VOICE*Prints*

JOURNAL OF THE NEW YORK SINGING TEACHERS' ASSOCIATION

May–June 2012

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FEATURED EVENT:

OREN LATHROP BROWN PROFESSIONAL DEVELOPMENT PROGRAM *

COMPARATIVE PEDAGOGY *Weekend 2012*

June 9–10, 2012, Saturday and Sunday

Teachers College, Columbia University, 120th Street, between Broadway and Amsterdam Avenue, NYC.

During this course, six master teachers will present teaching demonstrations after case histories of students have been discussed. Concrete links will be made between various teaching strategies and the scientific and medical information covered in other courses of the PDP program. Included in the course is an ON DEMAND review of **Scott McCoy**'s *Anatomy and Physiology of the Singing Voice and Acoustics of the Singing Voice.*

SATURDAY

Janet Pranschke, Introduction: 9:30 AM–10:00 AM
Stephen Oosting, Classical: 10:00 AM–Noon
Taina Kataja, Classical: 1:30 PM–3:30 PM
Jeffrey Gall, Classical-Baroque: 3:45 PM–5:45 PM

SUNDAY

Justin Stoney, Musical Theater/Contemporary Commercial: 9:30 AM–11:30 AM
Margaret Cusack, Classical: 11:45 AM–1:45 PM
Mary Saunders-Barton, Musical Theater/Contemporary Commercial: 2:45 PM–4:45 PM
Janet Pranschke, Wrap Up: 4:45PM–5:45 PM


Janet Pranschke


Scott McCoy


Stephen Oosting


Taina Kataja


Jeffrey Gall


Justin Stoney


Margaret Cusack


Mary Saunders-Barton

MESSAGE *from the President*

This issue of VOICE*Prints* represents, for me at least, a milestone of sorts, illustrating how far we have come as an organization and as a profession. Both Mr. Matt Edwards' and Dr. Don Miller's articles are impactful and informative, and yet at the same time can be considered somewhat controversial.

Mr. Edwards raises some very important questions: when in modern pedagogy have we, as a profession of voice teachers, been asked to consider the technological merits of amplification? Dynamic vs. Condenser Mics, Digital Voice Effects, Compression, and Auto-Tune are not terms or tools that we are used to dealing with. Indeed, for many traditional voice teachers these devices are considered "tricks of the devil" to be avoided at all costs. Although Mr. Edwards prefaces his article in terms of CCM repertoire, certainly classical singers will have occasion (we hope) to record their art. What better way to equip them with knowledge that may enhance their recording career, than to accept that this technology is here to stay and must be carefully studied and understood. Thank you, Matt.

Dr. Don Miller has long been regarded as the "father of harmonic spectral analysis." The development of his VoceVista program and the electroglottograph have revolutionized our understanding of the various "resonance strategies" used by singers, from world class to novice. However, as he himself is quick to point out, "technology and knowledge do not replace, but only supplement, the traditional expertise of the singing teacher." Dr. Miller is both generous about and reverent of the knowledge that the singing teacher brings to the process, while gently guiding us to a more fact-based and universal vocabulary.

As a practitioner of a "fact-based" pedagogy, that strives to both enlighten the singer's technique AND respect his artistic choices, I am very grateful for the mentoring that I've received from Don Miller. I would encourage each of you, if you haven't already done so, to order his remarkable book, *Resonance in Singing – Voice Building Through Acoustic Feedback* (available at Inside View Press). This book, along with NYSTA PDP courses, has vastly informed my own pedagogy, and I can wholeheartedly give them, and him, my strongest recommendation. Thank you, Don.

I am proud to serve as President while NYSTA continues to realize the ever-changing needs of our student population, and strives to meet those needs with the information necessary to more fully and completely train the singers (and teachers) of tomorrow. I hope you will enjoy this closing issue of the 2011-12 season. I look forward to hearing from you (as always) and to seeing you again next fall.

Sincerely,

David Sabella-Mills

President, NYSTA

MESSAGE *from the Editor*

Dear Colleagues,

This May-June issue of VOICE*Prints* concludes the eighth volume of the journal and my fourth year as Editor-in-Chief. As always, it has been a privilege to serve as your editor, and I am looking forward to the next two years.

