Contrary to that, Buddy Collette suggests filing the lungs completely from top to bottom.[145] He further suggests that it is the diaphragm that brings the air into the horn. Finally, he proposes that while playing, the muscles should remain firm while the diaphragm contracts.[146]

Liezl Stoltz compares the role of the diaphragm in sound production to the violinist's bow, explaining that it can control the speed and movement by being "slow or fast," or "light," with "sudden movements."[147]

Mitchel Lurie's article offers a unique way to learn air support by observing singers using their abdominal muscles. Lurie also mentions that more abdominal effort should be exerted when playing at a soft dynamic than when playing fortissimo.[148]

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[142] Ibid, 11.
[143] Scott Reiss, "Articulation: The Inside Story," *American Recorder* 47, no. 1 (2006): 12.
[144] Ibid.
[145] Buddy Collette, "Flexible Tone Production," In *Selected Saxophone Masterclasses*, 37. Edited by Windplayer, (Malibu: Windplayer Publications, 2004): 37.
[146] Ibid.
[147] Liesl Stoltz, "Making Music on the Flute." *Musicus* 30, no. 2 (2002): 97.
[148] Mitchell Lurie, "Tonal Concept & Breath Support," *Windplayer - For Woodwind and Brass Musicians* no. 59 (1998): 40.

Kimberly Cole Luevano agrees with Lurie's teaching, saying that breath control is the foundation for playing. Breathing deeper, relaxing the abdomen, and thus applying more lower abdominal support when exhaling is the key to greater breath support and tone production.[149]

Elke Gallenmüller talks about "back-breathing" in connection to the role the diaphragm plays in breathing.[150] She points out that the twelve ribs are connected to the spine by joints in the back where the diaphragm's movement is greater than in the front. She further teaches that support is not a still state but an act of doing, an act of being in dynamic balance that depends on the posture.[151] Mark Sellen sustains that the term *support* is best defined by the level of tension existing between the abdominal muscles and the diaphragm.[152]

Glen Gillis imagines of taking a breath as "drinking water" to fill the lungs.[153] He teaches that it is helpful to visualize the lungs, windpipe, throat, and the air column of the instrument as one, so that the "player and the saxophone become a single unit."[154]

Finally, Patrick Hagen claims that breath support is not being taught correctly everywhere in Germany.[155] He calls attention to the soft palate and the role it plays in

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[149] Kimberly Cole Luevano, "The Pedagogy Corner: Mitchell Lurie Part I.," *The Clarinet* 41 (June 2014): 18.

[150] Elke Gallenmüller, "Wenn man's kann, ist es ganz einfach: Die Atemstütze bei Bläsern," *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 19 (December, 2004): 164.

[151] Ibid.

[152] Mark Sellen, "Optimum Production and Control of Clarinet Tone," *The Clarinet* 25, no. 4 (1998): 29.

[153] Glen Gillis, "Spotlight on Woodwinds: Sound Concepts for the Saxophonist Part I.," *Canadian Winds: The Journal of the Canadian Band Association* 6 (Spring 2008): 85.

[154] Ibid.

[155] Patrick Hagen, "Die Erweiterung der Kernkompetenzen für Klarinette: Der Reflex-Atem und das Gaumensegel," *Rohrblatt* 32 (2017): 91.

relaxing the tongue as a necessary component when inhaling for reaching a naturally supported tone. This new feeling for "reflex-breath" makes support light and allows for easier play.[156]

Summary of Findings

Many good definitions of support have been introduced by the authors in this section. Each definition reflects individual awareness of the body's posture and its relevance for breath support. For example, Waln equating breath support with breath speed,[157] and Webster defining support by the "diaphragm leaning down on the abdominal viscera" to control the rate of airflow,[158] Sellen stating that breath support is created by the abdominal muscles in action,[159] and Wolf claiming that the support structure of the spine and the frame of the body aid better breath support,[160] and finally Field suggesting using continuous and conscious body movement as a supportive mechanism to achieving proper breath control.[161] In many respects, all these definitions echo personal experiences in relation to breath control which is defined as the resistance exerted by the abdominal, pelvic, and intercostal muscles that delay the ascent of the diaphragm and works in accord with the elastic recoil of the ribs.

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[156] Ibid.

[157] George E. Waln, "Clarinet Teaching Tips for Better Fundamentals," *The Instrumentalist* 11 (September 1956): 36-40.

[158] Webster, "No Visible Means of Support," 6-11.

[159] Mark Sellen, "Optimum Production and Control of Clarinet Tone," *The Clarinet* 25, no. 4 (1998): 28-31.

[160] Wolf, "The Alexander Technique," 8-9.

[161] Field, "Coordinating Breath with Performance," 18-19.

It is apparent that breath support or breath control is tied directly to posture by virtually every author. The close-knit relationship between breath support and posture is a constant point of discussion, reflecting individualized approaches to achieve the same goal. Most of the authors talk about a relaxed body with an erect posture to facilitate adequate muscle and rib expansion. As a result, advice ranges from maintaining an erect sternum, keeping the spine straight, standing against the wall, to pulling the hair on the top of the head upward to aid better posture and breath control. Only three authors use the word *poise*, and are familiar with one or more somatic fields. Guy uses the word *poise* in relation to the quality of air but not to posture.[162] Gaunt and Cossette et al. use the phrase *elastic recoil* to describe the natural movement of the ribs in exhalation. They are both familiar with the Alexander Technique. Webster writes about the prevalence of anatomically and physiologically incorrect phrases in the musical world and mentions that sometimes they are effective even if technically incorrect. From personal teaching experience and research, it can be observed that incorrect principles are used in the absence of a clear understanding of the mechanism of breathing. In such instances, one relies on the natural use of the body and knows little of the internal mechanisms. This often results in the development of false imagery based on partly sensory experiences to provide a desired working condition for the body. While incorrect imagery might create a shortcut to technical development, a surer foundation is to learn about the breathing mechanism and strive to incorporate that information toward making adequate changes to posture and breath support. Webster concurs with this thinking confirming that it is best

[162] Guy, "The Primacy of Breath," 32.

practice to use correct descriptions,[163] and supports it by outlining two examples of "wrong" methodology: the "Rostropovich end pin" and the "bent-elbow bowling technique."[164]

Such personal phrases are observed in several articles. Geraldine Allen uses the description, "control by the diaphragm for greater energy and power."[165] Pino discusses the floor of breath support to be the pelvic floor, as the lowest location of breath support. According to somatic principles, as in Alexander Technique and Andover Educators and so forth, such support should come from even further below, from the floor which acts as the lowest support for breathing while standing, or from the chair while sitting. It should also be noted that the spine, the abdominal muscles, and the ribs are a natural part of the support mechanism for instrumental playing.

Contrary to Allen, Collette makes statements in her research which show that the diaphragm contracts during inhalation and assists exhalation only passively by relaxing to its natural shape. The diaphragm does not carry air into an instrument, but rather the high-pressure air automatically moves to regions of lower pressure. The player can delay that process by actively holding the ribs with antagonistic muscle effort.

Many authors are of the opinion that the expansion occurs omnidirectionally around the lungs since the lungs expand in all directions. Conversely, if the torso expands in sequential order, it means that voluntary inhibition is placed on the breathing

[163] Webster, "No Visible Means of Support," 11.
[164] Webster, "No Visible Means of Support," 6.
[165] Geraldine Allen, "Clarinet Realities. I.," *Clarinet & Saxophone* 37 (Spring 2012): 13.

apparatus. It is also prevalent that the term *support* is tied to many relating topics, such as capacity, muscle action, rib movement, relaxation, airflow, and airspeed.

Gaunt, Cosette et al., Small, Scarlet, Weikert, Schellenberger et al., Guy, and, Lakin use auxiliary devices to measure processes and provide empirical data. These results prove helpful in all cases to monitor and provide measurements of invisible processes, and can greatly enhance further research on the subject.

On a final note, Cosette et al. admit that breath support is difficult to describe accurately due to its complex and invisible nature.[166] However, all authors express their ideas on how to eliminate tension and what role tension played regarding achieving better breath control in meaningful ways. Solutions offered were invaluable, with every related part of the body receiving adequate attention.

[166] Cossette et al., "From Breath to Support," 657.

Inhalation and Exhalation

Inhalation and exhalation are of great importance to musicians, possessing both quantitative and qualitative aspects. Quality is often defined by one's intent and how well respiration serves that purpose, and quantity is measured with various unit-based systems such as time, volume, strength, and so forth. Since the movement of air is invisible, quantitative research and the aid of auxiliary devices are of great value to musicians. Without them, one is left to rely more on standards of qualitative measurements, such as how well one executes a musical phrase, how easily one inhales and exhales, how one interprets a phrase, or whether one has a sufficient air reservoir to sustain a particular passage. External measuring devices allow qualitative standards to be associated with quantitative information about the breathing processes (long phrases become a number of seconds, sufficient air supply for a particular phrase becomes volume of air, control of exhalation is converted into sound pressure levels or airflow rate). These conversions are necessary tools for the individual to interpret and understand the physical, biological, and even chemical processes which are not visible. In the case of inhalation and exhalation, such measurements allow for a system that aids better tone production, finely executed breath support or more controlled respiratory functions. While present articles mainly deal with inhalation and exhalation from the qualitative aspect, a few provide quantitative data, which will be discussed in this section.

Review of Articles

Brooks de Wetter-Smith starts his article by stating that students should measure the amount of air inhaled against the length of musical phrases, dynamic level, musical intention, and one's lung capacity.[167] He suggests that they should be measured individually because this allowed the student to assess the quantity separately and put different segments together according to one's desire.[168] He uses general lung measurements according to age and gender as a reference point to gauge optimal conditions.[169] After analyzing the total lung capacity and the maximum achievable lung volume, the data for vital capacity can be gained. He further states that knowing the vital capacity is the most important factor in learning the potential for endurance.[170]

Noam Buchman's measurements show that during maximum inhalation and exhalation, humans move approximately three liters of air.[171] De Wetter-Smith explains that a spirometer helps put this capacity into measurable airflow rate, showing how effectively a player is using the air supply.[172] A reduced flow rate measured while maintaining "a given pitch and dynamic level of air" is an indication of "one's ability to focus the air stream."[173] He further explains that with an accurate focus in creating tone quality, the player requires less air to produce the same results.[174] He concludes that

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[167] Brooks de Wetter-Smith, "Breath Control and Tone Refinement," *The Instrumentalists* (March 1978): 83.

[168] Ibid.

[169] Ibid, 84.

[170] Ibid.

[171] Noam Buchman, "Breathing in L'Après midi," *Pan the journal of the British Flute Society* 32 No. 3 (2013): 30.

[172] de Wetter-Smith, "Breath Control and Tone Refinement," 86.

[173] Ibid, 87.

[174] Ibid.

adding measurement to something that is often discussed without such data helps the player make correct decisions regarding how much air should be inhaled and how it should be exhaled to achieve best tone production.[175]

Hagen writes that inhalation should occur at the point when the body indicates that it needs the air.[176] At this point, the reflex mechanism would take over resulting in quiet inhalation. He cautions that any tension along the airways would result in a noisy inhalation.[177] One method to relax the upper extremities is to inhale and exhale through both the mouth and the nostrils. This technique relaxes the oral cavity, the tongue, and the neck muscles completely.[178]

Gallenmüller also shares her concepts on noiseless inhalation. She explains anatomically how breathing happens and focuses on the fact that the lungs cannot *breathe*, but were rather ventilated, since the airflowed where less pressure existed, in order to equalize pressure from one region to another.[179] She further advises that one should let air rush in the lungs rather than forcefully inhale since one of the objectives of exhalation is to keep the diaphragm low for as long as possible.[180]

Gottschewski adds to the aforementioned technique, by observing that the expansion of the thorax is the greatest immediately after inhalation, together with the pressure from the ribs to go back to their neutral state.[181] Such adds resistance at the

[175] Ibid.
[176] Hagen, "Die Erweiterung der Kernkompetenzen für Klarinette," 95.
[177] Ibid., 92.
[178] Ibid., 95.
[179] Gallenmüller, "Wenn man's kann, ist es ganz einfach," 162.
[180] Ibid.
[181] Gottschewski, "Sinn und Unsinn von Atemübungen," 160.

beginning of exhalation require less muscle work from the internal intercostal and the abdominal muscles.[182]

Elgström takes a more holistic approach to respiration with a technique by Françoise Mézières.[183] This physiotherapeutic technique is based on awareness and exercises that rebalance the muscles and joints thereby improving posture, resulting in the body's ability to execute respiratory functions for instrumental playing in the most efficient way.[184]

O'Riordan teaches breathing from Feldenkrais viewpoint, encouraging correct posture to facilitate natural inhalation and exhalation, saying that the "dependence of proper breathing on the correct holding of the pelvis is also recognized by the yogi long ago."[185] He advocates that the skeleton should be balanced relative to gravity for breathing to become easier, spontaneous, and free. If the large muscles of the trunk are made to hold the body erect, they take over the role of the skeleton, and thereby obstruct breathing.[186] He reaffirms that good breathing could not be separated from an efficient posture, echoing Feldenkrais

> Most of the muscles of the respiratory system are connected to the cervical and lumbar vertebra, and breathing, therefore, affects the stability and posture of the spine, while conversely, the position of the spine will affect the quality and speed of breathing. Good breathing therefore also means good posture just as good posture means good breathing. [187]

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[182] Ibid.

