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PEVOC 11

August 31 – September 2, 2015
Firenze, Italy

Edited by
Claudia Manfredi

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SEPTEMBER 1

SEPTEMBER 2

POSTER SESSION

COMET SYMPOSIUM
SEPTEMBER 2

PEVOC 11 – FOREWORD

Welcome to the 11th edition of the Pan-European Voice Conferences PEVOC11!

PEVOC is an interdisciplinary conference for voice professionals to exchange knowledge about the human voice. The most significant themes of PEVOC are: pedagogy, art, medicine and science. To promote the scientific quality of PEVOC presentations an Advisory Committee has been established, now headed by Chairman Johan Sundberg and General Secretary Markus Hess. It is composed of experts in the various fields of voice including scientific, clinical, pedagogical, therapeutic and artistic ones. The responsibility of the Advisory Committee is to encourage all people interested in voice to participate in PEVOC and to foster European voice scientists to present their recent findings at PEVOC.
PEVOC takes place in different European cities every two years. The very first PEVOC was held in London, UK in 1995 and later in 2005. Then it came twice in Germany, in Regensbur in 1997 and in Dresden, 2009 respectively. It moved to The Netherlands, Utrecht in 1999 and Groeningen in 2007, then to Sweden, Stockholm, in 2001, in Austria, Graz, in 2003, in France, Marseille, in 2011 and finally in Czech Republic, Prague, in 2013, with a growing involvement over the years. The PEVOC website: www.pevoc.org collects information about all past events.

This year and for the first time PEVOC comes to Italy. I have the honour and pleasure to host this big event in the beautiful city of Firenze in conjunction with the MAVEBA International Workshop.
This will also be the occasion to celebrate the 20th anniversary of PEVOC establishment: an important milestone that clearly expresses the strength and interest of the scientific community for the topics of this conference with more than 200 participants from all over the world.
During PEVOC11 about 150 papers are presented in both oral and poster sessions divided into the following main topics: singing voice and singing pedagogy, acoustical and image analysis, mechanical modelling, speech pathology and therapy, occupational diseases, linguistics, emotions, children voice.
Moreover international experts offer 35 workshops and 6 round tables contributing to stimulate discussion among the participants on a wide range of the topics listed above.

On Wednesday, September 2nd 2015, the conference hosts a symposium of the Collegium Medicorum Theatri (CoMeT), composed of voice professionals from different cities of the world connected with major theatres, operas, or conservatories and organized by its President Philippe Dejonckere. CoMeT seeks to encourage scientific investigation, further clinical studies, exchange of knowledge and ideas and to develop educational activities in the field of medicine for professional voice care.
On Sunday August 30th a pre-conference training course is organized by the European Academy of Voice: a unique chance to be trained by the best tutors in the field. Details at: http://www.european-academy-of-voice.org/

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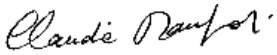
During the conference participants could visit the museum of the Military Health located inside the Convent and Cloister of San Domenico del Maglio, hosting the Congress. More events are offered to the participants during the congress: on Monday August 31st the Fiesole School of Music welcomes the participants with the Concert: "From the lands of Tuscany". Coordinated by Maestro and pianist Maolo Gonnelli, a string quartet, piano and voices perform music by Luigi Boccherini, Mario Castelnuovo Tedesco, Ermanno Wolf Ferrari and Giacomo Puccini. Finally, on September 1st a gala dinner will enable participants to visit Palazzo Borghese, one of the most elegant and opulent historic buildings in the heart of Firenze.

I wish to express my deepest thanks to all participants for the high level of contributions, to the members of the PEVOC Advisory Board and to the anonymous referees for the time devoted to the revision of the abstracts, to the Committee for workshops and round tables (Giovanna Cantarella Milano, Italy, Ruth Epstein London, United Kingdom, Franco Fussi Ravenna, Italy, Markus Hess Hamburg, Germany, Outi Kähkönen EVTA President, John Rubin London, United Kingdom, Johan Sundberg Stockholm, Sweden), flawlessly coordinated by Prof. Dejonckere and to my closest collaborators Andrea Bandini and Silvia Orlandi without whom this event could not have been organized and carried out with, I hope, the satisfaction of everyone.
Therefore I wish that Firenze, in addition to its history and art, will remain a nice 2015 memory for the international scientific PEVOC community.

Claudia Manfredi
Conference Chair



This Abstract book collects all contributions at PEVOC 11 organized into Session, Workshops and Round Tables. They are organized by date and by session according to the codes listed below.

LEGENDA

Free papers PEVOC 11

FP = Free Paper
S1-S4 = Singing
A1-A5 = Acoustical/mechanical analysis
M1-M4 = Medical
L1-L2 = Linguistics/Emotional
C1 = Children
O1 = Occupational

Workshops PEVOC 11

Wi = Workshop number i
Si = singing voice
Ped = singing pedagogy
Med = medical
Sp = speech pathology/therapy

Posters PEVOC 11

C = Children
A = Acoustics
L = Linguistics
M = Medical
O = Occupational
S = Singing

August 31, 2015

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W1-Singing Voice 1 (Room1)

THE PRACTICAL APPLICATION OF SINGING TECHNIQUE TO MUSICAL THEATRE AND CONTEMPORARY MODERN MUSIC

Mary Hammond L.R.A.M. F.R.A.M.
164 Camden road NW1 9HJ
www.maryhammond.co.uk

This workshop will show short filmed excerpts of "problems" presented in classes at The Royal Academy of Music London (Post Graduate Students of Musical Theatre)—with live discussion with audience of the decisions made

Singing teachers mainly rely on auditory perception----an understanding of how the voice works—as a non scientist-really helps us visualize what might be causing the problem.

I was the first vocal coach on Les Miserables ,Miss Saigon and all the explosion of shows that opened in London at that time----new sounds for the through –sung musical that at that time had very different demands---we had to work out how to fullfill them….

Having now worked as a singing consultant and coach on more than 100 west end .national theatre.RSC.etc shows involving singing---in many genres ..i have found the information being explored by people interested in voice invaluable and the resource of being a long term member of the British Voice Association and knowing who to ask when I don't know has been-and is- of huge benefit.
My teaching practice also includes many pop groups which also demands understanding of many different genres.
I am constantly aware of how much more research is needed to give us answers

W2-Singing Voice 2 (Room2)

INHALING SINGING

Françoise Vanhecke
University College, School of Arts, Ghent, Belgium

Introduction
In general speaking when we refer to extended techniques we think of special sounds and expressions using different aspects of the voice. In the western culture, singing in general is normally produced with expiring air such as wind instruments. Since several years, reverse phonation is implemented in voice and speech therapy and applied in artistic contemporary (classical) vocal music. Different designations, such as 'Inhalatory', 'Ingressive', 'Inspiratory', 'Inhaling', 'in', 'gasping', 'inspirer', 'aspirer', 'einatmen'. The new developed singing technique by Françoise Vanhecke, ISFV® inspires composers and results in new compositions implementing this new expressiveness of this 21st century.
The purpose
This workshop is proposed to those who are curious and want to explore and extend their vocal capacities by discovery of new voice colors and new ways of breathings.
With this workshop multiple capacities of the breathing apparatus, articulations with applications of different exercises conceived as basic techniques will be applied as special stimuli for new sounds, resonances and thus Inhaling Singing. Different positions of the posture as well as consciousness of physical and auditory perception will be perceived. In general, it is assumed when you discover and learn a new technique; in any domain, time and behavior are also important factors for improvement. Some learn by imitation and others with severe control. Ones may evolve or improve faster than others. This will be the same for this workshop. Being involved with new things, we are sometimes confronted with prejudice, which maybe have a psychological impact. Some will hesitate to do the initial workshop and I am convinced that even questions will rise, such as: Will I hurt my voice? – Shall I dare? - Is it dangerous? - Can I do it? – What can I express? Nevertheless I am sure that you will already experiment or be tented to do so before the workshop or just long to discover this joyful workshop exploring new boundaries of vocal music.
Equipment
piano or keyboard, mirror(s) comfortable clothes.