In this issue, we are grateful to include an article by Dr. Donald Miller, the inventor of VoceVista voice analysis software. In January, I had the privilege of hosting Dr. Miller during a two-day residency at Shorter University. Both Shorter and Auburn University (where I will begin teaching in August) are officially-licensed "VoceVista" schools, and Miller's invention of this technology has had incalculable impact on many institutions and private studios throughout the country. We are grateful for his contribution in this issue: "What Science Brings."

Matt Edwards, assistant professor of voice at Shenandoah University, is also making a name for himself as a CCM pedagogue. I know that voice teachers of all styles will find his article—"Audio Equipment for Singers"—useful.

NYSTA would like to extend a warm thank you to all four ENT's who offered free screenings to NYSTA members during the 2012 World Voice Day: Dr. Benjamin Asher, Dr. Michael Pitman, Dr. Michelle Yagoda, and Dr. Jared Wasserman.

Finally, I ask you to please remember that beginning September 2012, we will no longer mail hard copies of VOICE*Prints.* From this point forward, the bulletin will only be delivered online.

As always, VOICE*Prints* is YOUR publication, so please send all questions, comments, and suggestions for future articles to me at *voiceprints@nyst.org*.

Sincerely,

Dr. Matthew Hoch

Editor-in-Chief, VOICE*Prints*

COMPARATIVE PEDAGOGY WEEKEND 2012 *Faculty*

Soprano **Margaret Cusack** is Professor and Chair of the Piano and Voice Department at Westminster Choir College of Rider University, where she teaches private voice, opera literature, and voice pedagogy. She has been a Regional Governor of NATS and is currently a member of the Artist Faculty at the Brevard Music Center. Ms. Cusack's current and former students have sung at the San Francisco Opera, Los Angeles Opera, Washington Opera, Opera Theater of St. Louis, Glimmerglass Opera, and the Stuttgart Opera. She is a winner of the International American Music Competition at Carnegie Hall and made her New York recital debut at Weill Recital Hall in 1987. She made her New York City Opera debut in 1985 in *Carmen* and her Metropolitan Opera debut in *Elektra* in 1999 under the baton of James Levine. She has sung extensively in regional opera throughout the country, as well as in performances of major symphonic works in the United States, Europe and South America.

Dr. **Stephen Oosting** received his Bachelor and Master of Music degrees from Michigan State University and his Performer's Certificate and Doctor of Musical Arts in Performance and Literature from the Eastman School of Music. He has taught at Lehigh University, Olivet, Wagner, Upsala, and Nazareth colleges, the Eastman School of Music and William Paterson University. For the last fifteen years he has served on the voice faculty at the John J. Cali School of Music at Montclair State University, where he is Coordinator of Vocal Studies and teaches 19th and 20th-century vocal repertoire and vocal pedagogy. A frequent NATS adjudicator and presenter, Dr. Oosting has also served as governor of NJNATS. He continues an extensive career as a performer as well, in both opera and concert work, having sung more than thirty leading tenor roles from Puccini to Wagner and many oratorio and recital programs both here and abroad.

Jeffrey Gall has won international recognition for his expressive vocalism and theatrical skills, first as a countertenor and more recently as a baritone. His 1988 debut at the Metropolitan Opera marked the first appearance of a countertenor on that stage. His credits include performances at La Scala, La Fenice, Brussels Monnaie, Netherlands Opera, Deutsche Oper/Berlin, Chicago Lyric, San Francisco, Santa Fe, and Los Angeles companies. He has appeared in concert at Lincoln Center, Carnegie Hall and the Kennedy Center. He has recorded for CBS, Harmonia Mundi, Erato, Centaur, Nonesuch, Smithsonian, Symphonia, Arts, and London Decca. Mr. Gall is currently Professor of Music in the Cali School of Music at Montclair State University, where he teaches voice and directs the opera program. He is in demand as an authority on the performance of seventeenth- and eighteenth-century vocal repertory, and is an active scholar and lecturer on the music of Handel and his contemporaries.

Mary Saunders-Barton is Professor of Music, Head of Voice Instruction for the BFA in Musical Theatre at Penn State University. She also maintains a studio in Manhattan for professional performers.