[183] Edmon Elgström Misol, "Françoise Mézières's physiotherapeutic technique: An effective solution for correcting posture and respiratory problems in wind instrumentalists," *Artseduca* 17 (May 2017): 226.

[184] Ibid.

[185] O'Riordan, "An organic approach to breathing. I," 48.

[186] Ibid.

[187] Ibid, 49. See also Moshe Feldenkrais, *Awareness through Movement: Health Exercises for Personal Growth,* (New York: Harper & Row, 1972)

Guy stresses the importance of becoming aware of the breathing muscles in order to utilize them correctly,[188] while Alexa Still confirms that good posture is paramount for good breathing habits, because it contributed to freeing the lower abdominal muscles from holding the body erect, allowing the ribs to move freely.[189]

Demsley stresses not only the importance of the awareness of where the breathing muscles are and how they work but also the understanding of the distinct physical feeling created by diaphragmatic breathing. The low breathing exercises she suggests are all characterized by this understanding of "the inward and outward movement of the front of the abdomen and mid-section" and she adds that expansion needs to be felt all around.[190] In her article "A Practical Approach for the Instructor, Part 2," she stresses that both inhalation and exhalation are equally important.[191] She centers her thoughts around the action of the diaphragm by stating that the player should "have a physical memory of the diaphragm in action," and that the tension is the result "of the pressure exerted by the diaphragm against the air supply," a tension that could be a valuable tool "in gaining complete control over the way in which air is released."[192] As is briefly explained in chapter 2 on breathing anatomy, it should be noted that the diaphragm cannot be fully controlled, but is rather influenced by surrounding muscles. It is the abdominal and the intercostal muscles that create an antagonistic movement against the elastic recoil of the diaphragm, delaying its ascent, which is necessary for exhalation control. Damsey

[188] Guy, "The Pedagogy Corner," 30.
[189] Alexa Still, "Breathing: Arnold Jacob's approach," *Flute Focus* 1 (July 2008): 17.
[190] Damsey, "Breath Control II.," 6.
[191] Ibid.
[192] Ibid.

concludes that music might demand quick and efficient inhalation which does not sacrifice the lungs' capacity, and suggest exercises that aid the inhalation process and fit the music.[193]

BastaniNezhad writes that inhalation is generally looked at as the working phase of breathing.[194] Contrary to this notion, he comments that most wind instrumentalists forced the body to inhale rather than let it happen naturally, where exhalation is the primary and "working phase," while inhalation secondary and "automated phase."[195] He argues that by applying this method to breathing, the performer's breath control could be maximized and positively affected performance.[196] Good inhalation allows the muscular release of the neck, throat, tongue, trunk, and diaphragm. When inhaling this way, air automatically filled the lungs. He does not specify whether to use the exhaling muscles when exhaling, but when exhalation is completed, these muscles should be released immediately.[197] To put this idea in practice, Pinschof's four-step cycle of breathing is introduced: (1) exhalation, (2) kick, (3) relaxation, and (4) automatic inhalation.[198] The "kick" in this cycle meant that the abdominal muscles were applied right before inhalation, relaxing the breathing apparatus, and creating a more natural inhalation.[199]

Debost also insists that relaxed inhalation is a prerequisite for supported breathing.[200] He then adds that when we "breathe naturally," the air does not go in the

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[193] Ibid., 7.
[194] BastaniNezhad, "Automatic breathing," 33.
[195] Ibid.
[196] Ibid., 34.
[226] Ibid.
[198] Ibid.
[199] Ibid., *33.*
[200] Debost, "Blowing or Breathing?," 2.

upper part of the chest, which is not "the optimal prelude to playing."[201] Since the air expands the lungs in every direction, what Debost might have been referring to is the notion that the extra movement in the shoulder region is unnecessary and undesired since it indicated tension and an unnatural habit of respiration. Mitchel Lurie echoes this idea, suggesting that observing singers and how they use their abdomen and other muscles is a helpful way to overcome the created tension since singer's shoulders and sternum rose naturally. If these areas remain stationary, it means that they are voluntarily inhibited.[202] Debost also observes that a well-supported exhalation gives efficient inhalation in return.[203] Ransom Wilson confirms this idea when he writes that better inhalation equals better exhalation.[204] He also explains that during exhalation, the abdominal and the internal intercostal muscles contracted to control the diaphragm's return to its resting position, which allows for even airflow and slowed the ribs' excursion.[205]

Mather suggests a different technique for strengthening the sound, explaining that inhalation should be taken gradually with the sideway expansion of the ribs.[206] Once full inhalation is reached, the ribs needed to keep expanding further while exhaling so that the abdominal wall could collapse and give the sound extra resonance.[207] Mather also states that exhalation is controlled from below the ribcage, which should feel very open in the upper part of the chest.[208] He further warns against pulling the abdominal muscles inward

[201] Ibid.
[202] Lurie, "Tonal Concept," 40.
[203] Debost, "Blowing or Breathing?," 2.
[204] Wilson, "*Breathing: The Central Issue of Flute Playing*," 63.
[205] Ibid.
[206] Mather, "Breath Control and Embouchure," 61.
[207] Ibid.
[208] Ibid.

while inhaling, since such action contracts the intercostal muscles unnecessarily instead of keeping them relaxed.[209]

Baird Fouse focuses on a concept of an open throat and mouth during inhalation in addition to keeping the shoulders stationary, because it facilitates a relaxed body and extended air intake, as well as alleviated noisy inhalation resulting from tension.[210] George affirms that an open throat is essential to relaxed breathing, suggesting that the first step of the breathing cycle is exhalation.[211] She recommends exhaling all the air several seconds before inhaling, explaining that as a result, the breath would be of much better use, although she does not explains why that might be.[212] She suggests a panting exercise to explains and to demonstrate an open throat. This exercise also demonstrates the ideal position the larynx and the separation of the vocal folds. When panting, the throat needs to be in the desired open position for playing the instrument. She makes note of the double breath, which is achieved by taking an appropriate breath, then waiting and just before the phrase would start, taking another *catch* breath in order to sustain extended phrases.[213] This approach is also taught by Arnold Jacobs to aid deoxygenation during long phrases which require more oxygen to be stored in the lungs.[214]

Ellis explains that the lungs could be inflated in two ways—first, through lower expansion and second, through upper expansion.[215] Since inflating could occur from both directions (from bottom-up or from top to bottom), a player needs to experiment which

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[209] Ibid., 62.
[210] Fouse, "Breath Control Exercises," 38.
[211] Patricia George, "Breathing," *Flute Talk* 28 (February 2009): 6.
[212] Ibid.
[213] Ibid., 8.
[214] Ibid.
[215] Ellis, "*Breath Control on Piccolo*," 32.

method worked best.[216] Kanter took a more open approach to teach good breathing technique by stating

> Posture yourself so that when you inhale your posture does not restrict the lung cavity's ability to expand fully. Bad posture is the main reason for not being able to take in enough air. Slouch in a chair, and try inhaling a very deep breath. If you feel the expansion of your lung cavity change your posture, then your posture is restricting your lung cavity's ability to expand.[217]

He also pronounced a statement that some might be seen as controversial, saying that

> The resistance of the clarinet allows us to regulate how fast and how much air we expel through the instrument. We also regulate the flow of air with our throat. An error is to try to over-regulate the airflow with the throat muscles.[218]

It has been suggested that the throat should stay open or relaxed at all times during respiration.[219]

Gaunt echoes other authors, suggesting that players should release a small amount of air after inhalation while playing the oboe to avoid feeling inflated.[220] She suggests that over-breathing is more prevalent with the oboe than with any other wind instruments due to the resistance of the reed. For this reason, oboe players need to consider breathing between phrases to replenish the oxygen supply when playing extended phrases. She further suggests that they should (1) use breath in a continuous flow, discarding the

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[216] Jim Kanter, "Breathing and Blowing," *Windplayer* 7 (November/December 1990): 22.
[217] Ibid.
[218] Ibid.
[219] Ibid.
[220] Gaunt, "Breathing and the oboe," 36.

concept of holding it; (2) use the *out-breath* as the active and energized phase of breathing, to which the *in-breath* becomes an automatic response;
(3) consider the basic directions of the breath: up and out while exhaling, down and in while inhaling; (4) use rhythmic breathing in relation to the music; (5) pay attention to the correlation between the quantity of air inhaled and the needs of a musical phrase; (6) consider integration of breathing and musical expression, taking into account the physical strain created by long uninterrupted *out-breaths* and the consequent changes in blood chemistry; (7) apply contrary motion and dynamic balance of muscular tension and relaxation; (8) consider the need to prepare muscles for playing, to avoid excess tension, and to stretch muscles after use, as in any athletic activity. [221]

The results of her study includes physiological changes during performance, which are: (1) the number of breaths taken in a minute decreased by 50 percent; (2) oxygen saturation dropped; (3) carbon dioxide level rose in the blood; (4) inconsistent usage of abdominal and ribcage volume is observed, and (5) more balanced volumes between the chest and abdominal measurements could be measured.[222] She observes that the heart rate fluctuates from 130 bpm to about 160 bpm on average and adds that with every breath, the heart rate increases during performance and decreases when playing stops.[223] This heart rate response occurs with a slight delay behind the action as the body adjusts to postural distortion by creating the air pressure for playing. [224] She explains that

[221] Ibid, 39.
[222] Ibid, 40.
[223] Ibid, 43.
[224] Arendt Bouhuys, *The Physiology of Breathing: A Textbook for Medical Students*, (New York, Grune and Stratton, 1977), 75-87.

postural distortion tends to affect breathing patterns and results in "mouth gasping," and that the breathing pattern also changes posture. As a result, she concludes, a cycle of interdependence is observed, where breathing becomes more effortful.[225]

Josh Kemp considers developing breathing successfully by developing sensory awareness to maximize the sensory information available related to the breathing mechanism.[226] To do so, he suggests exercises to develop an awareness of areas of the body where air passes, explaining that an increased awareness meant finer control over the elements.[227]

Buchman writes about the impact of the head and neck on the breathing passage, stating that any downward or sideways movement of the head bends the windpipe making the air entry more difficult.[228] He also defines inhalation as creating negative pressure in the lungs, and advocates a slow inhalation before playing as opposed to Gaunt's rhythmic breathing and Tipton's "one must take care not to inhale too far in advance of a passage," since this is "usually a manifestation of anxiety and, of course, unnecessarily tiring."[229] Buchman explains that the lungs could be filled with air calmly because "we have the time," thereby providing a maximum capacity of air. [230] When gauging how much air should be used for a particular phrase, he lists six points to consider: (1) individual lung capacity, (2) quality of the tone, (3) how much lung capacity

[225] Gaunt, "Breathing and the oboe," 36.
[226] Josh Kemp, "Breathing Fundamentals for the Saxophone," *Clarinet & Saxophone* 39 (Fall 2014): 28.
[227] Ibid, 29.
[228] Buchman, "Breathing in L'Après midi," 28.
[229] Ibid. See also Albert Tipton, "Breath Control and Timing," *School Music* 42 (March 1971): 9.
[230] Buchman, "Breathing in L'Aprés midi," 30.

is being utilized, (4) dynamics, (5) level of anxiety, and (6) the movements performed during the play.[231]

Allen lists exercises to make better use of the breathing mechanism, some of which focus on awareness of movement and tension, offering steps to release them for a full breath. [232] One particular exercise pinpoints that the tension that stops the diaphragm from ascending is occurring in the lower abdomen, not in the larynx, pharynx, or mouth.[233]

Pino concurs with previous authors on the importance of maintaining an open throat or a relaxed throat during inhalation.[234] He suggests imagining the widening of the throat to the depths of the breath source and maintaining this posture while exhaling.[235] To maintain this *roominess* in the oral cavity, the tongue should shift slightly forward and the inhalation should be preceded by the correct final stages of exhalation. He explains that this could be attained by not taking a breath when the body signaled but holding out until all expellable air is completely exhaled.[236] This principle of expellable air contradicts Hagen who states that breath should be first taken when the body signals for it.[237] Pino himself alludes to that in his other article, where he defines relaxed breath as air taken through the nose only, which relaxes the upper airways, providing an open path for the air.[238]

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[231] Ibid, 31.
[232] Allen, "Clarinet Realities," 10-14.
[233] Ibid, 10.
[234] Pino, "Keith Stein IV," 38.
[235] Ibid.
[236] Ibid, 11.
[237] Hagen, "Die Erweiterung der Kernkompetenzen für Klarinette," 95.
[238] Pino, "Keith Stein IV," 40.