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Vande Gorne A.: Déluges et autres péripéties. Text: Werner Lambersy. Françoise Vanhecke, soprano, inhaling singer ISFV®, improvisator: 2015
www.francoisevanhecke.com ; www.isfv.be
TedxGhent PhD laureate 2013: https://www.youtube.com/watch?v=Xa1PwCRo8h4

W3-Speech Pathology/Therapy 1 (Room3)

doctorVOX: A NEW DEVICE FOR VOICE THERAPY AND VOCAL TRAINING

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ilterdenizoglu@doctorvox.com

doctorVOX is a new device (patent app.: 2014-GE-89535) designed by the author to provide voice therapy, vocal training and vocal humidification. This device is easy to carry and is safe to be used anywhere. It is intended to assist voice therapy and to serve as a supporting device for professional voice users. doctorVOX is designed to help to motor learning and cognitive processes involved in voice therapy and vocal training. doctorVOX provides instant humidification of the vocal folds. Additionally, herbal and medical products can also be used for inhalation.

doctorVOX uses the mechanisms of LaxVox Voice Therapy Technique for voice therapy and professional voice development. The main mechanism involves artificial elongation of the vocal tract and a secondary vibrating resistance (i.e. water bubbles) for vocal tract impedance. The artificial elongation is provided by a built-in tube which is designed nearly the same length with the human vocal tract. It is designed for rehabilitation of dysphonic patients and habilitation of the professional voice users.

There are two tube openings on the top. The swan-neck like tube indicates the breathing outlet from the container. The phonation inlet is the opening of the inner tube from which the user can blow voice into water. The upper part of the device is formed by two tubes mounted one inside the other. The inner tube is for blowing and phonation. The active length of the inner tube is about the same length with the human vocal tract so that standing waves form in a natural way. The bottom part of the device which is named the container is filled with water for voice therapy exercises. Maximum water height is designed to be below phonation threshold pressure. Water spillage during blowing and aspiration of water during inhalation, are prevented by two main mechanisms. First resistance to keep water in container during bubbling is the circle fold (like an inkstand) at the roof of the container. The second resistance is the enlargement in the neck part of the device.

doctorVOX can also be used as an instant vocal fold humidifier. The user can humidify the vocal folds by inhaling water vapor (45-50°C) through the swan-neck shaped breathing tube. Herbal/medical products are able to be vaporized through bubbling and can be inhaled from breathing tube. During vocal exercise, user blows air/voice through the inner tube and takes the advantages of Lax Vox technique. During inhalation from the breathing outlet, air enters from the phonation inlet and passes through water to be humidified. The humidified air directly affects vocal fold mucosa.

The device is not yet on trade and future clinical studies are needed to be done.

W4-Singing Pedagogy 1 (Room4)

PRIMAL SOUNDS IN POP VOCAL PEDAGOGY

Dane Chalfin, Kim Chandler
Leeds College of Music, UK

Following six years of clinic-based research a practical model was created that describes typical vocal sounds and postures used in contemporary singing including pop, rock and musical theatre, using everyday, emotive language or "primal sounds."

This practical workshop will explore various primal sounds including endoscopic views, support strategies and how they apply to contemporary pedagogy and rehabilitation. Using vernacular, emotive terms gives students and patients easy access to reflexive, intuitive sounds they already know without having to learn a new technical language. Describing sounds emotionally may also increase the connection between interpretation, performance and technique. The ethos is not one of creating a new vocal methodology, but giving teachers and therapists tools that students and patients can access easily, regardless of previous training models.

The workshop will ideally last one hour and participants will be encouraged to participate in making sounds, palpating themselves (and one another) and engage with audio and video footage.

DANE CHALFIN
Dane Chalfin is one of the UK's leading vocal and performance coaches. His clients have included charting bands/artists like Hurts, Delphic, Courtney Love, The Whip, Wu Lyf, Embrace and Everything Everything; performers like Peter Kay, Justin Lee Collins and Claire Sweeney; the West End cast of Rock of Ages; cast members from national tours of Wicked, The Producers, Evita, Saturday Night Fever and Mamma Mia; and record labels including Sony, Columbia, Universal, Polydor and many independents (www.21stcenturysinger.co.uk).
Dane is Principal Lecturer in Artistry and Performance at Leeds College of Music, where he looks after artistic development across all disciplines including Classical, Jazz and Popular Music (www.lcm.ac.uk).
Dane also held an official NHS appointment for a vocal coach rehabilitating injured professional singers as part of a multidisciplinary voice clinic. He has trained vocal coaches and speech therapists all around the UK and presented his work at many international voice conferences. He served two terms as a Director of The British Voice Association and is currently the President Elect. Dane recently wrote three chapters for TC-Helicon's The Ultimate Guide to Singing: Gigs, Sound, Money and Health.

KIM CHANDLER MMus(Dist) BMusEd AMusA
Kim Chandler is a leading contemporary singing specialist, both a performer and as an industry vocal coach. She has over two decades of high-end professional performing experience and runs a busy private vocal studio where her clients include well-known artists, artists in development, professional singers and other vocal coaches (www.kimchandler.com).
Kim has been a Senior Lecturer at London College of Music and Principal Lecturer at Leeds College of Music, in addition to being a past Academic Head of the UK's leading contemporary vocal college (Vocaltech, now BIMM London). She is a regular presenter at national and international voice conferences and is the Head of Communications of the British Voice Association, having formerly served two terms as a Director and been a recent past President (www.britishvoiceassociation.org.uk).
Kim has written chapters for two new international publications – "The Ultimate Guide to Singing" (TC-Helicon) and "Teaching Singing in the 21st Century" (Springer). Her innovative "Funky 'n Fun" vocal training series has set new standards in contemporary singing exercises and is a popular seller to singers, singing teachers and institutions internationally (www.funkynfun.com).

FP-Singing 1 (Room1)

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THE ROLE OF THE VOICE RANGE PROFILE IN CLASSIFYING VOICES OF SINGERS

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INTRODUCTION: Classification of the voice is the determination of the vocal range in which a person can sing without harming or fatiguing his voice [1]. In classical music there are traditional six categories of singing voices: alto, mezzo-soprano and soprano are the female singing voices and bass, baritone and tenor the male voices types [2]. Some authors assume that the Voice Range Profile (VRP) provides useful information for classifying a voice. However, we could not find reports on the relationship between classifying a voice and VRP-results [3]. In this ongoing study the applicability of the VRP for the classification of singing voices has been investigated.
METHODS: VRPs of 157 professional choristers (90 females and 67 males) were performed according to the UEP standards[4] . The Voice Profiler® according to Pabon was used. The VRPs were assessed by eight voice experts. They were asked to judge to what voice class the VRP fits the best in order to assess the practical use of the VRP in classification of voices. The ratings of the voice experts were compared to the voice class in which the singers were singing comfortably in their career. In both females and males there were three levels corresponding to the traditional three categories of singing voices. The data was analysed with SPSS 21.
RESULTS
Female voices
The female group was composed of 12.2 % altos, 35.6 % mezzos and 52.2 % sopranos.
In 32.2 - 60.0 % the judgement of the voice expert was in accordance with the voice class of the singer. In 15.5 - 60.0 % the voice experts rated the fonetogram at a lower level than the voice class. In 7.8 - 26.6 % the rating of the voice experts were at a higher level.
Male voices
The male group was composed of 26.9 % basses, 26.9 % baritones and 46,3 % tenors.
In 35.8 - 76.1 % the judgement of the voice expert was in accordance with the voice class of the singer. In 11.9 - 47.7 % the voice experts rated the fonetogram at a lower level than the voice class. In 7.5 - 17.9 % the rating of the voice experts were at a higher level.
DISCUSSION: The results show that the judgement of the voice experts to what traditional category of singing voice the VRP fits the best does not correspond very well. The findings that the voice experts rated the fonetogram often at a lower level than the voice class of the singers may be due to the relative large number of sopranos and tenors. This study indicates that the VRP alone is not able to give enough information for classifying voices. The role of the VRP in clinical settings is clear[5], but the pertinent results would imply that the VRP is not as powerful as might be expected in classifying voices.

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WHERE IS THE SINGER'S FORMANT WHEN THE LEVEL GOES DOWN?

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INTRODUCTION

If the SF emerges or disappears can only be decided on when we are able to discriminate its characteristics from the normal spectrum structure seen in the 3-kHz region. So, the above question is inevitably one about the structure and dynamic stability of the surrounding spectrum context. Is this 3-kHz structure consistent with all voice types, on all sound levels over the whole pitch range, independent of the vowel or the register? If so, then this structure forms an extremely powerful reference point to start any further analysis from. If so, it will likely represent an important perceptual reference point too, as anything varying against, or within this reference, stands a better chance to be picked up due to its guaranteed presence. Sundberg [1] already found that the center frequency of the SF shifts with the voice type. The conjecture is that this could actually be a more general marker, one that is not exclusive for the SF.

This study aimed at characterizing the main spectrum shaping factors in the 3-kHz region and assessing their consistency over the Voice Range Profile (VRP). By doing this for large categorized data sets, there will be a direct indication to what degree a designated shape element could act as a reference to contrast the voice type, the register, or act as a SF marker.