In this and recent seasons her students could be seen on Broadway in *The Drowsy Chaperone, Wicked, Hairspray, Kiss Me Kate, Seussical, The Musical, Follies, Mamma Mia, Gypsy, In The Heights, A Tale of Two Cities, Hair, West Side Story, Book of Mormon*, *Newsies* and others. Mary is frequently invited to present her workshop seminar *Bel Canto/Can Belto* in the U.S and Europe. Her DVD tutorial *Bel Canto/Can Belto: Teaching Women to Sing Musical Theatre* was released in 2007. A second installment, "*What about the Boys?"* is in production. In the fall of 2011, Mary initiated an MFA degree in Musical Theatre Voice Pedagogy at Penn State University. She was recently inducted into the American Academy of Teachers of Singing. (AATS)

A native of Finland, soprano **Taina Kataja** is a fact-based vocal pedagogue and a NYSTA DVP with over three decades of teaching experience in Europe and the US. Her goal is to help her students find their authentic voices by habilitating a healthy and efficient vocal production. A trained vocologist, she also manages the voices of injured singers. Ms. Kataja is a top prize winner of numerous vocal competitions in Finland and Scandinavia and has been a featured soloist for major European music festivals. She has appeared with ensembles and orchestras in Finland, Austria, Germany, and the U.S., recorded extensively for Finnish, German, and Austrian radio stations, and produced music programs for Finnish Television. She earned diplomas with Distinction from the Sibelius Academy in Helsinki and the Hochschule für Musik in Vienna, Austria, where she was a pupil of Kmsgr. Hans Hotter. Ms. Kataja taught voice for the Vocal Arts Symposium in Spoleto, Italy, and since 1996 has served as a member of the voice faculty of the Mason Gross School of the Arts of Rutgers University.

Justin Stoney is a Voice Teacher and Vocal Coach and the founder of New York Vocal Coaching Inc. He has been featured in national and international publications such as Esquire Magazine, Newsweek/The Daily Beast, NME, and Backstage. Backstage readers voted Mr. Stoney as one of New York's favorite voice teachers.

Justin has been featured by the Learning Annex as a guest teacher. Justin is a member of NATS, NYSTA, VASTA, The Voice Foundation, Actors Equity, Screen Actors Guild, and AFTRA. Justin's pop/rock/RB clients have had international radio airplay, have reached number one on Billboard charts, and have signed with major record labels including Sony, EMI, and Disney Records. Bands, recording artists, and singer/songwriters have toured in the US and internationally. Justin's theater clients have also appeared in numerous Broadway and Off-Broadway shows. He is thrilled to be a part of the wonderful community of dedicated voice teachers with NYSTA!

Audio Equipment for Singers

by Matthew Edwards, MM

Students studying CCM repertoire in their voice lessons, even those who sing musical theater, will perform the majority of their performances using a microphone. Since the sounds a student can make on a microphone may sound unpleasant without one and vice versa, it is becoming increasingly vital for the singing teacher to integrate this equipment into the teaching studio. For students, it is also beneficial to become familiar with basic sound equipment including set up, tone quality controls, and digital effects that will give them control of their vocal tone when performing. If you have yet to add live sound to your studio and would like to take the next step in your transition to the pop/rock age, I will cover a few of the most basic and affordable pieces of equipment you can add to your studio. I will also offer a few suggestions if you or your students would like to go beyond the basics to create a system that will maximize possibilities in terms of vocal output and tone quality.

Portable PA Systems

When I first started playing in bands, owning one's own PA system was not only expensive, it was also cumbersome, both in size and weight. A lot has changed since then. Through the online retailer *MusiciansFriend.com*, one can now buy a complete starter system for less than $200 that is small and light enough to be moved by a single person and transported in the trunk of a car. The Phonic Powerpod 410/S710 PA Package, available only online, currently sells for $199.99 with free shipping and handling. The system includes everything you'll need to get started—head unit, two speaker cabinets (with cables) that can work as both forward facing units and monitors, and one dynamic microphone (with cable). The head unit offers four inputs, two-band EQ, Reverb, Tape in/Record Out, and 100W of power—more than enough for any voice studio and many small performance venues. The only feature missing is Phantom Power, which is usually not a necessity unless you are planning on using a condenser microphone (*see below*). If you want to tweak your system from the beginning or would like to add onto an existing system, there are several upgrades to consider.