Webster takes a holistic approach to breathing, describing five distinct ways to breathe, which were summarized as (1) empowered thoracic inhalation, (2) constricted thoracic inhalation, (3) paradoxical inhalation, (4) abdomino-diaphragmatic inhalation, and (5) thoraco-diaphragmatic inhalation.[239] Each of these features a different relationship among the chest, diaphragm, intercostal and abdominal muscles, and are somewhat similar to previous authors describing the combined-breathing technique.[240] While they are very detailed, they do not address breathing against resistance, since Webster encourages breath support by maintaining the inhalation posture—i.e. an elevated sternum and ribcage that did not allow the diaphragm to ascend rapidly.[241]

Webster's views on the influences of posture and muscle work on the diaphragm contradict other authors, who see it as the abdominal and the intercostal muscles that hold back the diaphragm from going back to neutral rather than the elevated rib and sternum.[242] Webster states that inhalation on a "tucked-in tummy" would prevent the diaphragm from its normal downward movement, advising to control the amount of air escaping into the instrument by using the inhalation muscles to oppose the exhalation muscles during the exhalation.[243]

Lawrie Bloom uses a clarinet barrel to open the air passage to freely breathe in as much air as possible by suggesting breathing through the barrel placed in the mouth.[244] Anatomically, the open mouth prevents the throat muscles from contracting, creating an

[239] Webster, "No Visible Means of Support," 7.
[240] Ibid, 8.
[241] Ibid.
[242] Ibid.
[243] Ibid, 10.
[244] Lawrie Bloom, "Relaxed Breathing and Tonal Production," *Windplayer* 8, no. 6 (1991): 32.

open path for air to enter the lungs. Once the player is familiar with the feeling of breathing this way, it is emulated with the instrument.[245]

Wolf advocates visualizing the breathing cycle in connection to the spine to activate natural reflexes of the body and to not restrict the breathing mechanism.[246] She suggests that this breathing cycle frees the body from compression and squeezing and creates greater awareness.[247] In the same article series, Welch describes a breathing exercise asking the student to "breathe in slowly," and while inhaling, to use their abdominal muscles to push their belly "way up."[248] What Welch means by this statement is to push the belly *out* rather than *up*, which lowers the diaphragm.

Allen describes inhalation as a partial vacuum created by the diaphragm in the chest cavity.[249] This corresponds with Gallenmüller's idea of letting air rush in instead of sucking it in with constricted throat muscles.[250] Allen reiterates that the diaphragm does not have muscular physiology to control the process of expiration, a concept with which many authors agree.[251] He further explains that relaxed abdominal muscles were crucial to the diaphragm's descent and the enlargement of the thoracic cavity.[252] Buyse also confirms the vacuum principle as initiated by the descent of the diaphragm.[253]

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[245] Ibid.
[246] Wolf, "The Alexander Technique," 8.
[247] Ibid.
[248] Grace Welch, "Deep Breathing," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006): 10.
[249] Allen, "Breath Control," 52.
[250] Elke Gallenmüller, "Wenn man's kann, ist es ganz einfach: Die Atemstütze bei Bläsern," *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 19 (December, 2004): 164.
[251] Allen, "Breath Control," 52.
[252] Ibid.
[253] Buyse, "Breathing Demystified," 16.

O'Riordan extends awareness by asking the student to sense the connectedness to the floor.[254] He guides the individual to lie down and perceive changes in the body's movement, noticing how the body make contact with the floor as breathing occurs.[255] He offers awareness exercises based on the Feldenkrais Method and directs the player to observe any changes that take place before and after the exercises. In accord with Guy, O'Riordan emphasizes awareness as an integral part of efficient breathing.[256]

Summary of Findings

From the articles review, it can be derived that the authors agree on much of what efficient breathing means and its relationship to breath control. They agree that efficient inhalation requires adequate relaxation of the body while maintaining an upright posture, though, upright posture is not always clearly described. Webster refers to it as keeping the sternum erect.[257] Others describe it as keeping the torso erect while relaxing. Multiple authors write about awareness of posture, movement, and tension in relation to proper breathing. Some of the awareness principles discussed are tied to somatic principles such as the Feldenkrais Method,[258] the Alexander Technique[259] or in Still's article, to Body Mapping.[260]

[254] O'Riordan, "An organic approach to Breathing," 46.
[255] Ibid, 44.
[256] Ibid, 46.
[257] Webster, "No Visible Means of Support," 6-11.
[258] O'Riordan, "An organic approach to Breathing," 44-46.
[259] Wolf, "The Alexander Technique," 8-9.
[260] Still, "Breathing: Arnold Jacob's approach," 17-18.

Debost observes that a well-supported exhalation gave efficient inhalation in return[261] which correlated with George's cycle of breathing, putting the exhalation as the first step of the cycle.[262] Some authors are not concerned with the order of breathing but focus solely on sections of the breathing process and prescribed techniques with and without the use of an instrument to train the muscles for specific tasks. Webster and Pino each describe more than ten exercises for inhalation and exhalation. Webster draws on yoga exercises,[263] O'Riordan writes from the Feldenkrais perspective and BastaniNezhad from Pinschof's method (Vienna-born Australian flutist).[264]

Another interesting point of discussion is regarding the differences between inhalation approaches. Some approach inhalation purely as a voluntary act and others as a natural function of the body which should occur without interference from voluntary actions or it is described as a reflex to inhalation with which one should work and not override. Gaunt advocates rhythmic breathing to help match the rhythm of inhalation to the rhythm of the task,[265] contrary to Tipton's and Miles's approach.[266] In contrast to this, Buchman advises considering dynamics, tone quality, phrase length, the level of anxiety, and amount of air according to parameters that affected exhalation when taking a breath.[267] Demsey, Reiss, and Gaunt use imagery to help airflow continuation in order to avoid breaking the cycle mechanically. In this way, breathing becomes an integrated

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[261] Debost, "Blowing or Breathing?," 2-6.
[262] George, "Breathing," 2-9.
[263] Webster, "No Visible Means of Support," 6-11.
[264] O'Riordan, "An organic approach to Breathing," 44-46. See also BastaniNezhad, "Automatic breathing," 32-37.
[265] Gaunt, "Breathing and the Oboe," 33-59.
[266] Albert Tipton, "Breath Control and Timing," *School Music* 42 (March 1971): 9. See also Nancy Miles, "Breathing Exercises for Wind Players," *Windplayer* 54 (April 1996): 37.
[267] Buchman, "Breathing in L'Aprés midi," 28-31.

action of performance rather than just a technical foundation for *tanking up* air. Wolf gives direction to the airstream to better help its way in and out of the lungs.[268]

Some authors challenge conventional thinking. Mather suggests a different technique for strengthening the sound, which is unnatural for the body. It is clear that through his suggested technique the workload of the breathing apparatus is minimized. However, if players use the natural recoil, such excursion could also happen very quickly and effortlessly.

Ellis suggests a two way-lung expansion—first, through lower expansion and second, through the upper expansion.[269] As mentioned in anatomy publications, lung expansion occurs omnidirectionally and simultaneously, therefore, muscle and skeletal movement should follow this natural process—an overall and simultaneous expansion. In my years of teaching experience, the challenge with the suggests technique is that it promotes micro-tension, which may be difficult to notice.

Pino's idea of drawing breath in the last moment also contradicts some of the other authors discussion on the topic. While muscles have certain flexibility to act for a time without becoming tense, anatomically, when the last drop of air is expelled from the lungs, it is too late to take breath freely because the muscles are overly tensed and require a longer time to relax and recover.

Stoltz's suggestion to direct the air stream towards the back of the mouth, just as Emmanual Pahud teaches it, conflicts with body mapping principles as taught by the Alexander Technique because Alexander Technique emphasizes the position of the

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[268] Wolf, "The Alexander Technique," 8-9.
[269] Ellis, "*Breath Control on Piccolo*," 32.

windpipe in the front of the throat.[270] Directing the inhaled airstream in a mismapped throat could cause tension, over-work, and inhibition.[271] This can be similar to not using a roadmap correctly and driving off the paved road, which might result in driving off a bridge or into a roadside ditch.[272] To put it simply, air moves into the lungs through the windpipe regardless of intention.

Many articles that focus on inhalation and exhalation do so in relation to breath support or breath control. Inhalation is the primary focus of discussion in connection to lung capacity, while exhalation is discussed mainly in connection with breath control. All of the articles offer valuable insights, ideas, techniques, and many provide a workable list of exercises to contribute to the development of instrumental respiration. Finally, articles that present quantitative data contribute greatly to further building an understanding of inhalation and exhalation as a tool for greater breath control.

Lips, Tongue, Throat, and Embouchure

The final section of this chapter will review how articles address tone production and breath control in relation to primary factors of sound production such as the throat, tongue (and in case of the flute the lips, too) and secondary factors such as the lips and the embouchure. Since clarinet playing requires a different embouchure, lip work, and tongue position or shape that might not be applicable to other woodwinds, special attention will be given to these differences. The oboe and the bassoon, for example, are

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[270] Stoltz, "Making Music on the Flute," 97.

[271] Jerald Harscher, "Body Mapping for Better Playing," https://www.berklee.edu/bt/222/body_mapping.html (accessed June 6, 2019)

[272] Barbara Conable and William Conable, *How to Learn the Alexander Technique: A Manual for Students*, 3rd ed., (Portland: Oregon Press, 1995), 44.

double reed instruments, where the portion of the reed in the mouth is smaller than the mouthpiece a clarinetist or saxophonist places inside the oral cavity. The mouth opening for double reed instruments is very small compares to the lip aperture for saxophone playing. The flute is the only instrument in the woodwind family that uses an airjet to produce sound and the mouth hole lays entirely outside the mouth. These individual woodwind instrument characteristics may cause changes in teaching fundamental principles of breathing relative to the lips, tongue, and embouchure.

Review of Articles

Hagen states that a relaxed tongue is a necessity to the desired tone because it could obstruct the windway even if the muscles of the airways are relaxed.[273] He quotes Tobias Füller saying that players need to relax the soft palate because this also contributes to a relaxed tongue. The reason for this is the tongue's and the soft palate's mutual connection to the same nerve and band of muscles. As a consequence, a trained soft palate means that the tongue is trained as well.[274] He indicates that the tongue has to cooperate with the airstream and to be carefully guided, suggesting that if the tongue does not contact the sides of the teeth, the airstream is not quick enough, resulting in the inability to produce the desired tone.[275] If, however, the tongue is placed well and a healthy airflow is supplied over the registers while playing, "a consistent tension of the

[273] Hagen, "Die Erweiterung der Kernkompetenzen für Klarinette," 96.
[274] Ibid.
[275] Ibid.

embouchure muscles" is noticeable—something he said is the result of a "stable embouchure."[276]

Gallenmüller focuses her thoughts on the *accessory support* mechanism.[277] She writes that it is very common to aid the lack of support with all sorts of redundant activities, with a very popular method being consistently using throat pressure combined with the tongue and the neck muscles. However, she clarifies that the created elastic tension ultimately leads to the cramping of the tongue, neck, or lips (in isolation or in any given combination) because the required air pressure cannot be produced. This, for example, is manifested in having a lump feeling in the throat and in tongue movements when changing registers or when playing wide intervals, and/or in manifestations of fatigued embouchure such as shaking of the facial muscles.[278] In addition to the cramping sensations, the shoulders could raise to create a perfect accessory support mechanism, and through that movement cut off the airstream halfway through, hindering sound production.[279] The results are a rougher sound, a constricted tone that sounds shrill in the high register and most likely collapses in the mid-register of the flute. She concludes that for a free-floating tone, a fine coordination and balancing of posture, respiratory musculature, embouchure, and a sound concept are necessary.[280]

Gábor Mihály draws a comparison between the "old school's" and the "new school's approach" to clarinet playing in his article "Zum Schulwechsel in der Technik

[276] Ibid.
[277] Gallenmüller. 164.
[278] Ibid.
[279] Ibid, 166.
[280] Ibid.

des Klarinettenspiels," describing what he sees as the correct position of the tongue.[281] As per his definition, the tongue should be somewhat arched, which secures the narrowing of the air path and allows the airstream to speed up before entering the mouthpiece. This sped-up air stream makes the movement of the reed much easier.[282] He further assesses that the tip of the tongue needs to depart from the tip of the reed, which enables the reed to vibrate, and calls it "an air-centered approach," a new method that looked for solutions in the technique of blowing.[283] Embouchure, he states, is an evenly controlled position of the musculature in all registers of the instrument which facilitates an even tone throughout the entire range.[284]

Müller focuses his attention on the tongue, and similarly to Gallenmüller, discusses the role of the tongue in creating the differences between the abdominal and chest breathing.[285] He explains that the abdominal breathing brought the sensation of the floor and its gravitation which is an advantage when performing.[286] Chest breathing results in a neck constriction, which has a negative impact on the sensitive areas of the throat and the tongue. With abdominal breathing, he concludes, such danger is reduced to a minimum.[287]

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[281] Gábor Mihály, "Zum Schulwechsel in der Technik des Klarinettenspiels," *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 14 (September 1999): 125.