METHOD & MATERIAL

Starting material were VRP recordings, exclusively per register mechanism, of trained male (N=8) and untrained (N=18) and trained female (N=12) voices all exclusively phonating the vowel /a/. These were all spectral VRP's, that contain a storage matrix organized in cells, 1 ST wide and 1 dB high, where each cell holds an F_0/SPL specific time-averaged narrow band power spectrum. The thus resulting arrangement of spectra compares to an F_0/SPL-differentiated LTAS set-up. To compensate for F_0-dependent differences in frequency sampling, all narrowband linear frequency scale power spectrum averages were post-processed to derive a harmonic envelope (HE) curve. In parallel with the HE curve, a frequency derivative (DHE) and second derivative (DDHE) were calculated also. The DHE peaks at the frequency locations where steepest spectrum gradients occur and will thus report if a spectrum peak is associated with steep shoulders. The overall DHE average will indicate to what extend such a steep structure maintains a consistent frequency position. The DDHE reports the spectrum envelope bending and presents a measure of the sharpness of a spectrum peak that is independent of the actual peak level.

RESULTS AND CONCLUSIONS

-Although only tested for the vowel /a/, a "bump" at 3 kHz was consistently observed at all sound levels, all fundamental frequencies, all voice registers and with all voice types or voice training levels.

-DHE spectra, when averaged over the VRP, indicated that the up-going shoulder of the 3rd formant is the most consistent element of the overall structure that constitutes the overall bump around 3-kHz.

-With all voice groups and all registers, taken over the complete VRP area, a high negative correlation was seen between the relative energy of the peak around 3 kHz and the downward spectrum slope over the 3-10 kHz range.

-Within voice types, the cutoff frequency that is associated with this up-going shoulder showed a remarkably low variation, with SD values in the order of 150 to 200 Hz. This low SD was unexpected given the large dynamic variations in the material, the wide pitch range and the rather loose control on the vowel identity.

-The effect of SPL on this cutoff frequency is negligible; for the F_0 a ca. 50 Hz/octave upwards drift was seen.

-An average constant 200 Hz cutoff frequency difference was observed between male and female voice groups. Based on this feature alone it should be possible to do an almost instant sex discrimination that works under all conditions as long as it is the vowel /a/. Synthetic test signals that only contrast on this aspect will be presented to give the audience an indication of the perceptual relevance of this spectral detail.

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OVERTONE SINGING: SELECTION BY AMPLIFICATION OR BY DAMPING? IS A FLOW MODULATION MECHANISM INVOLVED?

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INTRODUCTION

Overtone singing is generally seen as exemplary for to the source-filter model. Tuning or frequency matching of a source harmonic to a formant of the vocal tracts boosts that specific harmonic. The more narrowband -and thus selective- the formant, the more one harmonic stands out from its environment. There are some considerations and observations that make us doubt the idea that it is a further narrowing of formant bandwidth with a corresponding amplification or accumulation that is the mechanism responsible for the isolation.

(I) In order to facilitate the above mechanism, formants should be able to reduce bandwidth very rapidly and precise. Exact tuning is useless with a wide bandwidth. For one specific frequency in particular the vocal tract filter should adapt to a state of almost no damping or energy loss. The strange thing is that overtone singers seem not to make large adjustments in their articulatory setting to reach this alleged ultra-resonant state. Moreover, it is hard to associate the observed articulatory changes with a strategy that would reduce losses even further.

(II) Although the overtone selection effect is easily simulated with a formant synthesizer, real overtone singing seems to show a different dynamic behavior. In the electrical model, a constant bandwidth means that the exponential growth has the same time constant as the exponential decay, the same number of dB's per second. When a designated tone emerges in real overtone singing, the tone seems not build on its own amplitude with a more precise match or an even narrower bandwidth. The moment a stable level is established the tone appears to have gained a certain resistance against frequency mismatching. Thereby its amplitude remains rather stable as if a state of saturation is maintained instead of a delicate balance. There is no gradual detuning but more a sudden loss of connection.

(III) With a very pressed voice and irregular source vibration the mechanism still works. Typically the higher overtones are targeted when this pressed setting is used. This is precisely the condition where a stable and precise frequency match is considered essential in order to build and maintain a more constant tone.

(IV) In their articulatory technique, overtone singers seem especially concerned with carefully channeling the airflow around their mouth opening or around some other constriction or ridge in the tract. They seem less concerned with precisely tuning the overall resonance space of the vocal tract. Different overtone singing techniques could also be associated with different constriction locations. In principle formants should have no fixed location in the tract, but they seem to attain a locality in combination with a constriction or projection point.

In this paper the hypothesis is tested that overtone singing could actually be relying on a nonlinear flow modulation mechanism. The idea is that first the formant resonance preconditions the selection of a specific sinusoidal pressure pattern. In sync with this pressure pattern there is an associated flow modulation that becomes more substantial due to the guiding or channelization near a constriction. Just as with a mouth whistling, where the resonance of the mouth cavity determines the frequency on which the flow modulates on itself in the constriction area. Note that the whistling mechanism is not relying on a sharp edge or labium and that the interaction of the flow with the cavity resonance will work the same, independent of the direction of the flow. The pressure variations associated with a formant resonance are still important, but for their ability to periodically reshape the flow or periodically dissipate out of sync influences from the air flow in a non-linear way. As the magnitude of the flow near a constriction is not as large as with whistling, the size of the effect, and thus the acoustical levels will be small.

Several strategies will be used to find evidence for the above hypothesis:

-Comparing over time the level of the selected overtone in selective or unselective conditions.

-Estimating time constants of the exponential growth or exponential decay rate.

-Checking to what extend an interference with the projected airflow near a constriction is able to or destroy or to enhance the selection of an overtone.

THE FEMALE MIDDLE SINGING VOICE: GLOTTAL SOURCE CHARACTERISTICS AND RESONANCE STRATEGIES

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Using recorded non-invasive signals of VoceVista (spectrum analysis and EGG), objective characteristics of the female middle register are described in some detail as they occur in classical singing, "mix," and belting. These characteristics include two points of transition: 1) from the lower ("chest") register, and 2) the move to the upper extension at secondo passaggio; as well as varied resonance adjustments of the first and second formants in these transitions.

EXPLORING THE ACOUSTIC VOCAL PROFILE OF "SCREEN SINGERS" AT THE GREEK ELEMENTARY SCHOOL

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The last twenty years the research domain on studying and understanding the acoustic function of the children's singing voice is under a continuously development due to the advent of new technologies which support the research, education and evaluation of the singing voice ability. There are relatively a few studies on the acoustics of the children's voice and its relationship with their singing development in school and also in different aspects of their lives.

Taking in account that the Greek Elementary school music curriculum of music education hasn't a well-structured proposal for vocal pedagogy and singing development of children in the classroom we will try in this research:

a)to understand and create an appropriate pedagogical method for investigating singing abilities in Greek language through the creation of children's voice profile (Voice Range Profile) and other pedagogical tools in school (children aged 6-8 years old) b) to investigate if there is an improvement of the pitch accuracy through a visual feedback system during a systematic screen-based approach

c) to understand the modality of singing in greek music repertory

In addition, we will present a statistical control model of the singing voice before an after the experiment. Furthermore, we will discuss the impact of a more structured knowledge of the acoustic function of the voice on the child's singing. Finally, we will discuss which way a commercial visual feedback system (like the one we have used) is inadeqaute or not to educate children which are tuned in a different musical background and the necessity to create a new tool which could recognize micronunances of several tunings based on the Ancient Greek, Byzantine and traditional Greek music?

DOES A CHOIR REHEARSAL AFFECT THE SPEAKING VOICE? A STUDY OF VOCAL LOADING IN FEMALE AMATEUR SINGERS BASED ON ACOUSTIC ANALYSIS

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Amateur choir singers sometimes experience changes in speaking voice as well as vocal fatigue after choir singing. A possible physiological explanation to this phenomenon could be that muscle activation patterns to regulate pitch and loudness during singing [1-3] affects subsequent speech.
The aim of the present study was to investigate if vocal loading in terms of a choir rehearsal has an effect on the speaking voice in female amateur singers. It was hypothesized that the singers would speak with a higher mean fundamental frequency (F_0) and a more hyperfunctional voice quality after ended choir rehearsal.
Eleven healthy female amateur singers served as subjects. They were asked to read a standard text before and after a choir rehearsal. Acoustic analyses of mean fundamental frequency, F0 in Hz (reflecting pitch), standard deviation of F0 and 80% central range, CR, in Hz (reflecting pitch variation) and mean H1-H2 in dB (reflecting hyperfunction) were made using the Praat software and automated scripts.