Microphones

Microphones come in two main types: dynamic and condenser. Dynamic microphones use a mylar diaphragm, moving within a magnetic field, to turn vibrations into an electrical signal that can be amplified. Condenser microphones use two thin metal plates, one positive and one negative, separated by a layer of insulation. As the sound hits the first thin metal plate, causing it to vibrate, the distance between the positive and negative plates is changed, creating an electric signal that is then sent to the amplifier. In general, dynamic microphones tend to be found mostly on the live concert stage while condenser mics are used mainly in the recording studio. Each microphone has a different frequency response that affects the output. Most have some sort of "cut" in the lower frequencies and a "boost" in the 9kHz range. "Spec sheets" are available online for most mics, enabling singers to evaluate the impact on their tone quality before purchasing.

Dynamic Microphones—cheap, rugged, and easy to use, the Shure SM-58 is the industry standard for live stage performance. *Musician's Friend* sells the SM-58 for $99 with free shipping, but one can often find them used on *Craigslist*, sometimes for as little as $25 each. Since they are nearly indestructible, this is one aspect of your studio set-up that you should not feel guilty buying used. In addition to their hardiness, dynamic microphones are fairly proficient at avoiding feedback, making them an excellent choice for rock singers who must deal with a high level of stage noise. However, this feature is largely due to the fact that their ability to amplify sound quickly dissipates with distance. Therefore, singers must often sing with their lips touching—or barely touching—the metal screen in order to get their best tone, especially if they sing with a softer or smaller, gritty sound. At louder dynamic levels, you do want to create some distance between yourself and the mic, but usually no more than three to four inches.

Condenser Microphones—these are the mics of choice in the recording studio due to their high level of sensitivity. These microphones allow the audio engineer to place the singer at varying distances and achieve different sound qualities based on the way the microphone amplifies the spectral slope of the singer. Using a condenser mic, performers can sing at nearly inaudible levels acoustically, but end up sounding intimate and earthy on a recording. To hear examples of this type of usage check out "The Story" by Brandi Carlile and "Glitter" by Pink. The same vocal effects can be produced with a dynamic microphone in live performance, but not with the clarity required on a high quality sound recording.

For artists who spend a considerable deal of time in this part of their voice, such as jazz singers and singer-songwriters, there are also live performance condenser mics available on the market. One of the most popular is the Shure Beta 87A which uses a similar design to the SM58. Just be sure that your sound system supplies phantom power before purchasing one of these mics—otherwise it will be incapable of picking up sound.

Digital Voice Effects Processors

Digital Voice Effects Processors are still relatively new to the market and have yet to gain widespread popularity among semi-professional singers. While guitarists will spend thousands of dollars on their live sound rigs, most singers are willing to accept whatever is offered when they arrive at the gig. Thanks to a company called TC Helicon, that is no longer necessary. While there are other vocal effects processors out there, TC Helicon has been leading the way in research and quality. The units are expensive, but considering that the average guitar player spends between $2,000 and $3,000 on his rig, asking a singer to pitch in $799 for the voice doesn't seem unreasonable. TC Helicon's premier unit, the VoiceLive2, incorporates more than ten effects in 205 factory presets and puts them at the singer's feet in a programmable stomp box that also includes phantom power, MIDI in/out, USB connection, guitar input, and monitor out. For the singer who needs more basic effects, TC Helicon has begun separating out the effects into smaller, less versatile pedals in their VoiceTone series, starting out at about $199 each.

Matthew Edwards

There are several vital effects that teachers and students should be aware of when trying to craft their sound. Those listed below are included in the VoiceLive and can also be purchased separately as stand-alone rack mountable units.

Compression

CCM singers often use a wide variety of vocal colors and volume levels in their performance. When using amplification, this can prove problematic for the sound team. To solve the problem, sound engineers use compression.

Compressors limit the audio output of a sound source. The user sets a maximum acceptable level for the sound output called the "threshold." The user then sets a ratio to reduce the sound output once it surpasses the threshold. The typical ratio for a singer is usually 3:1 or 4:1, which means that for every three decibels beyond the threshold level, the output only sends 1dB. For example, if the singer went 21 dB beyond the threshold with a 3:1 ratio, the output would only be 7 dB beyond the threshold point. Mic technique can provide some of the same results, but compression tends to be more consistent and gives the singer freedom to focus on performing.

Reverb
Natural reverberation occurs when the audience hears the direct signal from the singer and then milliseconds later, they hear the singer's voice again as it is reflected off the side walls of the hall. In many CCM venues the space is designed to inhibit natural reverb, but without reverb even the best singer can sound amateurish. By simulating the acoustic time delay, electronic reverb can turn any room into a concert hall and give the singer complete control of size and shape at the touch of a button.

