Imagery and Science in Singing Pedagogy: Redefining Imagination – A First Step to Resolving the Debate

ABSTRACT

Traditional imagery in bel canto singing teaching methods appear, at face value, to be the antithesis of contemporary approaches to voice science. However, pedagogical analysis of the use of imagery, which considers the relationship between ontology, language, and practice, suggests that this is a false dichotomy, predicated on a lack of clear communication and shared aims between scientists and teachers. Imagination-based teaching strategies can be synthesized with a rigorous understanding of voice science if pedagogical and research aims are aligned and a unified language for learning is developed through collaboration between voice scientists, singing teachers, and performers. To achieve this, the field must first rede-fine the understanding of the nature of imagination and its application to the creation of a new scientifically accurate imagery schema.

Introduction

This article is in reply to De Lillis' (2020) Voice and Speech Review article, which succinctly outlines the history of the debate between traditional voice teaching and modern voice science. To move the debate forward, the central argument of this paper is that hostility between these disciplines need not exist if scientists and teachers had better communication and shared understanding of the nature of singing at both the physiological and psychological level (Nair 1999; Helding 2007). Such collaboration could help to avoid misunderstanding the role of language and imagination in learning that appears to lie at the heart of the debate (Miller 2001; Stark 2003). The benefits of voice science to both singer and teacher cannot be fully realized until consensus is reached on an evidence-based pedagogy, which critically and skillfully combines both subjective somatic knowledge and objective knowledge from science. To achieve synthesis between singing as both art and science, we must reassess our understanding of the imagery used in traditional approaches, for which I propose using the philosophical framework of Lens Theory (Wiltsher 2019). Applying Lens Theory would assist in creating a synthesis between vocal anatomy and physiology, neuropsychological processes, emotional connection to the music, and the singer's subjective somatic experiences. Subsequently, we need to apply this new understanding to the creation of a revised imagery schema for vocal education that considers image type, purpose, and accuracy in light of current scientific understandings.

The Science Vs Art Debate

There exists a plethora of excellent surveys of the history of the conflict between singing as art and science (De Lillis 2020), and it is evident that science has made many important contributions to our knowledge of the vocal system. From the early days of vocal tract dissection by Galen of Pergamum (in AD 129–199) to the development of the laryngoscope by Garcia II (in 1854), which for many heralded the decline of the dominance of the Bel Canto School, developing scientific under-standing has presented a challenge to artistic traditions. Although the debate raged through the late nineteenth and early twentieth centuries, 1970 saw a paradigm shift, affected by the establishment of the Voice Foundation Symposium. Putting a spotlight on understandings of vocal pathologies led to "voice" becoming formally recognized as a medical sub-specialism of otolaryngology in the 1980s, spawning a new generation of specialist vocal health researchers such as Sataloff and Titze. In the twenty-first century, scientific understanding and its application to singing continues to advance, notably its contribution to our understanding of cognition in neuroscience and psychology (Gardner 1993; Verdolini 2000; Howard-Jones 2018).

Understanding how the voice works has given insights into why problems arise, as well as potential treatments (Miller 2004), and many have questioned the authority and accuracy of the oral tradition of singing teaching and its reliance on imagery (Ware 2013). Discoveries in voice science have shed light on falsehoods and misconceptions within this "received wisdom" (Cleveland 1989) and rapidly dispelled many of what Deirdre Michael (2010a, 2010b, 2012a, 2012b, 2015) refers to as "vocal myths," which proliferated within the practice of singing teaching. Those who embraced the science of singing argued that teachers needed to know the physiology and anatomy of the voice to accurately monitor, assess, and prescribe effective interventions to manage vocal faults, as well as avoid practices which could be harmful (Seiler 1879). Today this concern for vocal wellbeing is at the heart of writings about singing teaching (Chapman 2017; Williams 2019).