The results showed that the group as a whole spoke with a significantly higher mean fundamental frequency (F_0) after the choir rehearsal than before. A two-tailed paired t-test proved a significant difference for the group by $P<0.04$. A physiological interpretation for these findings could be that longtime vocal loading and contraction of the cricothyroideus muscle will increase mean F_0 in the speaking voice.
Furthermore, the subjects tend to have a greater variation in pitch after the choir rehearsal and amplitude differences between H1 and H2 tend to be larger after the choir rehearsal. However, these findings failed to reach statistical significant.

The main result of this study was that the subjects increased mean F_0 in speaking voice after ended choir rehearsal, which supports the findings in other vocal loading studies [4-6]. Those studies are based on teachers' voice use and vocal loading in speech only.
Further investigations are needed to investigate the correlations between voice use and vocal loading in singing and speaking.

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FP-Acoustical/Mechanical Analysis 1 (Room2)

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VIDEOKYMOGRAPHY IN CLINICAL PRACTICE

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This presentation will be devoted to the fundamentals of videokymographic imaging and to the application of videokymography in clinical pracice.
The presentation will provide case examples of characteristic pathologic conditions, which were diagnosed thanks to videokymographic findings. When is videokymographic imaging applied in clinical practice, videokymography allows detailed diagnosis of vibration disorders of the vocal folds in small developing lesions, which are difficult to detect using other methods. It enables an early detection of cancerous tissue on the vocal folds. It serves as a great help in detecting organic basis of damaged vocal fold tissue, which has otherwise been considered a functional disorder. It allows detecting tiny scarred areas and increased stiffness of the mucosa and of the submucosal tissues.
Videokymography is a high-speed videolaryngoscopic examination method, which allows obtaining detailed information of the vibratory behavior of the vocal folds and surrounding tissues. In contrast to the standard strobovideolaryngoscopic methods, which work properly only on regular voices and do not allow detecting irregularities, the high-speed imaging does not suffer from this limitation and allows detecting real vibration of the vocal folds. Videokymography differs from the other high-speed videolaryngoscopic methods in that it uses a special videokymographic camera which provides two images simultaneously – in the left half it shows the standard laryngoscopic image (50 or 60 images per second), in the right half it provides the kymographic image showing the vibratory behavior of a selected part of the vocal folds in high speed (7200 line images per second).
The high-speed kymographic images are available immediately, which makes the method friendly for use in busy clinical practice. Research on videokymography in voice disorders identified over 30 vibratory features which reveal on various causes of vibration disorders of the vocal folds .

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THE AMPLITUDE IRREGULARITY OF ELECTROGLOTTOGRAPHY - SYNCHRONOUS OBSERVATION OF THE VOCAL FOLD VIBRATION WITH HIGH-SPEED DIGITAL IMAGING

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Objective**:** To objectively evaluate the severity of pathologic voices, methods for performing the acoustic analysis of voice signals, such as perturbation and noise measures, have been developed and utilized over the past several decades. However, recent studies have cast doubt on the reliability of these acoustic measures. Meanwhile, because the irregularity of the vocal fold vibration has been considered to be one of the origin of pathologic voices, vigorous attempts for objectively monitoring the vocal fold vibration have been made using glottographic techniques such as electroglottography (EGG). To date, several researchers have advocated that the period and amplitude perturbation measures of EGG signals could be finer indicators to detect vocal abnormalities. However, it is still unclear what phenomena on phonation are represented by the irregularity of the EGG waveform in pathologic voices. In particular, the mechanisms of the amplitude irregularity of the EGG waveform in pathologic voices, which are "representing relative variation of the vocal fold contact area," are only speculative. The aim of this study was to verify the speculation by the direct observation of the vocal fold vibration using high-speed digital imaging (HSDI) in the pathologic voices showing the amplitude irregularity with subharmonic structure in EGG signals in order to provide a rationale for the usefulness of performing a perturbation analysis of the EGG waveform.

Methods**:** The Osaka University Graduate School of Medicine gave approval for this study. A vocal fold vibration with sustained vowel /e:/ at a natural and comfortable pitch/loudness was recorded using HSDI synchronized with acoustic and EGG signal channels. The HSDI system included a monochrome high-speed camera (Phantom Miro ex4; Vision Research, Wayne, NJ) with a 300 W xenon light source. A 70-degree 5.8 mm rigid laryngoscope or a 3.6 mm flexible rhino-laryngo fiberscope was used for laryngeal visualization. The video recordings were captured at the rate of 4000 frames per second with a 256×256 pixels and 16-bit resolution. The EGG signal was obtained using a Model 6103 electroglottograph (KayPentax, Lincoln Park, NJ). The digitalization and synchronous data acquisition were achieved using a DAQ device (NI-USB 6341; National Instruments, Tokyo, Japan), set at the sampling frequency of 48000 Hz and 16-bit quantization. The vocal fold vibrations were analyzed using techniques of a glottal area waveform (GAW) and kymographic images of anterior, middle and posterior trajectories of the vocal folds, accompanied with the visualization of acoustic and EGG waveforms.

Results**:** First, HSDI of the vocal fold vibration of a diplophonic voiced female with a left vocal fold cyst was analyzed. On HSDI, a submucosal protrusion in the middle portion of the left vocal fold and a lateral phase difference of the vocal fold vibration were observed. The EGG waveform showed a tricrotic waveform pattern with lower, moderate and higher positive peaks, demonstrating a $F_0/3$ subharmonic frequency. The GAW revealed a tricrotic pattern with the consistency of the maximal closures (negative peaks) in the glottal areas with the positive peak amplitudes of the EGG waveform. The kymographic images of three trajectories also revealed the tricrotic pattern in the degree of glottal closures in accordance with the EGG waveform.

Next, HSDI of a female patient with muscular tension dysphonia with a short-term bifurcation in a sustained vowel was analyzed. On HSDI, both the anterior-posterior and lateral phase differences were observed without an organic lesion. The EGG waveform showed a dicrotic waveform pattern with lower and higher positive peaks, demonstrating a $F_0/2$ subharmonic frequency. The GAW revealed a larger dicrotic pattern in the glottal areas of maximal openings (positive peak) with a smaller dicrotic pattern in the maximal closures. The kymographic images of the middle and posterior trajectories also revealed the dicrotic pattern in the degree of glottal closures in accordance with the EGG waveform.

Conclusions**:** The results of this study revealed that the dicrotic/tricrotic variations of the EGG amplitude clearly associated with the dicrotic/tricrotic variability of the glottal areas. In particular, the variation of the maximal openings as well as that of the maximal closures impacted on the variation of the EGG maximal peaks. A unitary interpretation of these results can ensure the speculation that the variation of the EGG amplitude represents the relative variation of the vocal fold contact area. Therefore, the irregularity of the EGG amplitude can be one of the measures reflecting the irregularity of the vocal fold vibration, leading to the measure related with vocal pathologies.

RIGOROUS PHASE ESTIMATION OF ABNORMAL LARYNGEAL MOVEMENT DURING THROAT CLEARING USING HIGH-SPEED IMAGING AND ELECTROGLOTTOGRAPHY

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INTORODUCTION: Throat clearing in addition to phonation and swallowing are classified as cooperative movements associated with the larynx. Although throat clearing has been used as a vocal training technique principally to treat aphonia, it is difficult to judge whether a patients is actually able to perform effective throat clearing. In addition, the methodology for evaluating the degree of impairment of laryngeal movement during throat clearing remains insufficiently developed compared with that for phonation and swallowing disorders, perhaps due to the short duration and fast movement of throat clearing as well as the low time resolution of videos. The aim of the present study was to characterize abnormal laryngeal movement of throat clearing using high-speed imaging and electroglottography (EGG) with high time resolution. In particular, we attempted to differentiate each phase of laryngeal movement during throat clearing and quantify the changes in the vocal fold angle and subsequently compared these measurements between weak and strong throat clearing, and between healthy participants and patients with unilateral vocal fold paralysis (UVFP).
METHODS: Ten normal healthy adults and 20 patients with UVFP were enrolled. While the EGG electrodes were fitted in the cervical skin and a transnasal flexible fiberscope was inserted, the participant asked to perform weak and subsequent strong throat clearing, and high-speed laryngeal movie (4,000 frame/sec) and acoustic/EGG signals were recorded. Based on the vocal fold movements and waveforms of the EGG signals, the durations of the inspiration, compression and expiration phases were measured. In addition, using the motion analysis software Dipp Motion Pro program (DETECT, Japan), the maximum vocal fold angle and vocal fold angle velocity in the inspiration phase were calculated. These measurements were compared between weak and strong throat clearing in the normal participants and between the normal and UVFP groups.
RESULTS: The use of high-speed imaging and EGG enabled us to determine the borders of each phase. The ends of the inspiration and compression phases were determined based on the rise in the EGG signal and the opening of the aryepiglottic sphincter, respectively. In addition, the start of the inspiration phase was defined to be the timing when the vocal folds were opened maximally. Concerning the durations of each phase, in the normal group, strong throat clearing showed a significantly shorter duration of the inspiration and compression phases (both: $p<0.01$) and longer duration of the expiration phase ($p<0.01$) than weak throat clearing. In the normal group, strong throat clearing showed a significantly higher angle velocity during vocal fold adduction in the inspiration phase than weak throat clearing ($p<0.01$). In contrast, in the UVFP patients, only the duration of inspiration phase showed a statistical significance. In the comparison of these two groups, eight of the 20 patients exhibited neither glottic nor supraglottic closure, and the abnormal group showed a significantly shorter duration of the compression phase ($p<0.01$).
CONCLUSION: In the present study, high-speed imaging and EGG were useful for determining the borders between phases during throat clearing and enabled measurements of the duration of each phase in both the normal participants and UVFP patients. In the normal group, significant differences were found in the durations of all three phases. In particular, strong throat clearing was associated with short inspiration and compression phases. In addition, strong throat clearing exhibited a significantly higher angle velocity during vocal fold adduction in the inspiration phase. In addition, the UVFP patients exhibited impaired glottic and supraglottic closures with a significantly shorter duration of the compression phase. These results suggest that the durations of individual phases and vocal fold angle velocity derived from high-speed laryngeal images may be clinical indicators reflecting the effectiveness of throat clearing.