EQ
While classical singers need to spend a considerable deal of time understanding spectral analysis, formant tuning, and acoustics in order to alter their spectral envelope, pop/rock singers only need to turn a few knobs on their graphic equalizer, known as "EQ." On a ten-band equalizer, the the typical frequencies include (in Hz): 31, 63, 125, 250, 500, 1k, 2k, 4k, 8k, and 16k. For a female, cutting frequencies in the 31-125 range can help eliminate unwanted room and breath noise. If the singer would like a little bit more "ring" or "presence" in his or her voice, it's only a few sliders away by bumping up the 2k-8k range. Using EQ to its full effect, a singer can easily brighten or darken the voice as needed in the studio and live performance.

Harmony
For those times when background vocalists are singing slightly off pitch or need a little help, the TC Helicon provides an option for computer-generated background "singers." VoiceLive's singers are never off-pitch and their vibrato never out of control. However, they also have no expression, individuality, or variations in timbre to add to the mix. While some solo artists use this effect quite successfully, most of the singers I know use it along with their live singers to beef up the sound and keep the harmony tight.

Auto-Tune
Auto-Tune has gained a bad reputation in the last few years. Auto-Tune was first used in studios as a useful way to clean up minor imperfections in otherwise perfect performances. However, it has now turned into an industry standard most singers are hesitant to record without. Whether or not an artist agrees with Auto-Tune, it is a reality in today's market and can actually prove quite useful if the sound system is less than ideal. Since the VoiceLive offers a wide range of correction and sensitivity settings, the effect can easily be set to assist the singer without making him sound like T-Pain.

Powered Monitors
Onstage volume levels can vary considerably. With drummers being able to produce sound levels as high as 120 dB, it is next to impossible for a singer to produce enough sound onstage to have any acoustic feedback. Just as a classical singer is prone to "pushing" in a poor acoustic environment, so are CCM singers. If the venue does not offer a decent monitoring system (speakers that face the singers onstage so they can hear themselves) singers can be left in the undesirable position of performing without "hearing" themselves at all. Thanks to the many low-priced powered monitors now on the market, singers can add a mic cable splitter and powered monitor to their equipment list for less than $150. If they are using the VoiceLive, they can plug in their own portable monitor right onstage and have complete control of their volume levels.

Conclusion
The decline of the major record labels has benefited many unsigned artists across the U.S. who are now able to find fame— although not always fortune—on YouTube and in their local communities. Semi-pro singers can now sound like they're signed to a major label, for only a small investment and a little time spent reading. Not only will this help them (and their teachers) win fans, it can also help save their voices so they can sing for many years. Once everyone finds out you are their teacher, you may discover a whole new clientele eager to work with you!

To see a complimentary Matthew Edwards YouTube video, go to http://www.EdwardsVoice.com (click on "Multimedia.")

Equally at home in classical and Contemporary Commercial Music Styles, ***Matthew Edwards*** *has performed operatic and musical theater roles with companies including Tri-Cities Opera, Ash Lawn Opera Festival, New Jersey Opera, Atlantic Coast Opera Festival, Bay View Music Festival, the Acadiana Symphony Orchestra, Dayton Philharmonic Pops, Hudson Valley Symphony, Miami Valley Symphony, Cincinnati Opera Outreach, and Lyric Opera Cleveland Outreach. As a guitarist, keyboardist, and singer, he has also performed pop/rock as a soloist and in bands. He has directed and acted with The Theater Lab (Dayton), Canal Days Festival, and KNOW Theater (Binghamton). He has also served on the production staffs of the Dayton International Air Show's 100th Anniversary of Flight Celebration, and the Radio City Rockettes Christmas Spectacular in Cleveland, OH.*

A specialist in working with contemporary singers, his current and former students have performed on American Idol, on and off-Broadway, on national tours, TV, cruise ships, and in bands playing throughout the US. He has worked with independent recording studios and record labels as vocal and performance coach and frequently works with classical singers learning how to "crossover."