However, despite recognition of these positive developments, the value of these contributions to the art of singing teaching continues to be debated. For every teacher who promotes an understanding of voice science there are as many who are either oblivious to its existence, through lack of adequate training (Callaghan 1998) or hostile toward its advance on what they perceive as the unquantifiable and subjective activity of singing; "[the] sole purpose of training for the profession of teaching is to improve the connection between the imagination and the sounds that eventually issue from the singers mouth" (Hemsley 1998, 111). There is a profound concern that focusing on science will lead to mechanistic performances, "forced voice production and vocal health issues" (Linklater 2006, 15) from focusing too much attention on one area of vocal production and thus preventing the voice from functioning holistically

(Paternaude-Yarnell 2003). The question repeatedly asked by critics of voice science is whether it can truly address issues of vocal aesthetics and artistry (McCoy 2012).

Although much headway was made in allying these fears by emphasizing the mind-body connection during singing (Bunch-Dayme 2009; Doscher 1999) and the importance of a well-functioning mechanical vocal system as a basis for the application of imagination in creating pleasing vocal performance, many still believe that despite best efforts, science cannot yet explain how to effect beautiful singing. A great proportion still utilize the traditional master-apprentice model of singing teaching, rich in imagery, as compensation for the perceived lack of applicability of science to somatic experiences. The use of the term somatic is vitally important here, as at the heart of the debate rests the disparity between subjective and objective knowledge. If we are to resolve this debate, science must give more attention to the somatic and recognize the value of intuitive knowledge. More value must be given to the qualitative as well as the quantitative, with a blended, mixed methods approach being applied to research, pedagogy, and practice.

The Fundamental Problems

For some, the enduring limitations of voice science lie in its ontological and methodological positions. The search for objective, measurable truths has become the over-whelming trend in contemporary voice pedagogy, yet this approach is not without its challenges. Callaghan (1998, 2014) refers to the small scale of many studies with limited participants and often a lack of a control group through which to mediate findings. Additionally, the way in which samples are selected raises questions about its wider context. For example, in Ware's (2013) study of singing teachers and their use of science and technology, participants were self-selecting. This poses problems for wider extrapolation of the findings as one might suggest that respondents were those more likely to apply science in their practice since they were found via a journal advertisement, indicating that they are already committed to continued professional development and collaboration with voice professionals from related fields. For studies such as this to have real impact and meaning, we need to include those who are not already thus engaged.

We must also consider study location. Often laboratory conditions bear little resemblance to the singing studio, and we must question whether results gained in research can be replicated. Studies from other scientific disciplines suggest that laboratory results can be less useful than those from the field when it comes to practical application (Sun and May 2013). However, a landmark survey of psycho-logical experiments found that the reliability of the data when applied in the field was very much dependent on subfield, research topic, and the effect being measured (Mitchell

2012). To extrapolate from laboratory findings accurately and use-fully, we must consider the environment within which the studies take place and how this relates to our own teaching environment, and crucially (to successfully embed singing as motor-learning in the implicit memory) the environment within which the end goal—performance—will take place (Helding 2008, 2009; Verdolini 2000). A third, and arguably most important methodological problem can be found at the genesis of all research: what questions are we asking? Voice researchers are simply not asking the right questions (Helding 2007). When examining the value of science across society, it is important to remember that science does not have all the answers (Steane 2018). There are many areas which science can explain, but what it cannot do is make value judgments (Scriven 1972). It is unable to explain aesthetic value and by extension cannot therefore offer a comprehensive explanation of either what makes a "good" voice or how to produce a "good" voice.

Verdolini argues that to apply scientific learning to singing more effectively, we need to attend to the psychological differences between "knowing that" and "knowing how" (Verdolini 2000). For example, science has illuminated much about the workings of the respiratory system and the role of abdominal musculature in inspiration. Although there remains some discussion over what exactly is meant by "supported singing" (Watson and Thomas 1985; Leanderson, Sundberg, and von Euler 1987), it is generally agreed that the diaphragm is an active muscle of inspiration. This knowledge has contributed to the evolution of breath management for singing and the dominance of the "belly out" school and use of SPLAT breath (Chapman 2017); however, it does not actually tell us how to optimize the efficiency of this system when applied to the art of singing. Informed by science, one can learn that taking a deep breath is important and what happens, but one cannot know how to apply this breath coordination to artistry. One can be adept at breathing strategies, but this does not necessarily translate into producing a pleasing vocal sound. The voice is a complex, holistic system and is more than the sum of its parts.