[282] Ibid.

[283] Ibid.

[284] Ibid, 126.

[285] Matthias Müller, "Verbesserung der Atemfunktion bei Bläsern durch den Spirotiger," *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 19 (December 2004): 169.

[286] Ibid.

[287] Ibid.

Aarhus Von Niels Bak discusses what effects playing with different vowels has on the lips and on the air stream.[288] In his research, he finds that professional musicians who play with vocal positions "uu" and "ee" (other than "aa"), impair the airflow through the lips because of the difference in lip-opening, and when measured, different shapes of the oral cavity and the larynx indicate different intra-oral pressure rates.[289] Further elaborating on this finding, he writes that

> The 'vocal' or 'resonance theory' states that mastering the changing vocal positions is a necessary component of proper embouchure for the recorder. This theory is found in the German discipline-related literature but does not mention the limitations of its distribution. The French acoustician E. Leipp in his book written in 1962 extends this principle not only to the recorder but all other woodwind instruments. According to the English literature, the vocal positions have no bearing on the mouth or the throat because they are just simple components of the airway through which the air should be free to be exhaled into the flute, therefore, the control of the air pressure will only be impacted by the respiratory musculature.[290]

He concludes that the technique of blowing is similar for both recorder and flute playing and that the lips played a meaningful role.[291] BastaniNezhad, a flutist, concurred with Bak, saying that the lips could be modified naturally based on the vowel shape that is crucial to the tone production.[292] He further reiterates Pinschof's views, by saying that without it, the tone cracks "from biting the embouchure too much."[293] In other words, too much pressure is exercised on the lips and facial muscles.

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[288] Aarhus von Niels Bak, "Eine physikalische und physiologische Untersuchung der Blastechnik des Blockflötenspielers," *Das Musikinstrument: Internationales Fachblatt für Herstellung* 27, no. 5 (1978): 812.

[289] Ibid, 183.

[290] Ibid.

[291] Ibid, 184.

[292] BastaniNezhad, "Automatic Breathing and Flute Performance," 35.

[293] Ibid.

G. O. van de Klashorst connects the mouth-lip and facial muscles to the overall posture more than other authors.[294] He explains that through a focused standing or sitting posture, facial muscles were activated by reflex, whereby through a regular posture, "by contrast, the tone of the facial-, intercostal-, and the abdominal muscles" decreased."[295]

Guy advocates the need to feel the release of air as opposed to pushing or pressing it.[296] He compares the air stream with somebody taking the edge of the air stream and pulling it quickly through the lips just as a measuring tape would be pulled through its housing.[297] He notes that the lip muscles are among the weakest in the body and the jaw muscles are the strongest and that playing the clarinet necessitates more lip and less jaw strength.[298] To distinguish lip and jaw muscles which are often confused, Guy suggests an exercise of holding a pencil in the mouth with the teeth alone, followed by holding it with the lips folded around the teeth, and then without touching the pencil, folding out the lips to eventually hold the pencil only with the lip muscles.[299] He explains that such an exercise shows the feeling of largeness at the back of the mouth, which is the feeling of an open throat, putting the embouchure into the proper position. His concluding thoughts echo the "poised" position by Robert Marcellus and encourage the player to place the tongue forward and high in the mouth.[300]

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[294] G. O. van de Klashorst, "Die Disposition des Musikers: Teil 3: Die Klarinette: Haltung, Bewegung und Atmung." *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 4 (April 1989): 180.

[295] Ibid, 177, 186.

[296] Guy, "The Primacy of Breath," 34.

[297] Ibid.

[298] Guy, "The Primacy of Breath," 32.

[299] Ibid.

[300] Ibid, 35.

Demsey agrees with Guy's views that the release of the air stream should be directed through the lips with a small opening or aperture.[301] She explains that this allows the player to execute much longer phrases than with a larger aperture. She points out that the lips alone cannot control the speed of the airstream, but only give shape to the air. The diaphragm controls the airspeed regardless of the size of the aperture of the lips.[302] In addition, Demsey also writes about the tongue and throat in relation to breathing, noting that the tongue needs to be flat in the mouth throughout respiration and the throat relaxed and open, allowing the air to move freely passing both "potential obstacles" along the way to avoid a tight, airy tone quality.[303]

Roger Mather writes that the flute embouchure or the lip position requires far more mobility during playing than during speech.[304] Folkers reflected that the 18th-century writers on the flute seemed to focus on the lips in relation to tone production but not on the shoulders, throat, or the chest.[305]

Cossette et al. conclude in their study "From Breath to Sound: Linking Respiratory Mechanics to Aeroacoustic Sound Production in Flutes," that a balance exists between airflow and lip-to-edge distance in flute playing.[306] BastaniNezhad, further expands on that notion, suggesting that the tongue should remain in a resting position on

[301] Demsey, "Breath Control and the Beginning Flute Student II," 6.
[302] Ibid.
[303] Ibid.
[304] Roger Mather, "Breath Control and Embouchure for Teenage Flutists," *Flutist Quarterly* 13 (Winter 1988): 61.
[305] Folkers, "Breath Control on the Baroque Flute," 1.
[306] Cossette et al., "From Breath to Sound," 665-666.

the inner surface of the lower front teeth. He concludes that yawning is always accompanied by flattening of the tongue and opening of the throat.[307]

Grodd, also writing from a flute perspective, maintains that a flexible and dynamic flute sound is similar to a "kind of bow, string, and arrow-tension," which is "regulated between the lower abdomen and the lips."[308] He does not exclude other factors, such as the throat, but does not further explain whether he thinks that the throat impacted the sound or not. He does elaborate, however, that without this balanced tension, the sound is produced or centered inside the body and is altered through the tightening of the lips.[309] He suggests that the two points of control should be as far apart as possible, commenting that if that did not happen, balance becomes focused elsewhere and tension is not shared all throughout the breathing mechanism.[310]

Gaunt quotes Schuring who advises breathing often to provide fresh oxygen and allow the blood to flow back into the lips.[311] This practice is especially meaningful in correlation with the regeneration of the blood flow to avoid fatiguing areas such as lips, and fingers.

Palanker suggests simulating the double lip embouchure to feel how much of the lips should relax.[312] This helps direct the air and open the throat more precisely. Waln teaches that putting too much lip over the teeth deadened the vibration of the reed.[313] The

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[307] BastaniNezhad, "Automatic Breathing and Flute Performance," 35.
[308] Grodd, "Breathing: Irony, contradiction or joy?," 30.
[309] Ibid.
[310] Ibid.
[311] Gaunt, "Breathing and the Oboe," 36. See also http://www.public.asu.edu/~schuring/Oboe/air.html (accessed 6 June 2019)
[312] Palanker, "Clarinet Basics," 67.
[313] Waln, "Clarinet Teaching Tips," 38.

placement, of course, varied with the thickness of the lips, since they should exert some pressure, albeit balanced.[314]

Terrence Small presents findings from a study conducted with an oscilloscope measuring waveforms of selected pitches, providing a graphic representation of tone quality.[315] As part of the results, he concludes that all participants who could see the visualization increased their breath support and half of the participants decreased their lip pressure.[316] He reasons that with the increased effort of the exhalation muscles, the pressure from the lips needed to be taken completely or partially away for balanced tone production.[317]

Pino writes somewhat along this vein saying that the effect of the breathing mechanism is brought to naught if the air is forced through a contracted jaw or pinched lip at the reed.[318] He further indicates that the blowing of the breath in a forward direction relaxes the lips in a way a baby's suckling relaxed the jaw.[319] He suggests having the combination of those two things as an ideal setting for clarinet playing. Teaching more on the lip, he says that "the sensitivity with which very gentle puffs of air play against the circular orifice of the lips, and breaking the seal to vibrate the lips," is a close approximation to what should occur while playing.[320] For proper voicing, he also suggests never raising the tongue to the point that it blocked the air passage. He

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[314] Ibid, 39.
[315] Terence Small, "Wind Instrument Tone Quality: A Visual Perception Approach," The Instrumentalist 23, no. 9 (1969): 58.
[316] Ibid.
[317] Ibid.
[318] Pino, "The Clarinet Teaching of Keith Stein IV," 38.
[319] Pino, "The Clarinet Teaching of Keith Stein V," 41.
[320] Ibid.

elaborates by commenting that keeping the back part of the tongue low but the center up, or arching the front is a good position for voicing on the clarinet.[321] If the tongue is too high, the tone becomes thin, and if it is too low in the middle, the sound turns unfocused and flat.[322] Generally, the tongue needs to remain forward to facilitate good articulation habits and tone production, because a good attack is dependent on the coordination of breath control and tongue shape. In the same way, tone release involves the coordinated action of breath-controlled "air stoppage" and "tongue-trapping" on the reed since

> An excellent practice for opening the windway is to think of opening the oral cavity and the throat widely as breath is inhaled to the depths of the breath source, maintaining this posture while exhaling as well.[323]

Gillis confirms that tone production is the coordination of inhalation and exhalation with the critical release of the tongue from the reed,[324] while Pino describes imagining widening the throat to the depths of the breath source and maintaining this posture while exhaling to achieve the best open throat position during inhalation and exhalation.[325]

Sellen stresses the need for the player to consider the interrelations of factors such as breath, lips, jaw, mouth shape, mouth size, and head resonance to be able to control tone production in its fullness.[326] He discusses the proper placement of the reed on the lip by bunching the lower lip towards its center, saying that this gives the musician the

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[321] Ibid.
[322] Pino, "The Clarinet Teaching of Keith Stein IV," 39.
[323] Pino, "The Clarinet Teaching of Keith Stein V," 43.
[324] Gillis, "Spotlight on Woodwinds," 85.
[325] Pino, "The Clarinet Teaching of Keith Stein IV," 38.
[326] Sellen, "Optimum Production," 29.

maximum control over the reed, and the cooperation between the lips and the flexibility of the mandible provides the maximum amplitude of the reed.[327]

Benoit Amy de la Breteque developed possible ways to work with instrumentalists who suffer from focal dystonia by conducting studies with a fiber nasopharyngoscope, that he presents in his article.[328] He found that the larynx participates in controlling the quality of the sound in wind instrument performance by acting on flow rate and speed parameters of the expiratory air that passed through it.[329] Since the larynx helps adjust the intraoral pressure during instrumental performance, he observes that when it is positioned higher, it restricts the free movement of the air, while when it is lowered, it improves the sound.[330]

In oboe playing, the lips have a slightly different model of functioning than in clarinet or flute playing. The pressure of the upper and the lower lips have to be balanced. If the pressure is not balanced, the lips close the reed and restrict airflow. For this reason, the lips should form a seal all around the reed, both being equally important. Elizabeth Raum explains this concept in her article on phrasing and the other roles lips played by stating that

> Oboists should learn to round off the end of the phrase by dampening the sound with their lips. I describe it as closing down on the reed while keeping up the support until the end, so there's a fast decrescendo.[331]

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[327] Ibid.

[328] Benoit Amy de la Breteque, "Le travail du souffle chez les instrumentistes a vent," *Medicine des Arts* 29 (1999): 6.

[329] Ibid.

[330] Ibid.

[331] Elizabeth Raum, "Spotlight on Woodwinds: Oboe Basics," *Canadian Winds: The Journal of the Canadian Band Association* 6 (Fall 2007): 24.