Edwards was a member of the 2009 NATS Intern program where he was mentored by Jeanette LoVetri and Dr. Scott McCoy. He completed Level I-III certification in Somatic Voicework™ and will return this summer as associate faculty to teach a course on "Working with Technology and Somatic Voicework™. Recent presentations have included "Integrating Pop/Rock into Musical Theater Curriculums" at Indiana University; "Integrating Pop/Rock into the Private Voice Studio" at the Voice Foundation Annual Symposium in Philadelphia; International Voice Teachers panel in Gothenburg, Sweden; "Auditioning for College" Bowling Green State University SMI and Barbara Ingram School of the Arts; "How to Glee up your Choir" SCMENC. Affiliations include: NATS, NYSTA, and AGMA. www.EdwardsVoice.com


Kristen Dalto

The Janet Pranschke PDP Scholarship

In honor of Janet Pranschke, the Founding Director of the Oren L. Brown Professional Development Program, The Janet Pranschke PDP Scholarship has been established and will be offered annually to one Apprentice Teacher Member of NYSTA. Scholarship applicants must be nominated for this award by a Singing Teacher Member in good standing. Scholarship recipients will be awarded access to all five courses in the PDP core curriculum, on demand and on site. Congratulations to **Kristen Dalto**, the 2011 recipient of this exciting new scholarship! Please refer to NYSTA's website for further details.

WHAT SCIENCE BRINGS

by Donald Miller, PhD

Many years ago, when the Voice Foundation *symposia* were still held in New York, there was an open discussion on a panel made up of three teachers of singing and three voice scientists. The questions to be considered were 1) What do voice teachers want from voice scientists? and 2) What do voice scientists want from voice teachers?

What the voice scientists hoped to learn from the voice teachers has faded from memory, but I think it fair to say that what the voice teachers really wanted from the voice scientists was verification that their teaching methods were correct and consistent with healthy voice use. Something to *learn* from the scientists would be secondary.

Singing teachers are typically ambivalent about engaging the insights gained from science. They have strong opinions regarding what is good voice production, and they are reluctant to submit their opinions to the judgment of those who lack their expertise or, worse, to machines.

The invisibility of most of the "moving parts" of the voice, together with the difficulty of capturing sound quality in words, has resulted in terms that are freely and variously interpreted, rather than precise language with referents in the objective world that science inhabits. The result is that singing teachers get used to having the last word in their own studios, where the language differs in subtle ways from that of other studios. In contrast to verifiable entities like pitch, even widely shared terms such as placement, cover, and support are used variously and lack an objective, factual basis that outsiders can understand.

Application of voice science and technology to singing voice production in recent years has not fulfilled the singing teachers' wish for confirmation of their own teaching as the correct method, except perhaps in the wishful thinking of the teachers. It has, however, made it possible to get past the barrier of idiosyncratic language. This is an important advance. It happens by making visible and objective certain aspects of voice production that language alone has failed to specify.

An important example of this is the impact of spectrum analysis on our understanding of *passaggio*. *Passaggio* is a phenomenon that is traditionally recognized as the transition between one part of the singer's pitch range and another. In singing pedagogy, the concept figures prominently in the training of male opera singers, specifically in the challenging task of proceeding smoothly and reliably into a well-executed upper extension.

Spectrum analysis, which displays the relative strengths of the series of harmonics (fundamental frequency plus overtones), gives objective insight into which of the formants (resonances of the vocal tract) the singer is using as his principal resource for sound. Both the recorded literature and original, acoustically-controlled examples show that the basic adjustment of skillful singers as they move upward through *passaggio* is to go from a dominant second harmonic, resonated by the first formant, to a dominant higher harmonic, resonated by the second formant. (*See Example #1, below*)

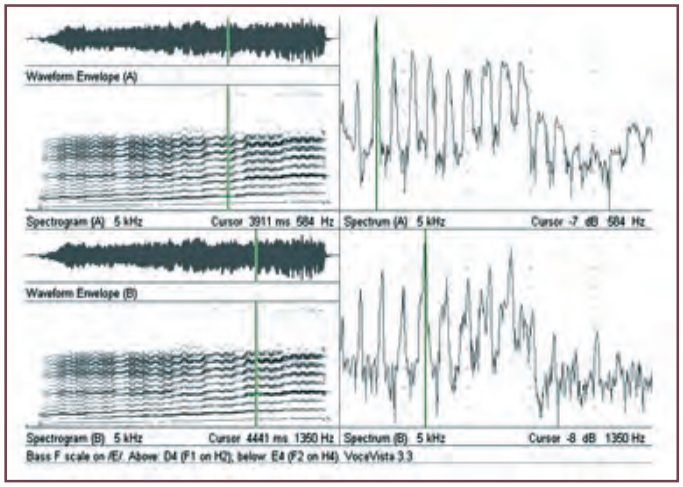
Whether this is called "cover," "turning over," or some further term hardly matters, so long as the basic mechanism can be observed objectively. If the results are displayed on a computer monitor, as they were in the "wired master class" that opened the biennial NATS national conference in 2008, both teacher and pupil can see whether the desired result is achieved. Those in the audience can see this as well, even if the teacher is describing it in unfamiliar language, or if one disagrees with the appropriateness of the move.