ELECTROGLOTTOGRAPHY AND VOCAL FOLD CONTACT AREA – HIGH SPEED VIDEO MEASUREMENTS

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I. INTRODUCTION

Electroglottography (EGG) is a frequently used non-invasive method for capturing vocal fold vibrations. The EGG signal has been considered to be proportional to the vocal fold contact area (VFCA). So far there has been only a single study (Scherer et al., 1988) investigating a direct relation between EGG and VFCA, however. That study showed approximately linear dependence of the time-varying EGG signal on measured VFCA. Since the movement of a vocal fold was induced by a mechanical arm and the resulting contact was assessed using illusionary stroboscopic method there is a need for detailed investigation under more physiological conditions.

II. METHODS

The experiments were performed using 3 red deer larynges in hemi-larynx preparations phonated on a bench in an excised larynx setup. The EGG signal collection utilized a conductive glass plate and the time-varying contact between vocal fold surface and the glass plate was captured with two high speed cameras (6000 fps) synchronized to the EGG signal (+/- 0.167 ms). The relative VFCA was measured by three experimenters who manually traced the borderlines of the vocal fold contact visible through the glass plate.

III. RESULTS

In the contacting phase, the normalized EGG signal was systematically preceding the normalized VFCA. The average difference between the normalized VFCA and EGG data in the three larynges was 0.180 (+/- 0.156), 0.075 (+/- 0.115) and 0.168 (+/- 0.184) in the contacting phase. In the decontacting phase, the average difference was 0.159 (+/- 0.112), -0.003 (+/- 0.029) and 0.004 (+/- 0.032) revealing a good agreement between normalized waveforms of EGG and VFCA in two out of three larynges.

IV. DISCUSSION AND CONCLUSION

Overall, data normalization, electrodes placement, anisotropic conductance properties of the vocal folds, and possible effects of electroglottograph hardware circuitry could cause some disagreements between the EGG signal and VFCA. More detailed investigation of the disagreement between EGG and VFCA in the decontacting phase of one of the larynges revealed an unusual geometry of the vocal fold. Unlike in other two larynges the lower lip was clearly separated from the upper one by a slight furrow on the medial surface of the vocal fold. The disagreement happened at the moment when the lower lip separated from the conductive glass plate (Fig.1A). This study calls for a careful interpretation of quantitative EGG data until further research provides more data and clarifies the issue.

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QUANTIFICATION OF GLOTTAL WIDTH VIA VIDEOKYMOGRAPHIC AND HIGH SPEED IMAGES WITH BIDIRECTIONAL ILLUMINATION

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I. INTRODUCTION

Laryngeal image assessment techniques have evolved from the initial endeavours to observe the vibration of the vocal folds in slow motion by means of stroboscopy [1] through to the implementation of state-of-art high-speed video (HSV) [2] devices. Among other renowned laryngeal visualization methods, videokymography (VKG) has shown to provide a practical and efficient way to visualize a number of important features of the vocal fold vibration [3]. A common feature often taken into consideration for describing the vocal cycle is the variability of the glottal width. The glottal width is related to the impedance of the glottis and it is an important parameter for understanding and modelling the vocal fold vibration. This report is about the implementation of bidirectional illumination (BI) technique with videokymography (VKG) and high-speed video (HSV) for visualization of the medial displacement of the lower vocal fold edges during glottal adduction, hence the estimation of the glottal width via image analysis. We hypothesised a reduction of the estimated glottal width using BI when compared to traditional techniques. Furthermore, we also hypothesised that changes in glottal width between the two techniques would be correlated to changes in fundamental frequency.

II. METHODS

A secondary light source was placed at the level of the cricothryroid space in addition to conventional VKG and HSV light sources (i.e. above the glottis). The participants were asked to sustain a series of different pitches whilst producing an [i:] vowel. The secondary light source was manually removed from the participant's neck during a single sustained phonation, hence images were obtained with BI and traditional illumination for the same phonation. The images obtained with and without BI were analysed using GIMP software and Octave. Statistical analysis was then performed using the statistical software R.

III. RESULTS

Results showed that VKG and HSV + BI allows for a better visual identification of the lower vocal fold edges during adduction. In addition, the glottal width was shown to be reduced for recordings using BI when compared to traditional illuminated methods. No correlation was found between changes in glottal width and fundamental frequency using BI versus traditional illumination.

IV. DISCUSSION AND CONCLUSION

The present implementation of a bidirectional illumination setup for VKG and HSV highlights the possible pitfalls of current measurements of the size of the glottis (i.e. inaccurate detection of the medial lower edge of the vocal folds, hence glottal space and width). This technique may be implemented for more accurate quantification of glottal area and glottal width in support to further investigating different aspects of vocal fold vibration as for example the different modes of vibration of the vocal folds.

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THE VIBRATORY PATTERN OF THE VOCAL FOLDS IN THE FOUR VOCAL MODES OF COMPLETE VOCAL TECHNIQUE. A VIDEOKYMOGRAPHIC STUDY

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INTRODUCTION: Complete Vocal Technique (CVT) is a style-independent singing technique and teaching method, developed by Cathrine Sadolin (DK). In CVT, all vocal sounds can be categorized into one of the four vocal modes: Neutral with / without air, Curbing, Overdrive or Edge. The distinction between the various modes is made on the basis of the shape of the supraglottal area and acoustic perception. Electroglottographic examinations have been preliminary, without definite results. Characteristics of vibratory pattern of the vocal folds might be used to identify the different vocal modes. Because videokymography (VKG) is a real time registration it is much more reliable than laryngostroboscopy in assessing the vibratory pattern of the vocal folds. The aim of the study was to investigate the duration of the closed phase of the vocal folds, the speed of closing and opening, and closure of the vocal folds anteriorly, posteriorly and in the middle by VKG.
METHODS: In this study, the vibratory pattern of the vocal folds was assessed by VKG of CYMO™. The contact of the vocal folds and the speed of closing and opening were assessed in the registrations in a semi-quantitative way.
The singers were instructed to sing a long note on one vowel in all vocal modes. Each mode was sung at 3 different pitches: low, comfortable medium and high.

- Neutral with air – low, medium & high pitch
- Neutral without air – low, medium & high pitch
- Curbing on – low, medium & high pitch
- Overdrive on – low, medium & high pitch
- Edge on – low, medium & high pitch

RESULTS: Distinct properties of the vibratory patterns that differentiate between the various vocal modes were observed. In the metal modes (Curbing, Overdrive and Edge), the closed phase of the vocal folds is longer than the open phase. This clearly distinguishes the metal modes from Neutral (the only non-metal mode), where the closed phase is equally long or shorter than the open phase. Only in the metal modes glottal closure was faster than glottal opening in some instances. But in one measurement in curbing, glottal opening was faster that glottal closure. This is another aspect that differentiates the metal modes from Neutral, where glottal opening and closure always are equally fast. Neutral with air is the only mode where the vocal folds did not close posteriorly in nearly all of the measurements.
DISCUSSION: The results of this study show that information about the vibratory pattern of the vocal folds can contribute to the distinction between the various vocal modes in CVT. These insights may also contribute to a visual explanation (VKG images) to singing students that it is very important not to sing with audible air in the metal modes. This is important, because many singers experience singing in the metal modes with audible air as uncomfortable and damaging.
These are possible explanations:

- The closed phase of the vocal folds lasts much longer in the metal modes than in Neutral, the only non-metal mode.
- Neutral with air is the only mode where it is possible to release the amount of air that is necessary in order to make
  it audible, due to the deliberate dorsal glottal opening.