She describes that the decrescendo is not to be achieved with the decrease of airflow from the exhalatory muscles but by creating greater resistance at the far end of the air stream where the sound is created.[332] Though it is possible to apply this technique to other reed instruments, it is the most effective way of showing the lip's multiple correct applications in sound production and in relation to the air stream for the oboe.[333]

Another flutist, Peter Lloyd writes that pianissimo is controlled purely by the lips and that changing the aperture is what created more or less airflow and facilitated the change in dynamic level.[334] Nancy Miles suggests bringing the lips forward and lowering the tongue to improve the quality of air intake.[335] Mary Karen Clardy recommends shaping the air column with the inside of the lips rather than with the teeth, jaw, and with the base of the tongue or the throat.[336] She outlines that the tongue position affects the speed and tone quality and when articulating, the back of the tongue needs to be relaxed, with the tongue positioned forward in the mouth—the interplay between tongue movement and the movement of the air needs to be one of floating.[337]

Liesl Stoltz explains that to produce a focused and fast air, the tongue has to lie flat in the mouth while the throat stays open to serve as a tunnel, a principle Walker and Melago second in their articles.[338] Stoltz further suggests thinking about the tongue as a

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[332] Ibid.
[333] Ibid.
[334] Peter Lloyd, "Breathing and Vibrato," *Windplayer* 58 (1998): 37.
[335] Nancy Miles, "Breathing Exercises for Wind Players," *Windplayer* 54 (April 1996): 37.
[336] Mary Karen. Clardy, "Flute Fundamentals. A Guide to Daily Practice," *Flute Talk* 14 (September 1994): 20.
[337] Ibid.
[338] Stoltz, "Making Music on the Flute," 98. See also Walker, Kerry Elizabeth. "Teaching Young Flutists Breath Control." *The Instrumentalist* 43 (January 1989): 21. See also Melago, "Using Breath Attacks to Improve Flute Tone," 46.

carpet to help with positioning. In her final comments, she describes sound production in an anatomically paradoxical way.[339] According to her, first, if the tongue lies flat in the oral cavity creating a hollow space for the air to pass through, the air would not accelerate nor be focused as physical laws would describe it. Second, she suggests that when the tongue is in a resting position, it rests against the hard palate.[340]

Another concept she introduces is how vowels and consonants relate to the tongue and air stream. In flute playing, the tongue and airstream are compared to consonants and vowels in speech. The tongue movement is similarly shaped by consonants since sound is "carried by vowels, whilst consonants give meaning to the sound stream."[341] A final important concept she discussed is the use of the tongue in relation to spoken language.[342] She observed that native French speakers have an advantage in articulation because they pronounce words far more forward in the mouth, which enhances clear and quick articulation, while those whose native language did not have this advantage have to develop such precision.[343] Sellen adds to this discussion by stating that when the tongue is held forward, the oral pharynx is enlarged, preventing restrictions in the air column.[344]

Finally, Fouse also focuses on creating an open throat and mouth while inhaling in addition to keeping the shoulders stationary. He states that this facilitated a relaxed body and extends air intake, further helping alleviate noisy inhalation as a result of

[339] Stoltz, "Making Music on the Flute," 99.
[340] Ibid, 98.
[341] Ibid, 99.
[342] Ibid.
[343] Ibid.
[344] Sellen, "Optimum Production," 29.

tension.[345] George affirms Fouse's and Webster's thoughts through an exercise by demonstrating why an open throat is essential to relaxed breathing.[346]

Summary of Findings

While articles in this chapter were of diverse opinions and approaches, some principles find agreement among authors, one being the presence of the relationship between the oral cavity's shape and the speed of the air stream. It is apparent that flute and recorder players attribute a slightly different role to the lips in regard to the air stream. That difference seems to come from the specific features of the instrument—i.e. the way air is released into the instrument.

Other differences are mainly due to the individual characteristics of the instruments such as the resistance of the bore, the reed(s), the reed and mouthpiece combination, embouchure approach, and appropriate tongue position. The authors make an effort to explains these nuances in detail from a personal and logical understanding. They also emphasize the importance of these factors in tone production as well as their relationship to breath support. Many authors focus on air and airspeed in relation to facilitating correct tone production. Miháltz, among others, emphasizes a focused airstream that is accelerated by the highly arched position of the tongue before it enters the mouthpiece. Two principles are relevant to this discussion, one is the Venturi effect, and the other is Bernoulli's principle. They both relate to airspeed, the oral cavity (tongue position), and intraoral-pressure. According to the Venturi effect, the air in exhalation can

[345] Fouse, "Breath Control Exercises," 36.
[346] George, "Breathing." 6.

only be accelerated if the tongue retains an even constriction in all registers and on all notes all the way to the mouthpiece opening which is the only position that would accelerate the air. This tongue position does not agree with direct midsagittal imaging of the tongue.[347] The latter principle states that an increase in the velocity of a stream of fluid results in a decrease in pressure.[348] Taking this principle further, exhaled air accelerates between the reed and mouthpiece, reducing air pressure, which pulls the reed shut against the mouthpiece (Bernoulli principle), and this motion is reinforced by the traveling pressure pulse phase within the bore.

It is evident that flutists had much more to say about lip involvement in sound production and in air control than any other woodwind author. This is probably due to the individual characteristics of the flute, where the lips play a primary role in coordinating the airstream—the flute is the only woodwind instrument where the lips do not seal around a mouthpiece. The function of the upper lip separately is rarely mentioned by flutists. One exception is Kathleen A. Melago, who teaches that the upper lip needs to be extended lower than the upper teeth to allow air to travel smoothly through the inner surface of the lips, allowing the inner side of the lips to serve as a pathway for the air.[349]

Clarinet authors focus mainly on the lower lip and some mention sealing around the mouthpiece for proper reed vibration support and to prevent air leakage. They agree that the lips contacting the reed and mouthpiece need to retain a softer composure while

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[347] Joshua Gardner, The Performance Physiology Research Laboratory, https://sites.google.com/a/asu.edu/performance-physiology-research-laboratory/about-the-ppr-lab, Accessed June 12, 2019.

[348] Bernoulli´s principle, Merriam-Webster dictionary online, https://www.merriam-webster.com/dictionary/Bernoulli's%20principle, Accessed June 12, 2019.

[349] Kathleen A. Melago, "Using Breath Attacks to Improve Flute Tone," *Canadian Music Educator* 54 (Spring 2013): 46.

the surrounding muscles maintained a firm position to avoid letting the air escape, which decreased air pressure and usable capacity. This also helps maintain adequate support for the reed's free vibration and doing so balanced the abdominal resistance with the resistance of the mouthpiece-reed combination.

Most clarinetist authors advocate placing the tongue forward and high because such practices relax the tongue and keep the throat open, whereas flutists advocate keeping the tongue flat. Some woodwind authors associate noisy tone and airy sound to an improper tongue position and some rather attributed them to muscle constriction in the neck area. In keeping an open throat, all clarinetist authors who discussed the tongue's role in playing suggest a highly-arched tongue position. It has been shown to me through direct imaging of the tongue that its position varies in shape for almost all pitches of the instrument, particularly those above written clarion E.[350]

Flute authors agree on laying the tongue flat in the mouth and pursing the lips thus creating an uninterrupted windway from the oral cavity to the instrument. This concept of creating a larger space in the oral cavity is said to produce a focused and fast air. Some flutists describe this position of the tongue as lying flat against the entire floor of the mouth. Flutists and recorder players also use vowels extensively which helped respond to the resistance of the instrument's registers and created a needed, even airflow throughout.

[350] Joshua Gardner, The Performance Physiology Research Laboratory, https://sites.google.com/a/asu.edu/performance-physiology-research-laboratory/about-the-ppr-lab, Accessed June 12, 2019.

In oboe playing, the lips fulfilled a slightly different model of functioning, since the pressure of the upper and the lower lips had to be balanced. If the pressure is not balanced, the lips closed the reed and restricted the airflow. Raum discusses that a decrescendo could not be achieved with the decrease of airspeed during the work of the muscles engaged in exhalation, but by creating greater resistance at the reed by pushing the lips together. Though this technique cannot be applied to other reed instruments, it is an effective way of showing the lip's multiple applications in sound production and its secondary function to the air stream. Oboe authors did not address tongue position.

All authors agree without exception that the throat had to remain relaxed. Some call it a relaxed throat and others an open throat. While some refer to open throat only for inhalation, such as George,[351] others emphasize this concept for exhalation as well. Fouse focuses on an open throat and mouth while inhaling in addition to keeping the shoulders stationary.[352] Besides her, many other authors connect noisy inhalation to constriction in the throat area.

Sellen writes that one has to consider the complex interrelationships between the breath, lips, jaw, mouth shape, mouth size, and head resonances when thinking about tone production and he directly ties the lips and the flexibility of the mandible to better resonance.[353]

In reviewing the articles, it is apparent that individual characteristics of the instruments facilitate differences in contributing factors of the lips, tongue, and

[351] George, "Breathing." 6.
[352] Fouse, "Breath Control Exercises," 36.
[353] Sellen, "Optimum Production," 30.

embouchure. The articles give many points of considerations and offer diverse ideas and approaches by which one may address and overcome certain challenges. This section is concerned with such functional anatomy that lacks much empirical validation among woodwind professionals. It is expected that with the further usage of CT scanning, MRI imaging, fiber-optic lenses, Ultrasound, and X-ray video recordings, musicians will gain a better understanding of the function of the lips, tongue, and the laryngeal muscles in instrumental playing.

CHAPTER 4

CONCLUSION

For this project, I have researched publications on breath control written by both professional musicians and professionals in other fields, published solely in woodwind journals. One of the limitations of this study is that it did not consider books or published articles written on the subject from brass and vocal professionals since it would have exceeded the scope of this work and potentially not be fully applicable to single or double-reed instruments. The publications came from three continents, Europe, Asia, and North America. Six languages were represented among the selected articles but the Chinese articles had to be disregarded due to translation challenges. Relevant catalogs have been researched for publications from 1896 to the present, and ninety-three proved to fit the scope of this study. It is evident that publications by woodwind authors on breath control before the middle of the 20th century were scarcely available. The oldest publication review is written by A. Uden in 1955. James Lakin is the first to take measurements regarding the breathing process with auxiliary devices in 1969. It is observed that the content on the matter improved as the time passed and more tools were available, allowing for measurement and data collection. With these technical advancements, it became easier to use medical and other technical devices to expand knowledge on the subject for woodwind players.

The results of this research project provide an in-depth insight into the topic of breath control and its various applications as discussed by woodwind pedagogues and a few other professionals. Anatomical information, technical principles, and methods of

teaching and learning were presented and discussed. Findings confirm that deviations and contradictions among the authors might exist, which may pose questions if they are not elaborated upon further through additional empirical research. It is also found that many unique and invaluable approaches have been devised to help the learner overcome general and specific challenges in an effort to acquire greater technical control.

The most discussed areas among the authors were regarding posture, inhalation, and the exhalation process. The support and the function of the diaphragm is the second most discussed subject. The least discussed areas on the subject were lip, tongue, and throat relative to the breath control. This might not mean that it is the least understood of all since both precise instructions and accented ideas were present, but many of the articles provide information that is contrary to already-existing imaging and acoustic research. Two of the outstanding articles with multifaceted measurements were by Cossette et al. and Gaunt. These studies provide immense insights into the parameters of breathing. These studies also measured the relationship between breathing and other physiological processes such as blood pressure, blood oxygen level, as well as other influences to the central nervous system.

Future considerations and extensions of this project might include charting the information into diagrams for easier access to specific topics, measuring data on processes not yet measured or recorded, and additional analysis of information provided, such as a comparative analysis of teachings on relevant principles. These might include subject areas such as the relationship between airspeed and tongue position; measuring the intraoral and extraoral pressure during instrumental playing while providing data on

muscle activity of the torso; the relationship between the tongue and the soft palate relating to breath control; or in what ways breathing rhythmically affects breath control and capacity and how it might relate to the release of tension. It is hoped that this document will provide guidance for others in need and inspiration for further research.

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APPENDIX A

GLOSSARY OF TOOLS OR MACHINES
USE IN MEASURING OR AIDING RESPIRATION-RELATED FUNCTIONS

Spirometer: An instrument measuring the different capacity of the lung such as how much air is inhaled and exhaled and how quickly it is exhaled. Different grades exist which could measure more data of more functions of the lung these include but not limited to: Total Lung Capacity, TLC; Vital Capacity, VC; Residual Volume, RV; Inspiratory Capacity, IC; Functional Residual Capacity, FRC; Inspiratory Reserve Volume, IRV; Tidal Volume, TV (here VT); Expiratory Reserve Volume, ERV.[354]

Oscilloscope: A device which translates audio frequencies into visual patterns by the means of electrical voltage and a cathode ray tube.[355]

Nasoscope or Rhinoscope: An instrument which examines nasal passages and cavities through a lens and a light put in a flexible tube.[356]

Spirotiger: A compact and light respiratory training instrument that comes with a mouthpiece, air guiding parts, and a customized breathing bag. It displays data on an LCD screen. Training with this device develops the lung while getting rid of the hydrogen ions and carbon dioxide. This helps to balance the muscles pH to keep them working properly.[357]

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[354] Brooks De Wetter-Smith, "Breath Control and Tone Refinement," *The Instrumentalist,* no. 32 (March 1978)

[355] Terence Small, "Wind Instrument Tone Quality: A Visual Perception Approach," *The Instrumentalist* 23, no. 9 (1969)

[356] Benoit Amy de la Breteque, "Le travail du souffle chez les instrumentistes a vent," *Medicine des Arts* 29 (1999)

[357] Matthias Weikert, "Laryngeal Movements in Saxophone Playing: Video-endoscopic Investigations with Saxophone Players - A Pilot Study," *Journal of Voice - Official Journal of the Voice Foundation* 13 no. 2 (1999)