The microphone signal on which spectrum analysis is performed is of course non-invasive, interfering in no way with the singer's normal production. A second non-invasive signal providing insight into voice production is that of the electroglottograph (EGG). The EGG signal traces vocal fold contact by means of two electrodes on opposite sides of the larynx.

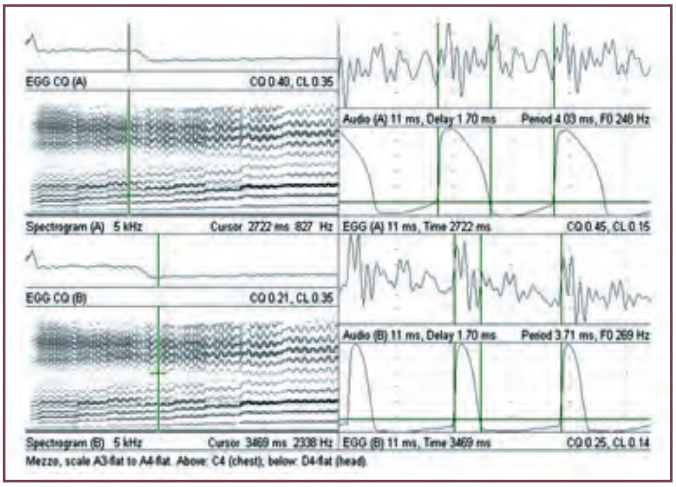
From this signal we can extract the ratio of the closed and open phases of the glottal cycle. This in turn gives us insight into the factor register (in its simplest form: chest or head). The EGG signal further gives important information on the natural robustness of the voice, as well as the success of the singer in firmly adducting the vocal folds. (*See Example #2, below*)

Feedback from the two signals I have described briefly here, together with explanation of the phenomena they monitor, is only the beginning of the positive contribution science (with related technology) has made to voice pedagogy. The technology is now affordable. What stands in the way of more rapid progress is the fact that the requisite knowledge for effective use of the feedback in the teaching studio requires considerable study. As it spreads into more pedagogy classes, and as a younger generation, accustomed to the technology, takes over, this knowledge will be part of basic pedagogy, and voice teaching will be the better for it.

Example #1



Example #2



Note, however, that the technology and knowledge do not replace, but only supplement, the traditional expertise of the singing teacher, which includes acute hearing that can diagnose the state of a pupil's voice, as well as the ability to devise an individualized program for its further development. We expect that the traditional expertise will be greatly enhanced by the technology. It will provide not only feedback on the success of the teacher's interventions, but also insight into what other teachers are achieving with their own approaches.

There is also a potential negative side to the effect of voice science on singing pedagogy. One such danger comes from the simple fact that calling attention to any particular aspect of singing draws attention away from other aspects that may be equally important. Technological aids focus on a limited part of what the singing teacher can give, albeit one that is essential and has been poorly understood.

A less obvious negative effect comes from the fact that science, by its very nature, seeks the most general truth it can find. This gives a kind of priority to physics, which describes relations in the inanimate world governing air pressure and sound transmission, over the particular strategies that we humans put to use for creating sound. It has been very helpful to generalize about voice in terms of source and filter, or the myoelastic aerodynamic theory of voice production, seeing the voice as a sort of machine for the production of acoustic signals. The engineer in us seeks the most efficient use of that machine.

In the biological world where these machines are found, however, different rules apply. Organisms use whatever is available for producing the desired acoustic signals. What is available has a long history, shaped by evolutionary forces and resulting in an enormous variety of mechanisms, some of them quite improbable. Periodic vibration can be produced by body parts that differ from one another in both large and minute ways. Understanding and coping with that variety is the province of the singing teacher.