It is my assertion that the reason science is not asking these questions is because it is intrinsically unable to answer them due to its antithetical juxtaposition to somatic activity. The fundamental problem underpinning the debate rests on the twofold dilemma of how we reconcile objective scientific study with subjective somatic experience, and most importantly for singing teaching, how we disseminate this information in a way that is transformational for our students. The issue of science communication by voice professionals cannot be overlooked. Stark (2003) argues that the entirety of the debate rests on the problem of language and the fact that voice scientists and singing teachers do not share a linguistic framework within which to synthesize their practice. We need to redesign the language of voice pedagogy in collaboration with scientists (Sataloff 1995) to ensure that our students have a beautiful but well-constructed and healthy vocal instrument, where each part is trained and then

connected to the others, through a holistic and artistically nuanced pedagogical approach.

My proposed solution is that we redefine the language we use in teaching within the combined frameworks of Philosophical Pragmatism (Dewey as collated by Hickman and Alexander 1998) and Lens Theory of Imagination (Wiltsher 2019). Pragmatism argues all experience is a posteriori (deductive reasoning known through observation and experience) and should be analyzed and critically evaluated using a scientific framework. As singing is somatic, with vocal knowledge drawn from practical experience, this guiding principle provides an excellent basis for unifying both science and art. Coupled with this, I argue that employing Lens Theory to redefine our understanding of imagery is a helpful basis for developing a new pedagogical schema of scientifically informed imagery that can address an individual's experience and interpretation of singing and music within an accurate physiological, anatomical, and neuropsychological framework.

Toward a New Language for Learning

"It is through language that teachers teach and children learn" (Alexander 2004, 4).

The language we use as teachers has the power to confuse or elucidate. In the teaching studio, it ought to be applied judiciously with thought to its purpose and potential consequences. In surveys of image-based language used by singing teachers (e.g. see Reid 1983), the language of singing teaching lacks a unified approach in its application of science. For many, scientific language holds little meaning and limited value in terms of practical application (De Lillis 2020). Therefore, imaginative language is employed when discussing concepts and tasks within lessons. However, imagery can perpetuate myths and misunderstandings if not grounded in accurate science.

For Paul Kiesgen, voice pedagogy is "a discussion of how the voice works combined with a discussion of how we can apply this information" (2005, 41). If we can change our terminology to include more scientific language, we can affect changes in the vocal production of our students (Swank 1984). Yet these changes can only be brought about when the aims of both scientists and teachers align to make the theoretical practicable (Nair 1999). Science needs to be applied to tradition to free us from the mistakes of the past and move forward with a fresh and revitalized understanding. It is then up to the teacher to gain enough up-to-date knowledge to judiciously apply science within singing lessons and select the correct language and imagery to inform but not overwhelm the student (Bozeman 2007). I argue that there remains a place for imagery

in the singing studio as a means of eliciting a well-connected and emotionally based primal sound (Chapman 2017), but this imagery should be grounded in anatomical and physiological accuracy and utilized as a vehicle for communicating science and inspiring its application. To do this, we must first redefine our understanding of imagination as a lens not a mirror (Wiltsher 2019).

Redefining Imagination

The difficulties surrounding our use of imagery have their roots in the rival schools of Aristotelian and Platonic thought. For Aristotle (De Anima), imagination was of central importance for understanding human experience and bridged the gap between our perceptions and thought. In contrast, Platonic mind/body dualism saw the image as a mirror; a pale reflection of knowable truths, and a poor form of cognition (Plato, Theaetetus; Wittrock 1977). During the sixteenth and seventeenth centuries, the deepen-ing of patriarchal systems during the Reformation and the increasing spread of Renaissance thought in Western Europe sowed the seeds for much of our present-day distrust of intuitive and somatic knowledge. Imagery was ousted as a mainstay of public academic life.