Breath Builder: A plastic tube with a ping-pong ball inside. Thought this tube one inhales and exhales and the ball moves up in the tube. The position of the ball then an indication of how much respiratory capacity one utilizes. If the airflow is too slow, the ball drops. This device is designed to show the minimum amount of necessary airflow. Too much use can cause any to hyperventilate and faint. Larry Guy writes in 2010 that the latest generation of this device is more sensitive o air pressure changes with its narrower tube that resembles the resistance of the clarinet mouthpiece. The ball inside the tube drops easier because of the higher sensitivity of the device.[358]

Air Bag: It is a big balloon that shows how much air has been exhaled. The exhaled air can be re-inhaled and so forth until the air is reusable. Inhaling the already exhaled air from the bag prevents hyperventilation. These bags come in already set sizes such as three or four liters, etc.[359]

Voldyne: This device indicates the strength of your inhalation. It consists of two chambers which measure air volume and air pressure. One has to first expel all air then take the tube and inhale as much air as possible in the quickest way. A gauge tells how many milliliters of air one can take in from 500 to 5000 ml. It is not recommended to use this device often only every few months to compare values.[360]

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[358] Larry Guy, "The Pedagogy Corner," *The Clarinet* 36 (December 2009); William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006)

[359] William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by *Windplayer*, (Malibu: Windplayer Publications, 2006)

[360] William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006)

Inspiron: This instrument is similar to the Voldyne, the difference is that it can be adjusted. It does not show measurements as the Voldyne does, however, it indicates how long one can sustain a steady flow rate.[361]

Facial-Flex: This device helps to build the muscles at the corner of the mouth. Larry Guy points out that these muscles aid in tonal focus, upper register control, and air-leak stoppage. It works putting this little device in the mouth between the corner of the lips. It creates resistance against the lip corners via a rubber band. Corners have to push this "extensor" together and the lips are so trained.[362]

Drinking Straw: Regular straw that helps to form the embouchure. The usage involves inhaling and exhaling through it forcefully a few times. At one point, during the forced exhalation the straw should be quickly removed so the embouchure stays the same. The next step is to finger notes on the straw while so exhaling. Following is to do the same thing on the clarinet playing easy arpeggios.[363]

Writing pen: This tool helps in putting a pen in the mouth to hold it with the teeth alone. After that one should take out and back in but holding it with the lips folded around the teeth. Without touching the pen, one should fold out the lips and eventually hold the pencil only with the lip muscles. This exercise shows which

[361] William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006)

[362] Larry Guy, "The Primacy of Breath," *The Clarinet* 36 (December 2009)

[363] Larry Guy, "The Primacy of Breath," *The Clarinet* 36 (December 2009)

muscles are the one in direct relation to the lips and also puts the embouchure in the proper position.[364]

Stationary bike: In connection with playing long tones with a metronome, the stationary bike can increase the strength of the abdominal muscles. By increasing the resistance of the bike, more muscle power is required to operate it while carrying out respiratory functions for playing. This exercise can be tiring so it should be used with moderation.[365]

Measuring tape: It is useful to visualize how the airstream travels through the windpipe into the instrument by pulling the tape out and releasing it without resistance.[366]

Digital-Display Sound-Level Meter: This device tells the player what decibel level being played at. It shows the real data about a crescendo or decrescendo. Wavering in the long tone exercise will be displayed truthfully as one seeks for ultimate control.[367]

Full-length mirror: Larry Guy encourages students to take a look in the mirror each time to visually observe what is being discussed. Topics could relate to breathing mechanism, embouchure, tongue placement, posture, hand position, and finger

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[364] Larry Guy, "The Primacy of Breath," *The Clarinet* 36 (December 2009)

[365] Larry Guy, "The Primacy of Breath," *The Clarinet* 36 (December 2009)

[366] Larry Guy, "The Pedagogy Corner," *The Clarinet* 36 (December 2009); William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006)

[367] Terence Small, "Wind Instrument Tone Quality: A Visual Perception Approach," *The Instrumentalist* 23, no. 9 (1969) see also Larry Guy, "The Pedagogy Corner," *The Clarinet* 36 (December 2009); William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006)

motions. Observing these physical features up-close, allows them to create awareness on their own and eventually become their own teachers.[368]

X-ray recordings: In Aarhus Von Niels Bak's study, radiographs showed the activity of the organ of articulation and its common characteristics in different person's playing. The X-ray study also shows activities of the mouth and the throat in combination with sound and air pressure recordings.[369]

Microphone-probe: Use to make sound spectrum audible created inside the oral cavity through a microphone insert on the mouthpiece.[370]

Vitalator calibrated bellows: This device measures vital capacity as well as residual air.[371]

Optoelectronic Plethysmography: Use to measure chest wall compartment volume.[372]

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[368] Larry Guy, "The Pedagogy Corner," *The Clarinet* 36 (December 2009); William Scarlett, "Devices and How to Use Them," In *Selected Breathing Masterclasses*, edited by Windplayer, (Malibu: Windplayer Publications, 2006)

[369] Aarhus von Niels Bak, "Eine physikalische und physiologische Untersuchung der Blastechnik des Blockflötenspielers," *Das Musikinstrument: Internationales Fachblatt für Herstellung* 27, no. 5 (1978)

[370] Terence Small, "Wind Instrument Tone Quality: A Visual Perception Approach," *The Instrumentalist* 23, no. 9 (1969). See also [370] Isabelle Cossette, B. Fabre, V. Fréour, N. Montgermont, and P. Monaco. "From Breath to Sound: Linking Respiratory Mechanics to Aeroacoustic Sound Production in Flutes," *Acta Acustica* 96 (July/August 2010)

[371] Stephen Schellenberg et al., "Air Pressure and Rate of Flow for Double Reeds," *The Double Reed* 5, no. 1 (1982)

[372] Isabelle Cossette, B. Fabre, V. Fréour, N. Montgermont, and P. Monaco. "From Breath to Sound: Linking Respiratory Mechanics to Aeroacoustic Sound Production in Flutes," *Acta Acustica* 96 (July/August 2010)

APPENDIX B

TECHNICAL TERMS

For definitions of technical terms use in this research paper, visit the following website: https://www.britannica.com/

Abdomen
Abdominal breathing
Abdominal muscles
Alveoli
Bronchi
Bronchial tubes
Capillaries
Carbon dioxide
Chemoreceptor
Diaphragm
Esophagus
Expiration
Expiratory reserve volume
Glottis
Hard palate
Hyperventilation
Inspiration
Inspiratory capacity
Larynx
Lips
Mandibula
Mouth
Nose
Oxygenate
Pelvic floor
Pelvis
Pharynx
Phrenic nerve
Reserve volume
Residual reserve volume
Respiratory system
Soft palate
Tongue
Throat
Trachea
Visceral cavity
Vital Capacity
Voice box
Windpipe

APPENDIX C

EXERCISES

Before I make a list of the applied exercises, I would like to write a few words about them. Exercises are commonly used when learning a musical instrument. Every person has experience in learning or carrying out many of them since it is part of the learning process. Exercises, in general, help prepare the body, and in many cases the mind, for specific tasks to be executed with greater control and accuracy. Few exercises are to be executed with an auxiliary tool such as a pencil, breath builder, book, or even with the aid of a paper. Some individuals might do exercises on a daily basis while others may do them periodically. Some authors advocate using specific exercises on a daily basis and others encourage to use them to attain a certain level of command or control over the body. Their value, nevertheless, is of great importance since all of these exercises have a specific aim.

In this section, I have created a comprehensive list of exercises from the articles review with the hope that they might give additional detail on the topics discussed and serve as practical studies for further development of instrumental techniques. The same exercises that were presented by more than one person are only included once in this list despite small deviations they might have. Most of the exercises came from professional musicians, however, some of them are authored by athlete coaches, yoga masters, and pulmonologists in woodwind journals. The author and the name of the exercise are referenced with footnotes. I have provided descriptors for unnamed exercises. This compendium of exercises is divided into six categories based on their focus: (1) capacity exercises, (2) control exercises, (3) general exercises, (4) endurance exercises, (5) awareness exercises, and (6) relaxation exercises.

Exercises to Gain Greater Capacity

Larry Guy[373]

Breath Builder with Wide and Narrow Tubes: (1) Make an embouchure and close down the wide tube with the pressure of the lips, and inhale and exhale strenuously, keeping the ball up. Put one hand on the abdominal muscles to monitor their expansion and contraction. Repeat 10 times in front of a mirror, observing the abdomen muscles and chest. (2) Close a large and a small hole at the top of the breath builder, thereby adding some resistance to its operation. Inhale and exhale as before and increase the lengths of both. Put the metronome on at 60 and count the number of beats you can exhale, keeping the ball lifted. Repeat 10-15 times, monitoring the expansion and contraction of the muscles of breathing. (3) Switch to the narrow tube, again close a large and a small hole, and inhale and exhale, keeping the ball up. With the metronome at 60, make a note of the highest number of beats you can exhale. Over the next few weeks, strive to increase those numbers. (4) Narrow tube again, metronome at 60. After the third beat of exhale, articulate, using the tip of the tongue, which will touch the lower edge of the tube (do not attempt to close the opening of the tube with your tongue-the ball will drop). Again, take note of your highest exhale numbers, and strive to increase them.

[373] Larry Guy, "The Pedagogy Corner," *The Clarinet* 36 (December 2009): 32-35.

Karen Demsey[374]

Clipping off beat: Set the metronome at 60 beats per minute. Inhale on five beats, achieving full capacity of air in that time. Without skipping a beat, the student should then exhale over 10 to 15 beats. This will vary from student to student, but it is important to stress complete control over the release of the airstream. When you have mastered this, change the inhalation time to four beats. From there, proceed to three beats inhalation time during the exercise, then two, and finally one, keeping the exhalation time the same each time so that the student must take in the same amount of air in a shorter length of time. It will be readily apparent at each attempt if less air has been inhaled in the shortened amount of time, as it will be impossible to exhale for the same number of beats as is previously done if the same intensity of the airstream is maintained.

Sarah Baird Fouse[375]

Panting: Begin in a standing position with an open throat and mouth. Take deep, slow breaths. Gradually begin to pant faster. The muscles around the waist should expand and move freely. Expand the waist outward while inhaling and contract the waist inward as the breath is exhaled. The intent is to relax the body and extend the breath intake.

The Thinker: Sit down, place elbows on knees and cup hands on the jaw to support the head. The take deep, slow breaths in a relaxed manner. When breathing in this position, expansion can only occur around the waist. If the belt or ban around the waist feels tight when inhaling, the breath is deep with good waist expansion.

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[374] Demsey, "Breath Control and the Beginning Flute Student II," 6-8.
[375] Sarah Baird Fouse, "Breath Control Exercises," *The Instrumentalist* (January 1980): 36-39.

Four-Second Balloon: Stand up and place the palm of the right hand one inch away from the stomach. Take a slow, four-second breath allowing the stomach to expand outward to touch the hand. Exhale then take another breath and hold for four seconds with your stomach touching your hand. Exhale slow! for four seconds. Next, place the thumb and the first finger firmly around the waist at the side slightly under the rib cage. Breathe deeply (four seconds), hold your breath (four seconds) and exhale slowly (four seconds). Then, place the first fingers of both hands on the back just below the rib cage and repeat the four-second exercise. These exercises further expand the lung capacity and strengthen the stomach muscles.

Steve Wilkerson[376]

Long Breath Pushes: This exercise is a series of long breath pushes where you literally push every bit of breath from your lungs on long sustained notes. You start on third space C and, playing mezzo-forte, produce the tone and let every ounce of air escape through the horn. Then when you think there is nothing left, push the stomach forward, pushing out the air you don't think is there, but it is. Continue this down on each chromatic note until there is nothing left. Take it to the lowest note on your horn. The last four notes should be the fullest, most well-rounded sounds of the exercise. Aim for the bottom end in your sound. The entire exercise if done correctly takes about 30 minutes. It should be done with total concentration.

[376] Steve Wilkerson, "Sound Advice: Breath Control for Saxophonists," *Downbeat* 68 (April 2001): 82.

Ransom Wilson[377]

Pressure and Tension: (1) Sit in a chair, raise your legs straight off the floor and hold them there for few seconds as you inhale as deeply as possible. The pressure and the expanded feeling that you get approximate what you will eventually be able to feel when you stand up and breathe before playing. (2) To further feel the effects of the diaphragm: fasten a belt (or an elastic band) around your waist, two to three inches below your rib cage (not too tightly!). Take a breath, and try to feel pressure against the belt evenly in all directions (i.e. not only in front, but on the sides and, most importantly, in the back). After you feel you have some control over this, try to play with the belt attaches. (3) To increase lung capacity: Set your metronome to 60, and play an easily produced note piano and hold for as many seconds as you can. When you are finished, repeat but add one second to your time.

David Pino[378]

Lie down: Lie down on your right side at a full-length stretch. Draw the extreme low back and the right-side musculature firmly together, band-like, around the sacroiliac and groinal areas, prompting the lower spine into an upright stance. There must be no sagging outward in the back nor any belly protrusion in front. Note the flattening action of the lower frontal abdomen, providing muscular tone which eventually spreads into the upper abdomen. This musculature fluctuates constantly in the control of breath, must always operate with suppleness and flexibility, and must never be tense or rigid.

