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# Use of Instrumentation in the Singing Studio



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[Modified from: Robert Thayer Sataloff, *Professional Voice: The Science and Art of Clinical Care*, 4th edition (San Diego, CA: Plural Publishing, Inc., 2017).]

## VOICE TRAINING APPLICATIONS OF MEDICAL TECHNOLOGY

FOR GENERATIONS, BOTH MEDICAL CARE AND voice teaching have been hampered by the need to rely on subjective assessment of the voice. On those fortunate occasions when the doctor or teacher has a skilled, unbiased ear and excellent auditory memory, subjective assessment may work fairly well. However, the health and safety of patients and students in general are better served by more objective methods of voice assessment. For voice teachers, dependence on the ear alone gives rise to special problems. For example, there is sometimes disagreement as to which vocal productions are good and which are bad; whether a voice is the same, better, or worse after a year or two of training; what exactly is meant by “good” or “bad”; and so on. Consequently, it would be valuable for a singing teacher or music department to be able to assess accurately the vocal performance and progress of each student through objective measures of voice function repeated over time. Such technology is no substitute for traditional, excellent voice training; rather, it provides an extra set of tools for the voice teacher to help identify specific problem areas and to assure steady progress. Physicians have been faced with the same needs in diagnosing voice abnormalities and assessing the results of treatment. Consequently, instrumentation has been developed for medical voice assessment, as reviewed in my book in chapters on the clinical voice laboratory and on new technologies, and much of this instrumentation has potential application in the studio.<sup>1</sup>

Although instrumentation to perform all the tests utilized in a clinical voice laboratory is not widely available, much of it can be found in large cities with medical schools, especially if there is a laryngologist specializing in voice in the area. More recently, good objective assessment programs have become available on the Internet, many as freeware. All the relevant tests are painless, and occasionally they have the added advantage of detecting an unsuspected and treatable medical problem that may affect vocal training and performance. Even the singing teacher who is not in a position to utilize such technology regularly should be familiar with it, because such analysis

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may prove extremely revealing and helpful in selected students with special problems that do not respond to a teacher's usual approach.

### VOCAL FOLD VIBRATION

For the purposes of vocal training, we include in the category Vocal Fold Vibration not only true measures of vocal fold vibration, but also visual evaluation of laryngeal posture. The flexible fiberoptic laryngoscope has revolutionized our ability to visualize the larynx. It is small (usually about 3.5 mm in diameter) and passes painlessly through one nostril. Occasionally, a gentle topical anesthetic is placed in the nose, but most people do not find the tube uncomfortable in the nose, even with no anesthetic. When connected to a video camera, the flexible fiberoptic laryngoscope allows the student, teacher, and physician to watch the position of the palate, pharynx, tongue base, epiglottis, false and true vocal folds, and other vocal tract structures during speech and singing. At some institutions, such as the Academy of Vocal Arts in Philadelphia, recordings of this sort have been made routinely for more than three decades, prior to each student's matriculation as a freshman. Laryngeal posture, degree of tongue retraction, signs of strain, and other factors can then be compared with future recordings over the course of training. Such recordings are not only instructive for the student and teacher, but they may also provide invaluable feedback in selected cases. For example, occasionally, teachers encounter a student with extremely "throaty" production, marked tongue retraction, and markedly excessive tension during singing. Most such students can have their techniques improved through traditional exercises, but an occasional student finds it very difficult to change technique to a more relaxed posture. Some such students do extremely well when the usual constructs and abstractions of the studio are supplemented by visual feedback. The student can watch his or her vocal folds and tongue base during singing and eliminate the hyperfunction and tongue retraction. While such situations do not occur often, it is useful for the voice teacher to know that such assistance is available for special cases. In a great many more cases, students and teachers find visual inspection of the larynx and pharynx during singing interesting and useful, although not essential.

Vocal fold vibration can be assessed by several means. The most common and best is stroboscoped laryngoscopy. It allows detection of scars, small masses, subtle neurologic weaknesses, and other problems that may be heard in the voice as hoarseness, breathiness, or weakness. It is invaluable for a singing teacher to have such information so that the teacher and student know whether the vocal problems they are hearing are merely training deficits or are the result of a physical problem that requires special training methods.

### PHONATORY ABILITY

Objective measures of phonatory ability are easily and readily available. Maximum phonation time is measured using a stopwatch, along with physiological frequency range and musical frequency range, which can be measured at the piano. These and other tests of phonatory ability should theoretically improve during vocal training, except for physiologic frequency range (which probably remains about the same). The student or patient is instructed to sustain the vowel [a] for as long as possible on deep inspiration, vocalizing at a comfortable frequency and intensity (loudness). Ideally, the frequency (pitch) and intensity are monitored using inexpensive equipment that can be purchased at a local radio electronics store. Physiological frequency range of phonation disregards quality and measures the lowest and highest notes that can be produced. Musical frequency range of phonation measures the lowest and highest musically acceptable notes. Such tests can be performed into a high quality tape recorder and sent to a laboratory for formal analysis, including spectrographic analysis. Frequency limits of vocal registers may also be measured, as well as several other parameters. Combinations of tests of phonatory ability allow measures of glottal efficiency that may be valuable and should theoretically improve during vocal training.