However, if we bridge the gap between these two positions and consider the possibility of imagery as a tool for gaining understanding of the empirical then we begin to see how it might be applied in the same fashion as a bridge between voice science and singing eaching. Aquinas, (Summa Theologica) discusses imagination in relation to the virtue of prudence (a priori knowledge or reason), which is employed to help us make sense of the world (a posteriori knowledge). Wiltsher (2019) has suggested that when employing imagi-nation in this way it is more accurate to refer to it as a lens that sharpens our perceptions and deepens our knowledge rather than a mirror which merely reflects existing experience in an attempt to categorize and understand new learning (Sheppard 2003). The image as a lens directs us to “phenomena themselves rather than to the relations they bear to other phenomena” (Wiltsher 2019, 14). This is important, as for something to be a truth it must have its basis in both fact and imagination (Otto 1930). Simply knowing something is true intuitively is not enough. For the singing teacher, imagination as a lens provides us with a tool which focuses our attention on the factual basis of the vocal system whilst the creativity of the image allows us to apply this artistically.

From Theory to Practice

To understand the importance of this redefinition in practical application, we may turn to Damasio’s Somatic Marker Hypothesis (1991). Grounded in the philosophies of

thinkers such as Spinoza (who emphasized the interdependence of the mind and body), Damasio postulates that it is from unconscious physiological responses to stimuli that we develop psychological understanding and meaning. By employing imagery that elicits certain emotions, we can exert control over various physical processes that we would not be able to manipulate otherwise. Coupled with growing understanding of the process of rehearsal and its positive effects on motor-learning, we begin to see how mental images could be utilized to produce a desired vocal sound by stimulating a physical response in a part of the vocal system that is not usually under proprioceptive control. Imagination can help us to rehearse and simulate activities even when we are unable to physically exert control over important elements of the activity in question; the brain imitates so the body can do (Currie and Ravenscroft 2002; Goldman 2006). Clearly this is important for many singing tasks where direct manipulation of the body is not possible (e.g. diaphragm).

Having outlined the theoretical framework of imagery within which to work, we can now see how that can be utilized to develop a new image schema for singing teaching. Taking Lens Theory and Pragmatism as our foundations, we can begin an up-to-date survey of current imagery use and assess whether each image is acting as a lens that sharpens our understanding of vocal anatomy and physiology. Within this analysis, we must also consider image type. Much of the debate focuses on verbal images such as metaphor, but with the advances in science, even independent voice teachers now have access to a range of imaging technology (Nair 1999; Ware 2013). Sports science also has much to offer here, with scope for considering a multi-modal approach to imagery-type and use. In particular, models such as PETTLEP (Holmes and Collins 2001) encourage exploration of both visual and kinesthetic imagery, as well as emotional imagery such as that considered in Damasio's study. With reference to a taxonomy of imagery (Holt 1964; Paivio 1971), we can gain further clarity and accuracy in our use of images as it will help us consider not only their design and content but also their application. For authors such as Helding (2008) and Verdolini (2000), it is not the content or the quantity of the teacher's knowledge that makes learning successful but how it is communicated to the student. Drawing on the work of Gardner (1993, 2006), we must also be aware of the variety of learning styles. For some, too much scientific information may cause them to become over focused on mechanics (Verdolini 1994); too little and the student may perform inefficiently. Similarly, a visual image may suit student a, whereas for student b a verbal metaphor may prove more beneficial. Therefore, I argue that for imagery to maintain its utility not only must it be grounded in current scientific understanding, but it must also be applied personally through use of co-construction (student- teacher collaboration at all stages of lesson planning, teaching and performance).