The singing teacher's science, then, resembles that of the natural historian who must produce a practical taxonomy of the variety of forms he encounters. It is much less the science of the engineer, who simplifies in the search for efficiency. The engineer tends to see the voice as a generalized mechanism that is described with such entities as subglottal pressure, glottal resistance, airflow, fundamental frequency, sound pressure level, and vocal tract tuning, with registers and vocal tract inertance thrown in for further complication. He looks for generalizable relationships between these entities, such as how much increase in subglottal pressure is needed to raise fundamental frequency by an octave or to add 6dB to the sound output.

The singing teacher, on the other hand, needs familiarity with the great variety among the voices that take on the challenges of the shared vocal literature (which the teacher must also know). He needs to know all about male and female voices; their extreme ranges and tessituras; registers and *passaggio* points; robust and delicate structure; typical strengths and weaknesses, together with how these develop in time; vibrato patterns and how these relate to voice type; appropriate models from the recorded literature—the list goes on. A truly knowledgeable singing teacher is like an expert birder with a sharp eye for detail and a vast acquaintance with the varieties of species in the world. And to that knowledge we must add a thorough acquaintance with the feedback signals.

I can illustrate the contrast between the engineer's and the natural historian's approach with anecdotes from personal experience. In Groningen I worked together with Harm Schutte, a medical specialist and voice physiologist. We began our joint research under the supervision of Professor Janwillem van den Berg, author of the highly regarded myoelastic aerodynamic theory of voice production. Van den Berg was a physicist who had great success in investigating the voice like a machine, notably in one instance with the larynx of a cadaver. When I declared my interest in registers of the singing voice, he suggested, logically, that we keep fundamental frequency, sound pressure level and vowel constant, making register the variable factor, as if those four variables adequately described a sung tone, the way voltage, resistance and current describe an electrical circuit. Harm Schutte's PhD dissertation, supervised by van den Berg, was on The Efficiency of Voice Production, basically comparing voices of normal subjects and patients by measuring acoustic output as a function of subglottal pressure at selected fundamental frequencies. Schutte told me that he was convinced that van den Berg was quite disappointed when efficient voice production could not be shown to be a significant factor in distinguishing normal voices from those of patients.

The scientist's tendency for generalizing too freely has a counterpart among singing teachers. Many of these also tend toward thinking that all good singing is basically similar. This misleading thought comes from our remarkable ability to imitate what we hear in another voice, imagining that we are doing the "same thing," even when the sound is produced quite differently. The scientist's typical fault of over-generalization is thus unlikely to be detected by singing teachers, who often overgeneralize in their own way.

To sum it up in a few sentences, I would put it like this: a truly knowledgeable singing teacher becomes acquainted, through long experience, with an extremely complex "natural world" of vocal literature and variable voice types. Voice science, together with the related technology, has greatly eased the difficulty of finding one's way in that complex world by describing a factual side of what singers do. As a result, the singers and singing teachers are much less dependent on vague concepts whose meanings vary from studio to studio and from individual to individual.

Embracing a scientific description of the singing voice, however, comes with a danger: that of losing sight of the great variety in the species of singers. The challenge is to find a science of the singing voice that recognizes proper levels of generalization.

Dr. Donald Gray Miller *designed and developed the software program VoceVista (Visual Feedback for Instruction in Singing). He began his career as an opera singer and voice teacher.*

Having completed his formal studies at the Yale School of Music, he continued with singing lessons in Milan and Berlin, making stage appearances in both cities. After a further year's engagement with the Wiener Kammeroper, he joined the faculty of the Syracuse University School of Music, where he taught for over two decades, rising to the rank of professor. During this time he was active as a bass-baritone, singing more than 25 leading roles from the standard repertory, along with many roles in contemporary works.

His interest in the application of voice science to the singing voice grew in the late 70's, and in 1984 he spent a semester in Groningen, the Netherlands, on a project with Harm K. Schutte and the late Professor Janwillem van den Berg. In 1987 he moved permanently to Groningen to devote himself to research on the acoustics and physiology of the singing voice as an associate of the Groningen Voice Research Lab. This has resulted in a number of scientific publications together with Professor Schutte, as well as a doctoral monograph, Registers in Singing, *published in 2000.*

An important result of his work in Groningen has been the program VoceVista, feedback for instruction in singing. VoceVista was introduced in 1996, when personal computers became powerful enough to perform real-time spectrum analysis. Since then it has been further perfected and is now in use in voice labs and facilities for training singers, particularly in the U.S., Germany, and the Netherlands.

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Matthew Edwards


Dr. Donald Miller