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[377] Ransom Wilson, "*Breathing: The Central Issue of Flute Playing*." 59-65.
[378] David Pino, "The Clarinet Teaching of Keith Stein IV: Breathing and Breath Control," 38-41.

Lie prone: Lie prone, with your back on the floor. Keep your feet flat on the floor as the knees draw in at an acute angle towards the trunk. Raise your hips off the floor and inhale, holding this position for a count of five. Straighten your knees to return to the prone posture, this time suspending the trunk between the heels and the shoulders for another count of five.

Lie on the back: Lie on your stomach with the spine arched backward in a radical, barrel-like curve, the thighs and legs bending backward to continue the hoop-like curving. Bend your elbows inward to a 90-degree angle on the floor, with the hands meeting under the chin as a headrest. Roll back and forth over the stomach in rocking-chair fashion.

Gymnastic Wheel: Purchase an inexpensive five or six-inch gymnastic wheel exerciser at a sports store. Place your knees on the floor with your hands grasping the wheel's handles. Roll the body to the floor by the use of the wheel forward and backward, the body going up and down, to develop the abdominal muscles. Do not overextend the forward movement. Secondly, extend the legs straight out behind, suspending the body between the wheel and the toes. Roll the wheel from underneath the chest to beyond the head, and back.

Knee Bending: Stand up. Assume the "upness" of spine and head (prescribed earlier in the article on posture and balance). Suddenly relax at the knee-joints, allowing them to assume an angle, but remain mindful of the entire body, especially the hips, back, and head; maintain their dynamic, postural "upness" without sagging in any part of the body. As the knees flex, hold in mind the maxim, "My back is lengthening and widening, and

my head is leaning forward and up." Allow the arms to dangle loosely at the sides, monkey-fashion. Complete the exercise by bending forward at the hips to a 45-degree angle, again concentrating on the "upness" idea. Hold the monkey-like posture for a minute before returning to the vertical position. The return procedure brings the knees to an upright alignment, followed by the trunk to its vertical position.

Michael Webster[379]

Finger Breath: Place the thumb against the palm with the index finger straight and vertical in front of the mouth, the mouth surrounding the second knuckle. Concentrating on the mouth, not the abdomen, pull air in with a loud, low sucking noise. Do not try to inhale to the maximum. Instead, allow the finger to slow down and regulate the intake of air. Quality is more important than quantity. This method of inhalation helps the throat and torso to relax and the upper ribs to expand effortlessly, including the back. While exhaling into the instrument, focus on the mouth rather than the abdomen. Many of us, in an attempt to support, make a fist with the abdomen thereby locking up the back.

Albert Tipton[380]

Chest enlarging: Expand the chest to the utmost allowing air to rush in. The chest will rise slightly as the lungs fill. Keeping the chest high, count fifteen seconds. Doing so will bring into play the muscles of the lower abdomen and diaphragm. Release the air but keep the chest and ribs open. Having done this, release the ribcage with even more air. Be careful not to overdo it as it might lead to fainting.

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[379] Michael Webster, "No Visible Means of Support," *The Clarinet* 38 (June 2011): 6-11.
[380] Albert Tipton, "Breath Control and Timing," *School Music* 42 (March 1971): 8.

Ransom Wilson[381]

Lung Capacity: To increase lung capacity: Set your metronome to 60, and play an easily produced note *piano* and hold for as many seconds as you can. When you are finished, repeat but add one second to your time.

Exercises to Gain Control

David Pino[382]

Nostril Flaring: Flare the nostril-tips holding them out wide to help open up and promote freedom of the nasal-sinus passages.

Mary Karen Clardy[383]

Release Control: Without using the flute, focus on controlling the release of air on such vocal sounds as "whoo," "sss," "woo" and so on. Add the instrument and practice long quarter tones, sustaining four beats at 60 bpm, then play even longer notes, extending them as far as possible.

Nancy Miles[384]

Measured breath: Practice playing with different lengths of breath. Breathe in for four full beats before playing a four-beat measure. Then breathe in one beat before playing the same phrase. You can experiment and control the length of that breath.

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[381] Ransom Wilson, "*Breathing: The Central Issue of Flute Playing*." 59-65.
[382] Pino, "The Clarinet Teaching of Keith Stein V," 38-41.
[383] Mary Karen. Clardy, "Flute Fundamentals. A Guide to Daily Practice," *Flute Talk* 14(September 1994): 18-20.
[384] Nancy Miles, "Breathing Exercises for Wind Players," *Windplayer* 54 (April 1996): 14-15.

Candle: Try blowing a candle flame so that it angles but doesn't go out. Control your breathing so you maintain the same angle. This helps with sustaining phrasing and controlling the speed of the airstream.

Alexa Still[385]

Trombone slide: This exercise provides a way of learning to assess our capacity, very beneficial for effective management of breathing opportunities. Using a hand as a level between empty (hand at full arm's length away) and full (hand at the shoulder), you can practice breathing in smaller than full breaths gradually working from increments of a third up to sixths, developing accuracy in assessing exactly what amount of air we contain. Having this degree of accuracy while playing makes it possible to judge exactly how long one can continue and just how big a breath one needs. Taking smaller breaths is often musically very advantageous but requires confidence!

Breathing bags: These are probably as common as metronomes among brass players! The point of a bag is to quantify the quantity of air we are able to breathe in and out. It is not to set world records (there is a limit to what can be done to improve capacity as we cannot change our given body size), but as a guide towards achieving a personal best, which will result from smart postural habits and perhaps some stretching of the ligaments involved in rib rotation/chest raise. After filling the bag with just one breath, the wrinkles or slackness in the skin of the bag should convey whether the breath is a good effort or nor (and perhaps the bag needs adjusting to bring it to a 'close' size permitting these finer wrinkles to happen). One breath in the bag can be inhaled and exhaled a number of times

[385] Alexa Still, "Breathing: Arnold Jacob's approach," *Flute Focus* 1 (July 2008): 17-18.

before running out of oxygen, so it is possible to work on speed. It should be possible to reinhale all the air with which you blow the bag up and do it quickly. Using the bag in front of a mirror is an excellent way of working on posture.

Cynthia Ellis[386]

Long tone: Play soft long tones on piccolo and time them with a goal of sustaining a good quality sound for about 60 seconds. This requires control of the air column at each moment of the exhalation process.

Sarah Baird Fouse[387]

Tire Inflation-Deflation: In a standing position with thumbs and index fingers around the waist, inhale deeply. Hold your breath, flexing the waist muscles. Expel the breath using a "hiss" sound. The hiss should be very intense, as loud as possible, and maintained at a consistent pitch. Maintain maximum muscle support around the waist until all the air has been expelled. The object of this exercise is to maintain air support at a consistent intensity. The exercise is also excellent for developing control to sustain tones longer.

Frank W. Lidral[388]

Smooth Ride: Lidral describes four long tone exercises in which the changing dynamic level serves as an indicator of the control of muscles of exhalation. The dynamic level changes should be executed without waver or jitter in the process. Exercises are played starting in pp gradually increasing to ff and back to pp on a given pitch; the other two

[386] Cynthia Ellis, "*Breath Control on Piccolo,*" Flute Talk (January 2009): 32.
[387] Sarah Baird Fouse, "Breath Control Exercises," *The Instrumentalist* (January 1980): 36-39.
[388] Frank W. Lidral, "Breath Control as Suggests by a Woodwind Specialist," *Woodwind, Brass & Percussion* (1984): 12-13.

exercises are comprised of either gradually increasing or decreasing volume to the end of the cycle. The last long tone exercise is set at a steady volume. He promises 100 percent improvement in a month if they are practiced daily for 10 minutes.

Karen Demsey[389]

Lying on the floor: Lie on the floor or another hard surface such as a large table so that the spine is well supported. Tell him or her to breathe normally, *not* deeply. Observe what part of the body rises and falls either by feeling or seeing or both. If the chest does rise and fall, you are most likely overly conscious of his or her breathing and is actively breathing rather than passively or automatically breathing. If this happens, breathe very gently through the nose. This usually prevents rapid inhalation which might cause shallow breathing from the chest only.

Book: Try the previous exercise with deeper breaths. Having mastered this, you should repeat the exercise with a book placed on the abdomen to gauge more tangibly the distance that the abdomen rises and falls. The main focus should be on the abdomen, as the majority of the "work" is done with the abdominal muscles. If you become overly conscious of filling up first the abdominal section and the mid-section, the breathing process is likely to become awkward and jerky, rather than smooth and fluid.

[389] Demsey, "Breath Control and the Beginning Flute Student II," 6-8.

General Exercises

Karen Demsey[390]

Sectioning: Take a deep breath, hold it briefly, then exhale. You might breathe from the upper chest only, and you will observe that the chest puffs out and the shoulders rise. If this happens, you are actually taking in only about one-third of the total amount of air that can be inhaled. Mark the divisions between the abdomen, the mid-section, and the chest with imaginary lines. One line should follow the waistline; the other should cut across the chest just under the bust. The inhaled air should fill the abdomen section first, followed by the mid-section and finally the chest.

Arya BastaniNezhad[391]

Automated breathing (Pinschof): This exercise has five stages. Initially, two notes a semitone apart are selected such as G-G# or A-A#. The first note is played with normal breath pressure while the second with the strongest possible accent, i.e. the kick, made by the lower abdomen pushing the air out in order to provide an in-breath immediately afterward. (1) The first stage consists of a series of repeated long low note as ending with a kick over an accented crotchet. **(**2) In the second stage, the timing of the kick is important, and the kicks are treated as rhythmic values. Rhythmic control of the kicks helps activate the relevant abdominal muscles. (3) The third stage is a more advanced form of the bending exercises that accompanies changing the vowel mouth shapes. (4) In the fourth stage, the focus is on a smooth scale-wise motion in the range of one octave done through kicking

[390] Demsey, "Breath Control and the Beginning Flute Student II," 6-8.

[391] Arya BastaniNezhad, "Automatic Breathing and Flute Performance," *Pan: The Journal of the British Flute Society* 32 (September 2013): 32-37.

the accented notes of F major scale. (5) The fifth stage is the continuation of the fourth stage over two octaves.

Sarah Baird Fouse[392]

Isometric exercises: Isometric exercises are those that push muscle against muscle-flexing. To improve muscle tone for good breath support, flex the muscles out around the waist and check for firmness. Flex this muscle several times a day to build firmness.

Alexa Still[393]

Singers' Chest: Standing with good attention to the knees and posture generally, hold arms straight through the elbows and horizontally. Inhale while rotating the hands so that the thumbs point first upwards and then behind with palms facing upwards. Gently exhale the first breath while rotating thumbs back towards the front and then to the floor, palms downwards. Repeat inhalation, but on this occasion keep inhaling little amounts as far as possible, 'topping up' to maximum capacity. When full, drop the arms to the sides but retain all of that air. The chest shape at this point is tremendously big and can set the example for what is personally attainable. (The arms help put the shoulders into the best spot but this chest shape it can be replicated without using the arms).

Patricia George[394]

One-nostril breathing: This exercise helps achieve balance and relaxation. Close one nostril with your fingertip and breathe naturally a dozen or more times. Then close the

[392] Sarah Baird Fouse, "Breath Control Exercises," *The Instrumentalist* (January 1980): 36-39.
[393] Alexa Still, "Breathing: Arnold Jacob's approach," *Flute Focus* 1 (July 2008): 17-18.
[394] Patricia George, "Breathing," *Flute Talk* 28 (February 2009): 2-9.

opposite nostril and breathe a dozen or more times. Then breathe regularly with both nostrils. Most people find that a more balanced breath is possible after doing this exercise.

Michael Webster[395]

Mountain Pose: Stand in front of a wall and raise your sternum touching the wall with the heels, buttocks, shoulder blades, and head. Breathing through the nose at a comfortably slow pace (which will get slower and slower with practice), inhale while lifting straight arms out to the side and up overhead, clasp your fingers, and invert your palms toward the ceiling. not to shrug your shoulders while stretching your arms straight up. The motion should be timed with the inhalation so that you are ready to exhale as you bring your arms back down to your sides.

Shoulder Rotation: Start with your hands clasped overhead. Inhale, leaning back. Exhale rotating the shoulders in an outward arc with your arms circling down close to your body and ending straight in front of you, shoulder level, palms up. Meanwhile, straighten your back. Inhale and retrace the movement to starting position without bending your back. Exhale bringing the arms to the sides.

Torso Twist: Inhale, raising your arms sideways to shoulder level, palms down. Anchor the feet, exhale while twisting to the 1ight, ending with the right arm stretched directly behind and the left arm stretched directly in front. Let your head move slowly with your shoulders. Encourage your hips to remain facing forward and your gaze to move toward your right band without straining your neck. Exhale while returning to center.