Consequently, it is also a clear way of explaining why it is not healthy to sing with audible air while singing with high intensity, i.e. in the metal modes. This study makes it easier to understand the importance of breath support and twang - which are applied in order to hold back the air - in relation to the vocal fold vibration of the different vocal modes.

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VOICE VIRILIZATION AFTER USE OF ANABOLIC STEROIDS RESULTS OF PITCH-RAISING SURGERY AND VOICE THERAPY – A CASE STUDY

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Anabolic androgenic steroids (AAS) are drugs used by athletes and body builders in order to improve their physical performance. The global lifetime prevalence rate of using AAS was reported in 2014 and was 3.3 % in total and 6.4 % in males and 1.6 % in females. Beyond the desired effect i.e. increased muscle mass, and decreased fat mass, AAS also have adverse side effects. In women, reversible changes are e.g. acne, hirsutism and irregular or cessation of menses. Irreversible changes are deepening of the voice and increased clitoromegaly. Voice virilization in women due to use of AAS is scarcely reported. Voice virilization in women caused by other exogenous administration or endogenous production of androgens has been described in women with menopausal problems, fibrocystic breast disease and congenital adrenal hyperplasia. The voice symptoms are lowered fundamental frequency (F0), loss of high frequencies, vocal instability such as involuntary shifts between the modal and falsetto register, hoarse or rough voice quality, creakiness and difficulties to project the voice.

A case study of a 30 year old woman who experienced undesirable voice virilization after intra muscular injections with AAS for 3 months at the age of 17. She was perceived as a male speaker by others on the phone and as a trans gender person. After the voice therapy, F0 was raised during voice exercises and the voice became more stable, but the patient still suffered from the virilized voice. She was referred to the Department of Speech and Language Pathology and the Department of Otorhinolaryngology, Karolinska University Hospital in 2009. The patient underwent pitch-raising surgery with the Cricothyroid Approximation method and postoperative voice therapy. Voice recordings and indirect laryngoscopy were made regularly at 6, 12, 18 up to 24 months post surgery. Digital audio recordings were carried out in a sound treated booth following a clinical standardized routine. The software programmes Soundswell and Phog (Neovius Data och Signalsystem AB, Lidingö, Sweden) were used for recordings and analyses. Habitual voice was recorded during reading of a standard text and narrating to a series of pictures and saved as a speech range profile (SRP). Loud voice was recorded during reading when she tried to make herself heard over 70 dB pink noise presented in head-phones. A voice range profile was carried out to document the physiological range. Cricothyroid approximation, Isshiki´s type IV was performed to increase F0.

Before surgery the patient spoke with a mean fundamental frequency (MF0) of 128 Hz, thus in a male frequency range. After surgery the MF0 increased to 200 Hz which is congruent with reference values from vocally healthy Swedish females for her age. The MF0 was stable at the 18 months follow-up. The patient underwent postoperative voice therapy in order to decrease voice instability and increase the voice speaking range, especially the highest F0 in the SRP. The physiological frequency range was highly decreased. The Minimum F0 was raised, as desired, but Maximum F0 was lowered, which explains a highly reduced area post surgery. The area was smaller in comparison to reference values for both female and male vocally healthy speakers.

There is a clear risk that women after doping with AAS develop a virilized male voice mainly due to largely spread ignorance about the irreversible voice effects such drugs may cause. Voice therapy can to a certain extent effect the voice to sound more feminine if the patient is motivated. Pitch-raising surgery using the technique Cricothyroid Approximation seems to be a possible treatment for women with a virilized voice when feminizing voice therapy is not enough. It is important to spread information about the irreversible side effects that may occur in women who uses AAS. If voice virilization occurs we strongly recommend referral for voice assessment and voice treatment to specialists in the field.

TRANSLATION, TEST OF RELIABILITY AND VALIDITY OF THE SWEDISH VERSION OF TRANSSEXUAL VOICE QUESTIONNAIRE$^{\text{MALE-TO-FEMALE}}$

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Gender incongruence occurs when an individual experience a discrepancy between gender identity and the sex assigned at birth and the bodily appearance. If this causes distress, the individual may meet the criteria for a formal diagnosis such as Transsexualism (F64.0) according to ICD 10 [1]. The number of individuals with the diagnosis Transsexualism who seek medical help has increased considerably in Sweden after the year 2000 [2], as in many other countries. Many transsexual male-to-female individuals (trans women) need to adapt their voice and communication to reach a feminine sounding voice and are, thus, in need of voice therapy. However, evidence for feminizing voice therapy is scarce and the need for treatment studies are evident [3], as well as the need for good patient outcome instruments. The Transsexual Voice Questionnaire for Male-to-Females (TVQ^{MtF}) is such an instrument [4]. It contains 30 items about voice function using four answer categories (never or rarely, sometimes, often, usually or always). Each item is scored 1-4 and their sum make up a total score (30-120). Higher scores are related to higher degree of difficulties. The purpose of the present study was to translate the TVQ^{MtF} into Swedish and to evaluate the reliability and validity of the Swedish version (Swe-TVQ^{MtF}) since an instrument in Swedish measuring voice-related quality of life among trans women has, so far, been missing.

TVQ^{MtF} was translated to Swedish and back-translated to English following guidelines by the World Health Organization (http://www.who.int/substance_abuse/research_tools/translation/en). Thirty trans women (mean age 37 years), 30 vocally healthy women (mean age 37), and 22 women with functional or organic voice disorders (mean age 46) participated by answering the Swe-TVQ^{MtF}. The trans women completed the instrument twice, with four to seven weeks in between, for test-retest calculations. Statistical analyses were performed using Cronbach's alfa (α), Intraclass correlation coefficient (ICC), Item total correlation (ITC), Pearsons correlation coefficient (*r*) and Kruskal-Wallis test.

The Swe-TVQ^{MtF} showed high reliability as the test-retest was excellent (ICC= 0.95; 95 % confidence interval 0.90-0.98) and the internal consistency was very high both times (Cronbach's α= 0.97 and α= 0.98). Also, high homogeneity for the ITC analysis of the items was found. Due to the sample size, a factor division could not be confirmed. When comparing the results from the three groups of participants it was found that the questionnaire managed to distinguish between trans women and vocally healthy women, as well as between trans women and women with voice disorders for the items related to femininity of the voice.

The results from this study shows that the Swedish version of TVQ^{MtF} is a robust instrument in terms of reliability, in accordance with a previous study [4], and validity. Therefore, it is recommended for clinical use by speech and language pathologists who are working with trans women both for assessment and evaluation of interventions such as voice therapy and pitch-raising surgery. Previous studies have shown that acoustical and perceptual assessment tools are not always consistent with the patient's own experience of the treatment [5]. The TVQ^{MtF} is therefore an important complement to other assessment tools. Apart from Swedish, the TVQ^{MtF} has been translated into Portuguese and currently into Finnish, Danish, Spanish, Dutch, German, Tamil, French and Croatian (http://www.shelaghdavies.com). This enables future comparisons between different countries using TVQ^{MtF}.

ARE WOMEN WITH REINKE'S EDEMA GOOD CANDIDATES FOR THE STUDY OF GENDER IN VOICE?

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INTRODUCTION: Gender - defined by Oakley as the social classification into masculine and feminine - is one of the important paralinguistic information transmitted by voice. When the person's own voice does not match his/her personality, a negative psycho-social impact may influence the person's well-being. Female smokers may develop Reinke's edema (RW) and they often visit the laryngology clinic complaining of being mistaken for men over the phone. Working with this group of patients might be very helpful, outside the medical setting, to understand the impact of voice features on the perception of gender in voice. Our hypothesis is that RW can be considered as a very informative group of speakers to study gender ambiguity in voice. Our primary objective is to find out how these women qualify their voice as far as gender is concerned. Our secondary objective is to verify whether the available self-evaluation tools are enough to track down RW's complaint. Our third objective is to evaluate the main questions that should be added to the evaluation of gender ambiguity in RW's voices.

