

EUROPEAN VOCAL PEDAGOGY – DIGITAL RESOURCES TECHNOLOGY

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DEVELOPING A METHODOLOGY FOR THE USE OF DIGITAL TECHNOLOGY IN TEACHING SINGING

Summary by Prof. Norma Enns

Two main goals motivated the examination of the usefulness of technology in teaching: to test the possibilities of applying various ways of representing the voice digitally in a singing lesson and to define some of the principles of methodology involved in using these tools.

Various kinds of software offer different ways of representing the voice digitally: the power spectrum, spectrograms, the electroglottograph, pitch representation, etc. Additional technology exists for measuring subglottal pressure, for example, but they are not yet available in reasonably priced practical versions for the teaching studio. Software for measuring the relative activity of the different groups of breathing muscles (*VidiVoce*). Voice range profiles offer the possibility of valuable documentation but are as a rule not suited to use as a pedagogical tool. The EGG also offers important information, but it needs experience and expertise, in order to be able to use it efficiently in teaching.

Spectrographic software is central to the use of technology in the teaching studio. Digital audio and audio-video data such as lesson or concert recordings or the voice simulation software *Madde* are also easily available and practical in the teaching studio. This article will be limited to software and methods, which can be used efficiently and requiring programmes and equipment that are available with minimal investment. The initial scepticism quickly gave way to curiosity as the project developed some basic tenets for further investigation:

- Digital technology offers helpful tools for teaching.
- Visualization by means of computer software can improve the effectiveness of our teaching.
- What role can these possibilities play in our teaching?
- Which pedagogy and methodology questions do we need to pose?
 - How much does the teacher need to know in order to use these tools effectively?
 - How much must the student know?
 - When and for whom should we use these tools?
 - What equipment is necessary, what would be a nice extension and what constitutes an unnecessary expense?

There are three basic areas or levels of use for technology in vocal pedagogy:

- the simplest form is its use as a tool for visualization,
- isomewhat more complex is its use for analysis and demonstration purposes,
- and for documentation in a simple form for pedagogical purposes, and much more complex and demanding, for scientific and research projects.

1. Voice Visualization as a pedagogical tool

- **Which technical questions can be addressed?**
 - Spectrograms offer direct assistance for work on many different parameters of tone. Onset and release, intonation, vowels, legato, crescendo-decrescendo, vibrato, consonants and many other details can be addressed quickly and in an easily comprehensible manner.
 - Some programmes with keyboard display are helpful for students, who do not have a keyboard instrument to practise with at home. Pitch recognition displays are helpful for

students who have no keyboard instrument to practise with at home, or who struggle with intonation problems – equally suited for advanced university voice majors and for work with students with amusia. (e. g. *Sing and See*)

- **What does the teacher need to know?**
 - Of course the ability to use a computer is essential, but a course of instruction is not necessary in order to be able to begin using software in teaching. Beginning with a free download, the teacher should experiment with his own voice. It is easy to recognize the quality of a tonal onset, for example, or the image made by precise, weak or missing consonants without being able to interpret the spectrogram itself reliably. The characteristics of a crescendo-decrescendo are also immediately obvious to any interested person when shown using the power spectrum display.
 - There is no limit to finding useful things in the software images. Greater understanding and knowledge only opens the door to further uses and more accurate interpretations.

- **What kind of equipment is necessary?**
 - The initial use of software in teaching requires nothing more than any standard laptop with an integrated microphone and a free download software, or even with a smart phone, iPhone or Android and an suitable app.
 - After the first experiments, and establishing it in teaching practise, it will be helpful to purchase a USB microphone and a programme suited to the teachers' and the students' specific needs.
 - There is no limit to purchasing expensive programmes and extravagant equipment, but it is not necessary for normal teaching practise.