[395] Michael Webster, "The Home Stretch. I," *The Clarinet* 34 (December 2006): 12-15.

Chin Tuck: Locate the sternoclavicular notch with your fingers by feeling your sternum (breastbone) and the two bumpy protuberances of the clavicles (collarbones) just above the sternum. Place your chin in the notch while relaxing the jaw and shoulders. Raise the sternum again, just to be sure. The chin tuck helps to keep the neck supple.

Werner Seltmann[396]

Inhalation: Place the hands on the abdomen. Breathe in and let the thorax expand as little as possible. The abdomen protrudes because the diaphragm lowers pushing the viscera down and out. Do now as in the first step and pay attention to the whole abdominal muscles stretching in all direction. The abdomen should stay flat and wide. The tension of the abdominal muscles becomes apparent. In the next step, take a very deep breath as if needs to yawn and set aside the deliberate inhibition of chest expansion and experience a combined-breathing.

Endurance Exercises

Sarah Baird Fouse[397]

Long Tone Contest: Begin in a standing position holding your flute and fingering C5 (flute). Inhale and sustain this pitch "'at a mezzo piano as long as possible. After all the breath is expelled, sit and relax. Then repeat the exercise. This exercise extends the breath.

[396] Seltmann, Werner. "Erfahrungen im Unterricht mit Anfängern im Blasinstrumentenspiel. Schwerpunkt: Die Atmung." *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 4 (September 1989): 115-23.

[397] Sarah Baird Fouse, "Breath Control Exercises," *The Instrumentalist* (January 1980): 36-39.

Uwe Grodd[398]

Bounce Breath: A good example of this is the often-require 'bounce' breath - tiny, short snippets of air intake after a small phrase or motif. This can be done for minutes at a time, without a large breath, while sounding simple and effortless. The larger muscle groups keep the breathing frame open and upright and in 'tune', and the tiny breaths simply flick into the body and onto a 'bouncing inner-membrane' that is flexing and exhaling at small intervals, as require.

Jim Kanter[399]

Endurance exercise: Turn on the metronome to 40 and play a chromatic scale starting on low E. Start the exercise with the tongue, and hold each note four beats. Slur from one note to the next. Play as many notes as you possibly can in one breath. Rest four beats and begin with the last note of the previous group. If you play E, F, F# (clarinet), and run out of air on the F#, rest four beats and start the next pattern on the F#. Continue with F#, G, G#, etc. Go from low E as high as you can play-eventually up to a double high C-and back down. The exercise is to be played forte. Play it as loud as you can and still produce a *beautiful tone.* Don't play louder than you can control the quality of the sound, but it should be a forte exercise.

[398] Uwe Grodd, "Breathing: Irony, contradiction or joy?," *Flute Focus* 1 (July 2008): 29-30.
[399] Jim Kanter, "Breathing and Blowing," *Windplayer* 7 (November/December 1990): 22.

Nancy Miles[400]

Top it off: Before starting a phrase that is particularly long, take a deep, relaxed breath and then, just before playing, take an extra sniff, literally a sniff, on top of what you think is as much air as you can hold.

Laurel Ridd[401]

Stirring stick: Students can practice imitating a stir stick with their lips to develop those little muscles.

Mixed: Octave slurs, volume tapers (using a tuner), pp long tones, and the overtone series are great exercises for the embouchure, and for the support.

Accent notes: The exercise involves playing short accented notes without tonguing them.

Awareness Exercises

Nancy Miles[402]

Awareness 1: To improve your awareness of your airstream, try blowing a candle flame so that it angles but doesn't go out. Control your breathing so you maintain the same angle. This helps with sustaining phrasing and controlling the speed of the airstream.

[400] Nancy Miles, "Breathing Exercises for Wind Players," *Windplayer* 54 (April 1996): 14-15.

[401] Laurel Ridd, "Developing Good Flute Playing in Individuals and in the Section," *Canadian winds: the journal of the Canadian Band Association* 11 (Spring 20013): 55-59.

[402] Nancy Miles, "Breathing Exercises for Wind Players," *Windplayer* 54 (April 1996): 14-15.

Josh Kemp[403]

Breathing Meditation: Lay down on the floor and stay still. Focus the mind on all of the physical movements which together make up the breathing mechanism. Sensing what is happening, what movement is occurring helps to be aware of them while playing the instrument. Keep the breathing at the forefront of one's mind, count the breaths one to ten and repeat round and round

Geraldine Allen[404]

Exercise 1 & 2: Inhale deeply and hold your breath (with your mouth open). What is stopping the breath from coming out of your mouth? Looking at the answer, feel the different tensions in your body. Take another breath and see what you think. Now release your breath. What change is there in your body in order for the breath to be released? Have a pause while you think about this. This could be a "Looking out of the window moment!" Feel what your body is doing, where are the tensions, what is preventing the air from coming out of your mouth? You need to know where the tensions are in your body. Try again and this time keep your throat as relaxed and as open as possible. It is not the throat that controls the airflow. Now breathe in and release your breath again. Notice that your abdomen remains expanded and tense while you are holding your breath and the abdomen is relaxed and the diaphragm moves up when you release your breath.

[403] Josh Kemp, "Breathing Fundamentals for the Saxophone," *Clarinet & Saxophone* 39 (Fall 2014): 28-29.

[404] Geraldine Allen, "Clarinet Realities. I," *Clarinet & Saxophone* 37 (Spring 2012): 10-14.

Linda Davies, Kathleen Reilly, Francine Toye[405]

Trans-abdominal muscles in lying: Lie down on the floor and find your neutral spine. Supporting your head if you need too, gently lift your shoulders up a few centimeters (1 inch). Hold for 3 seconds. Gently lower your head back down to the floor. Repeat. Build up gradually to 3 sets of 15 repetitions.

Bridging in lying: Find neutral spine. Push through your feet to gradually lift your bottom off the floor. Imagine that you are moving your spine segment by segment. Next, gradually lower your bottom back down to the floor. If you move segment by segment, this can improve your awareness of the spinal joint positions.

Pelvic tilts in sitting: This is a great exercise to do if you are sitting still for long periods of time: Find neutral spine in sitting. Lift pelvic floor and keep it lifted. Brace your abdominal muscles. Keep your upper back upright whilst tilting pelvis forwards and backwards.

Elizabeth Raum[406]

Stretched hand: Have somebody hold your instrument and have the person turn it backward so they can finger it. Then have them position it with the reed in your mouth to simulate playing it yourself. Put your hands on the person´s shoulders, lock the elbows so the arms are straight out, and push down on their shoulders. Sometimes you have to push

[405] Linda Davis, Kathleen Reilly, and Francine Toye, "Tuning up your body," *Pan: The journal of the British Flute Society* 32 (September 2013): 38-41.

[406] Elizabeth Raum, "Spotlight on Woodwinds: Oboe Basics," *Canadian Winds: The Journal of the Canadian Band Association* 6 (Fall 2007): 24-26.

down with all your strength. When you do this, the stomach automatically engages the support muscles and you find blowing the oboe easy!

Kerry Elizabeth Walker[407]

Blowing hard: Breathe in. Place the palm of your hand over your mouth, completely sealing it off. Now blow hard against your hand, trying not to break the seal. With your other hand, feel below your ribs, detecting the firmness of the support muscles.

Cough: Cough and at the same time feel below your ribs to detect the support muscles.

Holding breath: Inhale, hold the breath in and brace yourself as if someone were going to hit you in the stomach.

Balloon: Blow up a balloon to experience how it feels to blow supports air.

Leone Buyse (exercises, designed by James Kortum)[408]

Tighten the abdominal muscles by pulling in your stomach without your instrument. Remember that the abdominals are a sheath of muscles extending from the abdomen up to the ribs as anyone who has ever done sit-ups or "crunches" can attest! Maintaining this muscular tension, inhale and begin to expel air slowly from your mouth as if gently blowing out a candle. Still keeping the abdominals contracted, inhale and repeat this cycle two more times. Ask yourself if this unpleasantly tense sensation is similar to how you feel when playing the end of a long phrase, and if your subsequent breaths are fully satisfying or constricted. Begin the next exercise as in steps I and *2,* keeping the

[407] Walker, Kerry Elizabeth. "Teaching Young Flutists Breath Control." *The Instrumentalist* 43 (January 1989): 21.

[408] Leone Buyse, *Breathing Demystified: A Recipe for success*, (Galesville: Meredith Music Publications, 2008), 15-17.

abdominals tight. After exhaling for about three seconds, release the abdominal tension and continue to blow, meanwhile maintaining the same airspeed. Repeat this cycle twice, always beginning with contracted abdominals and then softening the muscles during exhalation. At this point, ask yourself if there is a noticeable difference in your breath capacity when you exhale with relaxed abdominals. Still, without your instrument, inhale with tight abdominals, begin to exhale, relax the abdominals, and when your air supply is depleted, allow air to enter your body naturally, in its own rhythm. Repeat this cycle two more times, *but with relaxed abdominals* at all times. Are you now starting to sense a natural rhythm to your breathing, perhaps even a slight pause between exhalation and inhalation? Are you becoming more aware of abdominal tension?

Werner Seltmann[409]

Exhalation: Stay relaxed and inhale very slowly stretching the process of exhalation for as long as possible. Proceed as in the first step and now breathe out the air through a very small opening of the mouth. Observe the chest and abdomen areas: The stomach should pull inside because the diaphragm ascends and the ribcage returns to neutral. For the next step, we start as in the second exercise but first let the ribcage collapse and try to keep the stomach out as long as possible in its peak-inhalation position. The diaphragm should then relax only slowly as the abdominal wall start to pull inward starting from below. This exercise helps to observe how the diaphragm functions.

[409] Seltmann, Werner. "Erfahrungen im Unterricht mit Anfängern im Blasinstrumentenspiel. Schwerpunkt: Die Atmung." *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 4 (September 1989): 115-23.

Breathe in and hold the breath in as if wanting to exhale. With the enclosed space, the muscles of exhalation start to act: Through the present tension of the diaphragm, the intercostal muscles and, to some extent, the abdominal muscles come into action so that the thoracic cavity barely shrinks. The resulting air pressure lowers slightly in the lower parts of the lungs. An inside pressure will be apparent at the height of the lower ribs and the beltline which is balanced by the abdominal muscles.

Sibylle Gottschewski[410]

Hair Puller: Grab your hair with one arm on the top of your head and pull it upward as if it is a long as to stretch your arm straight upward. Lower your arm sideways until it rests on the thigh. You should inhale as you pull your hair and exhale as you rest your arms. Before you repeat the exercise with the other arm, close your eyes and notice whether you feel both halves of the body, especially the shoulders, the same way.

Relaxation Exercises

Josh Kemp[411]

Alexandrian Lying Down: Lie down on a firm surface, with the knees bent up, but the feet flat on the floor and put some support, often a thick book, under your head allowing the back and chest muscles to relax. Allowing both greater lung capacity but most

[410] Sibylle Gottschewski, "Sinn und Unsinn von Atemübungen: Physiologische und methodische Aspekte der Atmung bei Bläsern. I," *Rohrblatt: Magazin für Oboe, Klarinette, Fagott und Saxophon* 12 (December 1997): 158-61.

[411] Josh Kemp, "Breathing Fundamentals for the Saxophone," *Clarinet & Saxophone* 39 (Fall 2014): 28-29.

importantly greater freedom of movement in many of the muscle groups which are directly involved in the cyclical movement of breathing.

David Pino[412]

Stein's Vomitosis System: A drastic but effective exercise to experience the open mouth and throat. The object is to simulate imaginatively a state of nausea commonly experienced by people at some time in their lives. As the sick feeling becomes overwhelming the stomach suddenly empties itself with a series of violent but involuntary muscular contractions in the abdomen. In a flash, the back of the tongue thrusts forward, the jaw drops, the mouth and throat are thrown open excessively, and the involuntary, upward propulsion feels as though the walls of the throat had been turned suddenly inside-out.

Nancy Zi[413]

Stretch: Kneel on the floor with your knees together. Sit on your heels, with your toes pointing behind you. Keep your back straight. Place your hands in your lap, palms down. Exhale, counting slowly from 1 to 10. Simultaneously bend slowly forward from the hips until your forehead reaches the floor in front of you. If you can't stretch that far, go as low as you can. Inhale rapidly while counting slowly from one to three. Simultaneously straighten up, returning to your original kneeling position. As you inhale, expand your

[412] David Pino, "The Clarinet Teaching of Keith Stein IV: Breathing and Breath Control," 38-41.
[413] Nancy Zi, "Strengthening Your Abdominal Muscles," In *Selected Breathing Masterclasses*, edited by *Windplayer* (Malibu: Windplayer Publications, 2006): 14-15.

abdomen and your sides, but don’t lift your shoulders or raise your chest. Repeat five times, then relax and breathe normally.