The literature on co-construction of knowledge in education continues to grow and is increasingly applied and practiced within the UK school system (Wells and Chang-Wells

1992). However, it remains largely unobserved within the tradition of master-apprentice instruction. The central thesis of co-construction is that student and teacher should plan and explore learning as a team (Bovill and Bulley 2011; Bovill et al. 2016). In somatic activity, which is by its very nature subjective, such co-construction of imagery, task, and language would enable the teacher to ensure that the learning was both accurate and effective whilst also helping students to understand the processes occurring in their own bodies. Singers could clarify, demonstrate, and explain their unique somatic experiences in the wider context of performance, teaching tradition, and contemporary scientific understanding.

Conclusion

Singing is grounded in anthropological embodiment; as humans we see and learn about ourselves and the world holistically, with both mind and body. As such we rely on imagery to make sense of the world, especially in processes that have their roots in somatic experience.

Singing is the archetypal somatic experience, and its subjective nature is what has given rise to the ongoing debate between voice science and singing teaching. As singers, we have a need for both mechanistic and imaginative understanding of our voices to enable them to function efficiently and beautifully. I believe that it is only through a scientifically up-to-date, detailed and systematic review of imagery type, purpose, and application that the debate can be resolved. Within carefully constructed ontological and philosophical frameworks, traditional voice pedagogy can be analyzed, synthesized, and ultimately united with con-temporary scientific understanding from a range of interdependent and complementary disciplines. The result will be the construction of a unique, forward-thinking educational model, which respects subjective personal experience and unique vocal qualities, as well as giving importance and value to the more quantifiable findings of scientific research.

For too long voice pedagogy has operated under a diametrically opposed system, and until such time as unity occurs and consensus is reached, the contribution of voice science to the art of singing teaching will be unable to reach its full potential.

References

Alexander, Robin. 2004. *Towards Dialogic Teaching: Rethinking Classroom Talk*. York: Dialogos.

Bovill, Catherine, and Catherine Bulley. 2011. “A Model of Active Student Participation in Curriculum Design: Exploring Desirability and Possibility.” In *Improving Student Learning - 18: Global Theories and Local Practices: Institutional, Disciplinary and Cultural Variations*, 176-188, edited by C. Rust. Oxford, UK: Oxford Brookes University.

Bovill, Catherine, Alison Cook-Sather, Peter Felten, Luke Millard, and Niamh Moore-Cherry. 2016. “Addressing Potential Challenges in Co-Creating Learning and Teaching: Overcoming Resistance, Navigating Institutional Norms and Ensuring Inclusivity in Student–Staff Partnerships.” *Higher Education* 71 (2): 195–208. doi:10.1007/s10734-015-9896-4.

Bozeman, Kenneth. 2007. “A Case for Science in the Voice Studio.” *Journal of Singing* 63 (3): 265–270.

Bunch-Dayme, Meribeth. 2009. *Dynamics of the Singing Voice*. 4th ed. Vienna: Springer-Verlag.

Callaghan, Jean. 1998. “Singing Teachers and Voice Science: An Evaluation of Voice Teaching in Australian Tertiary Institutions.” *Research Studies in Music Education* 10 (1): 25–41. doi:10.1177/ 1321103X9801000103.

Callaghan, Jean. 2014. *Singing and Science: Body, Brain and Voice*. Oxford: Compton Publishing Limited.

Chapman, Janice. 2017. *Singing and Teaching Singing: A Holistic Approach to Classical Voice*. 3rd ed. San Diego: Plural Publishing.

Cleveland, T. 1989. “Vocal Pedagogy in the 21st Century: Mental Imagery and the Teaching of Voice.” *Journal of Singing* 45 (3): 41–43.

Currie, Gregory, and Ian Ravenscroft. 2002. *Recreative Minds: Imagination in Philosophy and Psychology*. Oxford: Oxford University Press.

Damasio, Antonio, Daniel Tranel, and Hanna Damasio. 1991. “Somatic Markers and the Guidance of Behaviour: Theory and Preliminary Testing.” In *Frontal Lobe Function and Dysfunction*, edited by H. Levin, H. Eisenberg, and A. Benton, 217–229. New York: Oxford University Press.