METHODS: Two groups of speakers participated in the study: 10 women with normal voices (NW) and 11 RW. The participants were asked to rank their voice and their personality separately on a masculinity/ femininity scale. They were also asked to complete a questionnaire including the 10 questions of the VHI-10, 10 questions from the Transsexual Voice Questionnaire for Male-to-Female Transsexuals » (MTF-TVQ) and 2 added questions to emphasize the impact of voice quality on one's self-esteem, and to clarify the positive or negative impact of a masculine sounding voice in the Lebanese context. We used the non-parametric Mann-Whitney test to compare the self-evaluation scores of the gender of voice and personality between the 2 groups and to compare the answers given by the two groups to each item of our questionnaire. The non-parametric correlation test of Spearman was used to study the correlation between the questionnaire and the self-evaluation of the gender as far as voice and personality are concerned. A p-value <0.05 was considered as significant.

RESULTS: *RW evaluated their voice as being significantly more masculine than NW and their personality as being as feminine as NW. The questions which were significantly different in each of the two groups are:* It distresses me when I'm perceived as a man because of my voice*;* My voice makes it hard for me to be identified as a women*;* The pitch of my speaking voice is too low, The clarity of my voice is unpredictable, My voice problem upsets me, People ask, "What's wrong with your voice?". The questions which correlated significantly with the masculine perception of voice were: The clarity of my voice is unpredictable *and* My voice problem upsets me.

DISCUSSION AND CONCLUSION: Our results show that RW express the same voice complaint as MTF transsexuals, therefore they should be considered as a target group in the evaluation of gender ambiguity in voice. We suggest adding the following items in RW's evaluation : *It distresses me when I'm perceived as a man because of my voice; Rate your voice gender and personality gender separately on a scale from 1 to 9 with 1 = very masculine and 9= very feminine.* We are hopeful that these additions will allow a better understanding of the vocal complaint RW have, a better selection among RW to study gender ambiguity in voices and a better adaptation of the treatment strategy.

SWEDISH INTERDISCIPLINARY PROGRAM FOR INDIVIDUALS WITH GENDER DYSPHORIA WITH FOCUS ON VOICE

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The purpose is to present the interdisciplinary program offered to persons with gender dysphoria in Sweden with focus on voice assessment and intervention. Gender incongruence occurs when there is a discrepancy between a person's gender identity and the sex assigned at birth and the bodily appearance. If gender incongruence causes distress the individual could meet the criteria for a formal diagnosis, "Transsexualism" (F64.0), "Gender Identity Disorder not otherwise specified" (F64.9), "Other gender identity disorders" (F64.8) according to ICD 10, or "Gender Dysphoria" according to DSM-5. Medical treatment may include contrary sex hormones, voice and communication therapy, surgery to aid changes of primary and secondary sex characteristics, and hair removal (in natal males). The person can apply for a new legal gender. The number of persons with gender dysphoria who seek medical help has increased considerably in Sweden after year 2000 as in many other countries. There are six specialized psychiatric gender teams in Sweden responsible for diagnostic assessments and coordination of gender confirming medical interventions. Extended gender teams include endocrinologists, speech language pathologists (SLPs), phoniatricians, gynecologists, dermatologist, and surgeons.

Male-to-female transsexual individuals, trans women, and female-to-male individuals, trans men, are referred to a SLP for voice assessment when a gender dysphoria diagnosis has been confirmed by the psychiatric team. Assessment includes: 1) background information of relevance from an anamnestic discourse, 2) patients' self-evaluations using questionnaires, and 3) audio recordings, including voice range profiles, for acoustic and perceptual analysis. Trans women are also referred for a phoniatric examination including videolaryngostrobocopy. The following interventions are provided for trans women depending on the patient's needs. 1) information and recommendations, 2) voice and communication therapy, and 3) pitch-raising surgery (after voice therapy has been given). The following interventions are provided for trans men: 1) information and recommendations and 2) voice and communication therapy. Although testosterone treatment usually lowers F0 to male reference values many trans men need voice therapy because of vocal fatigue, voice instability, or dissatisfaction with the voice pitch or voice quality. The SLPs and phoniatricians meet regularly to discuss voice intervention and pitch-raising surgery, sometimes together with the patient, to provide optimal voice care.

The extended gender team at Karolinska University Hospital, which consists of all specialists working with gender confirming interventions, has regularly meetings. Once a year, the extended gender team organizes an information day for the general public, health care personal, patients and their families about gender dysphoria, assessments, treatments, and recent research. The gender team is also in growing collaboration with different trans-organizations. The Swedish National Board of Health and Welfare recently published national guidelines based on evidence for assessments and treatments for all professional areas involved in the care of adults, children and adolescents with gender dysphoria. The guidelines were also updated to make them more congruent with WPATHs (World Professional Association for Transgender Health) Standards of Care version 7 (www.wpath.org). Among other interventions, voice and communication therapy for patients with gender dysphoria should be offered. To work clinically with patients with gender dysphoria requires special training and competence as stated in Standards of Care version 7. Lectures are given within the area at each of the six speech language pathology university programs in Sweden to provide a basis for SLPs to work with voice and communication in patients with gender dysphoria.

The European Professional Association for Transgender Health (EPATH) was launched 2014 to promote mental, physical and social health, to increase the quality of life among transgender people in Europe, and to ensure transgender people's rights for healthy development and well-being (www.epath.eu).

COMPARISON OF VOICE QUALITY EVALUATIONS CONDUCTED BY BRAZILIAN AND FINNISH LISTENERS

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Several past studies have concerned terminology and protocols applicable in the perceptual analysis of voice quality and factors affecting the validity and reliability of it [1, 2]. Some studies have been conducted from within cross-cultural and cross-linguistic perspectives concerning the evaluation of pathological voices [3]. Few studies [4] have focused on the evaluation of normal and supranormal voice. This study compares evaluations of professional and non-professional speakers' voices by Finnish and Brazilian listeners focusing on the differences between the Finnish and Brazilian-Portuguese languages from linguistic and phonetic points of view.

Thirty experienced actresses with formal vocal training, and thirty non-actresses without any formal vocal training were included in this study. All participants were native speakers of Brazilian Portuguese, and had no history of voice disorders. Audio recordings of both groups were made with a 200-word reading task (approximately 1.5 minutes in duration) employing habitual loudness. The recordings were made in an acoustically treated booth (ambient noise level < 30 dB) with Marantz PMD-671 Solid State Recorder (Marantz, USA) and microphone headset AKH C420L (AKG, AUT), positioned at a distance of 8 cm from the lips (sampling rate 44.1 kHz, 16 bit/sample quantization). The overall voice quality was assessed by five experienced Brazilian speech language pathologists and by five experienced Finnish voice trainers (1 of them also a speech and language pathologist), both groups having experience working with people who have healthy voices that they use professionally. The rating was performed using a 10 cm visual analogue scale (0 = very poor quality, 10 = excellent quality). High quality headphones were used. Twenty samples were repeated in random order to assess the intra-rater reliability.

The inter-rater reliability of perceptual evaluation was good for both Brazilian and Finnish raters (Cronbach's alpha 0.78 and 0.75, respectively). The intra-rater concordance was satisfactory (Spearman's rho 0.6 and 0.63). The means of Finnish and Brazilian raters' evaluations correlated strongly (Spearman's rho 0.75), although there was no perfect agreement concerning the best and poorest voices. The findings suggest that cultural and linguistic factors do not have much effect on the perceptual evaluation of general voice quality by trained evaluators with experience in working with professional voice users.

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IMPACT OF BODY POSTURE ON PERCEIVED VOICE QUALITY

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I. INTRODUCTION

Body posture plays a substantial role in voice pedagogy and voice therapy. Few research has been reported about the impact of body posture on perceived voice quality. This study investigates the influence of body posture (standing, sitting and lying) on perceived voice quality.

II. METHODS

70 subjects, 31 males and 39 females with healthy voices between the age of 20 and 57 participated in this study. The participants had to perform three different speech tasks (a sustained vowel, counting and reading aloud) in a standing, sitting and supine body position. After the speech samples were recorded, the participants were offered a self-assessment form to indicate the perceived comfort and voice quality in every speech task and body position on a visual analogue scale (VAS).
The recorded speech samples were randomly presented to a panel of professional and ecperienced judges for perceptual evaluation of voice quality on a VAS.

III. RESULTS

The results show that there are significant differences between the postures with regard to the perceived comfort while speaking. The standing posture is considered by the participants to be the most comfortable position to speak, followed by the sitting and supine positions. The subjects judged their own perceived voice quality in the different postures similarly, although the difference between standing and sitting position was not significant in this case.
The professional judges were unable to discriminate perceptually between the postures with regard to voice quality and in general there was poor intra- and inter observer agreement. No correlation could be found between the findings of the subjects and those of the judges and in some cases they were even contradictory.
In general there are no significant differences between males and females with regard to self-perceived comfort and voice quality. Between the different age groups (20-40 years and 41-60 years) there are no significant differences for all judgments, except one.