- **How can the computer be used?**
 - It is important that these tools flow into the lesson just as naturally as other objects we use in teaching. Does anyone teach without a mirror today? The software enables teacher and student to see a visual image of acoustic properties of the voice, just as the mirror gives us information on posture. Using standard methods, for example imitation, teacher and student can compare the characteristics of the spectrogram.
 - The computer must always serve the larger purpose and not distract from the main goal of the lesson. The student has come to sing and it is important not to waste precious time with setting up technical equipment. The equipment should be set up and the programme opened before the beginning of the lesson, so that only a click or swipe is needed to kiss the display awake. Initially, the teacher should choose parameters that are easy to understand. If the teacher is familiar with the image produced by his/her own voice, it will be easy to identify the differences in the student's voice. Step by step, use can be extended to more and more parameters
 - The visual stimulus can be very helpful in aiding concentration, in focussing energy, and awakening interest in making different kinds of sound and finding out how they are "composed".

- **What is important when choosing software?**
 - When choosing software, it is important to define the purpose for which it is to be used and the needs of the students.
 - Initially, free download versions available for some programmes are completely sufficient. Software to purchase need not be expensive in order to serve most purposes.
 - Important factors to consider are easy handling, uncluttered attractive graphics, clear and easily understandable information for example on changing the display. It should not be necessary to go through complicated instructions for handling the programme!

- The age of a programme might be a factor since recently developed programmes often have simpler modes of handling, are clearer and more attractive to a student's eye.
- EVTA has concentrated mainly on using three different programmes, that were developed for three different uses, and therefore, quite different in graphics and function. All three are exemplary and can be used effectively for teaching.
 - *Sing and See* was developed for working with children, who for example, have no keyboard instrument to practise with at home. It has a clear keyboard that can be used to give a pitch for exercises, for example. It is helpful for working on intonation using the pitch display combined with the names of the notes. This display is easy to understand and very useful for many kinds of students: from amusia students lacking ear-pitch co-ordination and for university voice majors dealing with intonation difficulties. Like most computer programmes, it has different displays. In addition, the developer offers both a teacher's and student's handbook in English. Many colleagues in English-speaking countries use this programme.
 - *Sygyt* is a more recent programme developed for overtone singers. It has a clear attractive display and is easy to handle and switch between numerous different displays. It offers many possibilities and helpful settings for spectrograms, formants, power spectrum, etc. It is not suitable for work on intonation. A free download makes it easy to test, although the functions available in the free version are limited.
 - *Voce Vista* was developed for scientific and research purposes and is familiar to many teachers through congress presentations. The set-up is comparatively complex, handling it efficiently requires practise, but it also offers the possibility of working with the EGG.

2. Voice analysis and voice synthesis as a pedagogical tool

As a rule, a teacher works from an idea of the possible colour of a student's voice. Among other uses, spectrograms and voice synthesis programs like *Madde* are useful in showing a student how his voice actually sounds and how it could sound.

Spectrum Analysis

- **Which technical questions can I work on?**
 - A further step is using spectrographic software to make a precise analysis of the formants with the goal of improving the vowel quality and resonance strategies, for example in the passagi.
- **What does the teacher need to know in order to use these forms of analysis in teaching?**
 - In order to be able to apply formant analysis in teaching, it is necessary to be able to read and interpret spectrograms and spectrums reliably. The complexity of this analysis requires the teacher to have mastered more accurate knowledge than is needed for working with visualization. The teacher needs to be efficient in handling the equipment and the software, and he should be reliable in reading the data. If not, he should consult an expert.
- **What equipment is necessary?**
 - Initially, this kind of analysis can be done with the same basic equipment as listed above, and a full version of a software programme. However, it is important to note that factors such as distance from the microphone, or the quality of the microphone can strongly affect the results or give misleading information. More effort and additional expenditure is necessary in order to work reliably. An external microphone, (e.g. Samson GoMIC) is helpful, if possible with some form of holder

that assures a constant distance from the singer's mouth to the recording microphone.