De Lillis, Antonio. 2020. “Imagery and Science in Singing Pedagogy: A Debate Introduction and Literature Review.” *Voice and Speech Review* 15 (1): 89–95. doi:10.1080/23268263.2020.1753342.

Doscher, Barbara. 1999. *The Functional Unity of the Singing Voice*. Lanham, MD: Scarecrow Press.

Gardner, Howard. 1993. *Multiple Intelligences: New Horizons in Theory and Practice*. New York: Basic Books.

Gardner, Howard. 2006. *Changing Minds: The Art and Science of Changing Our Own and Other People's Minds*. Cambridge, MA: Harvard Business Review Press.

Goldman, Alvin. 2006. *Simulating Minds: The Philosophy, Psychology and Neuroscience of Mind Reading*. Oxford: Oxford University Press.

Helding, Lynn. 2007. "Voice Science and Vocal Art. Part One: In Search of Common Ground." *Journal of Singing* 64 (2): 141–150.

Helding, Lynn. 2008. "Voice Science and Vocal Art. Part Two: Motor Learning Theory." *Journal of Singing* 64 (4): 417–428.

Helding, Lynn. 2009. "The Missing Brain." *Journal of Singing* 66 (1): 79–84.

Helmsley, Thomas. 1998. *Singing and Imagination: A Human Approach to A Great Musical Tradition*. Oxford: Oxford University Press.

Hickman, Larry, and Thomas Alexander, eds. 1998. *The Essential Dewey Volume 1: Pragmatism, Education, Democracy*. Bloomington: Indiana University Press.

Holmes, Paul, and David Collins. 2001. "'The PETTLEP Approach to Motor Imagery: A Functional Equivalence Model for Sport Psychologists'." *Journal of Applied Sport Psychology* 13 (1): 60–83. doi:10.1080/10413200109339004.

Holt, Robert. 1964. "Imagery: The Return of the Ostracized." *American Psychologist* 19 (4): 254–264. doi:10.1037/h0046316.

Howard -Jones, Paul. 2018. *Evolution of the Learning Brain: Or How You Got to Be so Smart*. Oxford: Routledge, Taylor and Francis.

Kiesgen, Paul. 2005. "Well, Vocal Pedagogy Is All Subjective Anyway, Isn't It?" *Journal of Voice* 62 (1): 41–44.

Leanderson, Rolf, Johan Sundberg, and Curt von Euler. 1987. "Role of Diaphragmatic Activity during Singing: A Study of Transdiaphragmatic Pressures." *Journal of Applied Physiology* 62 (1): 259–270. doi:10.1152/jappl.1987.62.1.259.

Linklater, Kristin. 2006. *Freeing the Natural Voice*. 2nd ed. London: Nick Hern Books.

McCoy, Scott. 2012. "Some Thoughts on Singing and Science." *Journal of Singing* 68 (5): 527–530.

Michael, Deidre. 2010a. "Dispelling Vocal Myths: Part 1: Sing From Your Diaphragm!" *Journal of Singing* 66 (5): 547–551.

Michael, Deidre. 2010b. "Dispelling Vocal Myths: Part 2: Sing It Off The Chords." *Journal of Singing* 67 (4): 417–421.

Michael, Deirdre. 2012a. “Dispelling Vocal Myths: Part 3: Sing OVER Your Cold!” *Journal of Singing* 68 (4): 419–425.

Michael, Deirdre. 2012b. “Dispelling Vocal Myths: Part 4: Talk Higher!” *Journal of Singing* 69 (2): 419–425.

Michael, Deirdre. 2015. “Dispelling Vocal Myths: Part 5: Sniff to Raise the Palate!” *Journal of Singing* 71 (3): 319–324.

Miller, Richard. 2001. “The Syntax of Voice Technique.” *Journal of Singing* 58 (1): 49–50.

Miller, Richard. 2004. *Solutions for Singers: Tools for Every Performer and Teacher*. New York: Oxford University Press.