### AERODYNAMIC MEASURES

Aerodynamic tests may be especially valuable to the professional voice user and teacher. In some singers and actors, lung function may be substantially less than expected. It is important to identify such vocalists and optimize their pulmonary function through aerobic exercise and other means. In other singers and actors,

initially good lung function gets progressively worse during singing or other exercise. Such singers may have unrecognized asthma induced by the exercise of performance. It is essential to identify such performers and treat them, or usually they will develop the same kinds of hyperfunctional voice abuse problems seen in people with poor support technique, even if they are trained well.

In addition to measures of lung function, airflow can be measured across the vocal folds. This provides a good measure of glottal efficiency and an objective way to identify voices that are excessively breathy, pressed, or well adjusted. These parameters should also improve during training, and this should be especially noticeable with many beginning students.

### ACOUSTIC ANALYSIS

The best acoustic analyzers are still the human ear and brain. Unfortunately, they are still not very good at quantifying the information they perceive, and we cannot communicate it accurately. Acoustic analysis equipment used to be expensive for use during routine voice teaching. However, since most of the tests can be performed from a good quality recording, they are always at a singing teacher's disposal. Moreover, fairly sophisticated systems can now be accessed free over the Internet, as discussed below. It is sometimes useful to document progress in vocal stability, vibrato regularity, pitch accuracy, or development of desirable harmonics (the singer's formant). In nonvoice majors required to study singing, visual feedback instruments are available to assist students in learning to match pitches.

Teachers interested in using more elegant technology to analyze and document voice performance, as well as for feedback during singing lessons, can now do so without investing in expensive equipment. Technological, computer-based resources and their integration into traditional voice teaching have been summarized nicely by Nair in his book and its coordinated CD-ROM.<sup>2</sup>

### LARYNGEAL ELECTROMYOGRAPHY AND PSYCHOACOUSTIC EVALUATION

Laryngeal electromyography and formal psychoacoustic evaluation have relatively little applicability in routine voice teaching. However, the principles of psycho-

acoustics may provide useful guidance for school faculty juries judging singers, actors, and other speakers. Traditionally, such juries are composed of people with differences in opinion, taste, and sometimes personality; and the biases inevitably introduced in such situations are very difficult to identify and negate. Most music and acting schools handle this problem simply by trying to have enough people on each jury to have such problems "even out." However, study of formal techniques of psychoacoustic evaluation would probably lead to improvements in the jury system.

### DISCUSSION OF STUDIO APPLICATIONS

Currently available techniques for looking at, analyzing, and documenting voice function have been used successfully by physicians and a few farsighted voice teachers. They are not substitutes for good studio teaching technique, but rather are extra tools in the teacher's armamentarium. As such, it behooves the modern voice teacher to become familiar with available technology that may enhance teaching efficiency, consistency, outcomes assessment, and improvement over time.

There are also other reasons why singing and acting teachers should be familiar with and concerned about objective voice assessment. Political and legal developments over the past several years have made it clear that voice teachers are eventually (and probably soon) going to have to introduce the same kind of peer review and quality control practiced in other professions such as medicine and speech-language pathology. At present, most teachers and music schools rely on very little beyond personal opinion to define good singing, healthy singing, successful training progress, or even a "good voice." In modern times, such subjective vagaries may be insufficient for the individual voice teacher and especially for the music school trying to assess voice teachers and select an optimal voice faculty. Objective voice analysis may help. Not only can it define parameters and progress for individual students, but it can also help teachers in self-assessment and improvement and music schools in faculty assessment. Any good teacher is eager to identify his or her strengths and weaknesses, so the introduction of objective assessment should be viewed as a blessing by most high quality people in the profession. For example, consider a school with

four voice faculty members, each of whom is assigned 15 freshmen. Each freshman can be recorded on high quality audio and videotape singing standardized scales and an audition aria and can undergo comprehensive objective voice analysis. Such recordings can be repeated at the end of the first and second semesters, and annually (or more often) thereafter. Assume further that in each studio there are four new students with the same technical problems: tongue retraction, ineffective support, poor soft singing, and slight wobble. Then assume that these problems disappear within the first year in students of three of the teachers, but the problems present in students of the fourth teacher get worse, and two or three students of that teacher who initially did not have those problems develop them. Objective voice assessments detect such patterns early, document them in a clear, scientific fashion that eliminates the perceived personal persecution with which such information is often greeted, and allows the teacher, students, and

administration to make appropriate adjustments before significant (and possibly compensable) harm is done to the students.

Clearly, objective voice assessment has been a boon to laryngologists and can be a valuable adjunct to the individual singing and acting teacher. Moreover, it may provide our first real means to define good, healthy singing, acting, and teaching and to help promulgate high standards of practice among those who choose to call themselves “voice teachers.”

## NOTES

1. Robert Thayer Sataloff, *Professional Voice: The Science and Art of Clinical Care*, 4th edition (San Diego, CA: Plural Publishing, Inc., 2017).
2. Garyth Nair, *Voice Tradition and Technology: A State-of-the-Art Studio* (San Diego, CA: Singular Publishing Group, Inc., 1999).



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