Voice Synthesis with *Madde*

- **What does the programme show?**

- The voice synthesis software *Madde* offers both a pre-set voice and the possibility of synthetically setting a desired vocal sound. The concept of "voice portrait" proposed by Johan Sundberg describes the possibility of producing a synthetic portrait of an individual voice. In order to do this, the teacher needs the voice synthesis programme *Madde* and a reliable spectrum analysis.
- The synthesized voice, *Madde*, has pre-set formants 1 to 5, which define the timbre and vowel quality of a sound. By clicking them on and off, they can be used to show the effects of the single formants on vocal sound. This way, *Madde* can demonstrate the change in vocal sound, for example, when the 3000 Hz formants are present or missing. Entered manually according to the results of a spectrum analysis, the sound will resemble the human sound on which it was modelled.
- In addition, the aesthetics of vibrato can be demonstrated by changing the amplitude and speed of the oscillation.
- This programme opens the door to playing with the different components of the sound in order to extend his imaging of partials that are present or missing in his sound.
- *Madde* is a free download programme.

Methodology

As a rule, these applications may take more time than is available in a regular voice lesson, so it is advisable to agree with the student in advance when to do it, whether within the lesson time, or perhaps at an additional time, in order to be able to work without time pressure.

3. Uses for documentation, diagnostic and scientific purposes

- **Documentation**

- A simple form of documenting students' development is easily set up today by saving recordings from lessons or concerts. These data can be helpful to the student by identifying changes and comparing the objective results with his aural and physical self-perception and the comments made by the teacher. Most pedagogical purposes are served when this kind of documentation is made with readily available equipment. However, in order to be able to make a more detailed comparison, it is necessary to have comparable conditions such as distance from the microphone and similar microphone quality.
- A more precise documentation can be set up using the EGG and voice range profile, which offer significant information but can only be recorded and interpreted with proper equipment and expertise. This is usually only available at voice institutes or universities.

- **Diagnosis**

- Information gathered through technological means can also be useful in diagnosis when vocal development stalls or becomes problematic. Archived information can be helpful in defining a problem when a voice remains breathy, an onset or offset the remains too hard or too diffuse, or longer-term difficulties developing brilliance and carrying power, as well as unwelcome negative developments. They provide useful information for professional consultation with colleagues, medical or therapeutic professionals.

- **Documentation for scientific research purposes**
 - In the context of this article, it shall suffice to mention that documentation and analysis for scientific and research purposes by its very nature, demands appropriate expertise and high-end equipment and software in order to assure reliable data and detailed analysis and evaluation.

The Pedagogy: Usefulness and Limits

The EVTA project began with the aim of offering a maiden voyage of exploration in the new world of technology. Despite the excitement of discovery, many rightfully posed questions and reservations regarding the usefulness and limits of technological tools remain.

Dealing with technology is a challenge to our comfortable use of traditional methods, which have had long tradition and without doubt, still function well. The first boundary to the use of technology is set by the knowledge, expertise and curiosity of the teacher, his desire for renewal and changes in teaching practise. One of the first observations from my own students came totally unexpectedly: “The way you listen to us has changed since you have begun working with spectrograms. It feels as if you have a spectrogram running in your head!” Dealing with technology in the teaching studio changes not only the available information, it also transforms the way of looking at things, our perception, our way of working, and last – but not least, the teacher-student relationship. The teacher must be willing to let this happen.

Our students set a second kind of border, one that marks a huge territory. They come into our teaching studios from very different activities and life contexts with widely differing kinds of motivation. Some of them don’t care at all about looking at a digital image of their voice. Others maintain a new-found motivation and the excitement of discovery over a long period of time, and yet others are tempted into a false dependency, missing the transferral to their own physical sensations and hearing. Just as with every pedagogical approach, it is important to pose the basic pedagogy question: what is helpful for which student, and to know when and why to use it and what will hamper his development.

No computer will ever take over the teaching job: that remains the calling of the voice teacher. But interested, young students today demand that they be actively involved in their lessons, and not be bombarded with frontally delivered information and directions. They are looking for specific explanations and information, and they want to apply what they have learned in the lesson and be able to evaluate the result. They are already handling many kinds of technology, exchanging apps, downloads and useful sources of materials, whether we want them to or not! It is only logical, that we study the possibilities for our professional work in a world in which computers are our everyday companions and in which our young students have already grown up as “digital natives”.

Many words of praise, criticism or reinforcement remain unsaid: there will be other opportunities for that. This article is written with the intention of stimulating and encouraging the reader to begin, to test technological possibilities, to exchange experiences with colleagues and to contribute to the pool of common knowledge of vocal pedagogy!

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