Mitchell, Gregory. 2012. “Revisiting Truth or Triviality: The External Validity of Research in the Psychological Laboratory.” *Perspectives on Psychological Science* 7 (2): 109–117. doi:10.1177/ 1745691611432343.Nair, Garyth. 1999. *Voice Tradition and Technology: A State-Of-The-Art Studio*. (Reprint). Boston, MA: Cengage Learning.

Otto, M. C. 1930. “Imagination and Teaching.” *The Journal of Higher Education* 1 (7): 387–390. doi:10.2307/1974172.

Paivio, Allan. 1971. “Imagery and Verbal Processes.” *Science* 176 (4035): 628–630.

Paternaude-Yarnell, Joan. 2003. “The Role of Imagination in Teaching Voice.” *Journal of Singing* 59 (5): 425–430.

Reid, Cornelius. 1983. *A Dictionary of Vocal Terminology: An Analysis*. New York: Joseph Patelson Music House.

Sataloff, Robert. 1995. “Rational Thought: The Impact of Voice Science on Voice Care.” *Journal of Voice* 9 (3): 215–234. doi:10.1016/S0892-1997(05)80230-9.

Scriven, Michael. 1972. “The Exact Role of Value Judgments in Science. Proceedings of the Biennial Meeting of the Philosophy of Science Association.” *Philosophy of Science Association Journal* 1972: 219–247. www.jstor.org/stable/3698971 .

Seiler, Emma. 1879. *The Voice in Singing*. Philadelphia: PA Lippencott.Sheppard, Anne. 2003. “The Mirror of Imagination: The Influence of *Timaeus* 70e Ff.” *Bulletin of the Institute of Classical Studies* 46 (78): 203–212. doi:10.1111/j.2041-5370.2003.tb02143.x.

Stark, James. 2003. *Bel Canto: A History of Vocal Pedagogy*. Toronto: University of Toronto Press.

Steane, Andrew. 2018. *Science and Humanity: A Humane Philosophy of Science and Religion*. Oxford: Oxford University Press. doi:10.1093/oso/9780198824589.001.0001.

Sun, Xu, and Andrew May. 2013. “A Comparison of Field-Based and Lab-Based Experiments to Evaluate User Experience of Personalised Mobile Devices.” *Advances in Human-Computer Interaction* 2013: Article ID 619767. doi:10.1155/2013/619767.

Swank, Helen. 1984. “Some Verbal Directives regarding Support Concepts and Their Effects upon Resultant Sung Tone.” *Journal of Singing* 40 (3): 12–18.

Verdolini, Katherine. 1994. “The Role of Elaborative and Perceptual Integrative Processes in Perceptual-Motor Performance.” *Journal of Experimental Psychology. Learning, Memory, and Cognition* 20 (3): 739–749.

Verdolini, Katherine. 2000. “Principles of Skill Acquisition Applied to Voice Training.” In *The Vocal Vision: Views on Voice by 24 Leading Teachers, Coaches and Directors*, Chapter 8, edited by Marion Hampton and Barbara Acker. New York: Applause Theatre Book Publishers.

Ware, Rachel. 2013. “The Use of Science and Imagery in the Voice Studio—A Survey of Voice Teachers in the United States and Canada.” *Journal of Singing* 69 (4): 413–317.

Watson, Peter, and Hixon Thomas. 1985. “Respiratory Kinematics in Classical (Opera) Singing.” *Journal of Speech and Hearing Research* 28 (1): 104–122. doi:10.1044/jshr.2801.104.

Wells, Gordan, and Gen Chang-Wells. 1992. *Constructing Knowledge Together*. Portsmouth, NH: Heinemann.

Williams, Jenevora. 2019. *Teaching Singing to Children and Young Adults*. Oxford: Compton Publishing.

Wiltsher, Nick. 2019. “Imagination: A Lens Not A Mirror.” *Philosophers Imprint* 19 (30): 1–30.

Wittrock, Merlin. 1977. *The Human Brain*. Upper Saddle River, NJ: Prentice Hall.