IV. DISCUSSION

We can conclude that on a perceptual basis it is not possible to discriminate between voice quality produced in different postures, although the subjects themselves indicate a difference in perceived comfort and voice quality between the three body positions in favour of the standing position.
However, this study emphasizes the attention that should be paid to the individual comfort sensation of patients during voice therapy.

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MANUAL VS AUTOMATIC SEGMENTATION OF SYLLABE REPETITION: APPLICATION TO DYSPROSODY IN IDIOPATHIC PARKINSON'S DISEASE

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Introduction: Patients with Parkinson's disease (PD) show a higher pace of variability during a syllable repetition task with rhythm acceleration with respect to healthy subjects [1], where the utterances were cut manually leading to long processing times usually prohibitive for clinicians. The aim of this work is to compare the performance of an automatic voiced-unvoiced (AVU) segmentation algorithm with reference values obtained by manually labeling the repetitions of the syllable /pa/ uttered by PD patients and healthy control (HC) subjects.
Methods: 32 PD patients and 29 HC subjects were asked to repeat the syllable /pa/ for at least 25 times at a comfortable steady pace without accelerating or slowing the articulatory velocity. AVU splits the whole signal into short frames of the same length whose energy is then computed. The algorithm, based on the Otsu's method applied to the energy histogram, allows finding two thresholds for the separation between two classes (voiced and unvoiced frames) [2].
In order to compare the results obtained with the AVU algorithm with those extracted manually, we computed the mean value (IntDur) and the standard deviation (SD) of the duration of the first 20 frames obtained with AVU. As concerns the comparison between PD and HC, the Duty Cycle (D) of the repetition (the percentage of voiced time with respect to the utterance duration) was computed, that was found lower in PD patients [2]. Moreover, the following parameters were computed: mean value and standard deviation of the first 20 repetitions (D_{mean} and D_{SD}); mean value for the first 4 repetitions (avD_{1-4}), for the repetitions from the 5th (13th) to the 12th (20th) (avD_{5-12} and avD_{13-20}); coefficient of variation (D_{COV}) on the whole task and the relative coefficient of variation ($D_{COV5-20}$); the ratio between avD_{5-12} (avD_{13-20}) and avD_{1-4} ($DRelStab_{5-12}$ and $DRelStab_{13-20}$), and their difference (DPA).
Results: The AVU algorithm provides results highly correlated to the reference ones (Tab.1). Concerning the comparison between PD patients and HC subjects, both groups show similar values of D_{mean} (around 0.50, i.e. on average the 50% of the recording is vocalic). The only parameter that shows significant differences between the two groups is $DRelStab_{13-20}$, with HC subjects that exhibit higher values than PD patients (92.97 ± 8.60 vs. 87.33 ± 10.36, p = 0.02).

Table 1: mean values, standard deviations and correlation coefficients for some parameters used to compare the AVU with the reference results extracted with the manual labeling.

Parameter	Group	Manual labeling	AVU	Correlation
IntDur (ms)	PD	545.15 ± 182.08	550.06 ± 186.59	0.997
	HC	505.56 ± 234.33	507.28 ± 236.09	
SD (ms)	PD	39.56 ± 20.15	41.56 ± 20.29	0.905
	HC	28.50 ± 16.51	36.03 ± 19.28	

Discussion: As $DRelStab_{13-20}$ is defined as the ratio between avD_{13-20} and avD_{1-4}, values below 100 indicate a decrease of D during the repetitions. In fact, D is the percentage of voiced time related to the whole utterance duration and a decrease of Interval Duration along the repetitions is present in PD patients though not significant (Tab. 1). Thus it could mean that there is a reduction of the vowel duration during the task. This is true for both groups, but more evident in PD patients. The results of the AVU performance as compared to manual labeling are very promising for the purpose of implementing an automatic and fast method to assess dysprosody in PD patients, the processing time being on average less than 2 s for signals lasting 20 s.

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DIFFERENTIATING DIPLOPHONIA FROM OTHER TYPES OF SEVERE DYSPHONIA BY ACOUSTIC ANALYSIS

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Objectives: Diplophonia is an often misunderstood sign of severe voice disorders. Depending on the underlying aetiology, diplophonic patients typically receive treatment such as phonosurgery or logopedic therapy. In current clinical practice, diplophonia is identified auditorily via the simultaneous perception of two pitches. Objectively, diplophonia is defined as the presence of the superposition of two oscillations at two different fundamental frequencies. This objectification favours more robust treatment indications and treatment effect measurements. Of particular experimental interest is the differentiation of diplophonia from other types of severe dysphonia. The aim of the study is to compare on that task the performance of the recently published Diplophonia Diagram [1], which detects the presence of diplophonic vibrations at the acoustic level, to the performance of conventional acoustic features. The validity of the features is discussed with regard to the signal models they rely on.
Subjects and Methods: The tested audio samples are part of a database of rigid endoscopic laryngeal high-speed videos of sustained phonations with simultaneous high-quality audio recordings of 80 dysphonic subjects (40 diplophonic and 40 non-diplophonic) and 40 euphonic subjects. From these, 125 sound fragments of homogeneous voice quality were selected for analysis (55 diplophonic and 70 severely dysphonic, but non-diplophonic). The fragments are between 125 ms and 2.048 s long. The tested acoustic features were jitter, shimmer, the Göttingen irregularity and noise features, the Harmonics-to-Noise-Ratio, the Degree of Subharmonics and the Diplophonia Diagram. Jitter is the average absolute difference of adjacent cycle lengths, divided by the average cycle length. Shimmer is 20 times the average absolute base-10 logarithm of the ratio of adjacent cycle peak amplitudes. The Göttingen irregularity feature is a combination of jitter, shimmer and the mean waveform-matching coefficient. The Göttingen noise feature describes the correlation between sub-band envelopes of the pre-whitened signals. The Degree of Subharmonics reports the presence of temporal metacycles or spectral subharmonics. The Diplophonia Diagram automatically tests for the presence of diplophonic oscillations. Automatic threshold classifiers were trained for each feature.
Results and Discussion: The Diplophonia Diagram assigned correctly 87.2 % of all samples. The best conventional feature is the Degree of Subharmonics, with an accuracy of 67.6 %. Jitter, shimmer and the Göttingen irregularity feature rely on the assumption that only one additive oscillator is active. Thus, their validity in the case of diplophonic voices is questionable. The Göttingen noise feature and the Harmonics-to-Noise Ratio are sensitive to both diplophonia and noise, which increases the risk for clinical misinterpretations. The Degree of Subharmonics is the only feature that considers two fundamental frequencies to exist simultaneously, but cannot distinguish between diplophonic beating and non-diplophonic amplitude modulation.
Conclusion: The Diplophonia Diagram achieves more accurate and valid results compared to conventional features, because of its higher specificity that relies on the explicit consideration of the existence of the superposition of oscillations with different fundamental frequencies. The conventional features are sensitive but not specific to diplophonia, i.e. their values increase for both diplophonia and other types of severe dysphonia. In future versions of the Diplophonia Diagram, non-additive diplophonia and (inter-)modulations should be considered.

Table 1: Accuracy (Acc) of all features under test. The p-values are obtained by a Chi^2-test for equal proportions with six-fold Bonferroni correction. Diplophonia Diagram (DD), Göttingen's irregularity (Irr), Göttingen's noise (Noise), Praat's Harmonics-to-Noise Ratio (HNR), Degree of Subharmonics (DSH), 95 % confidence intervals (CI).

	Acc, CI [%]	p-value
DD	87.2, [80.0, 92.5]	-
Jitter	58.4, [46.9, 67.3]	< 0.001
Shimmer	66.2, [56.8, 76.5]	= 0.002
Irr	57.7, [49.2, 66.1]	< 0.002
Noise	64.9, [58.1, 69.7]	< 0.001
HNR	54.0, [48.0, 60.0]	< 0.001
DSH	67.6, [61.8, 75.2]	< 0.001

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A DATABASE AND DIGITAL SIGNAL PROCESSING FRAMEWORK FOR THE PERCEPTUAL ANALYSIS OF VOICE QUALITY

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Clinical assessment of dysphonia relies on perceptual as much as instrumental methods of analysis [1]. The perceptual auditory analysis is potentially subject to some internal and external sources of bias [3]. Thus, the availability of an annotated database is of main importance. Databases to perform digital processing of the vocal signal are usually built from sustained vowels from English speaking subjects [6]. However, phonemes vary from one language to another and, to the best of our knowledge, there are no annotated Spanish databases with sustained vowels from dysphonic voices. This work shows our first steps to fill this gap by building a database of disordered Spanish voices and developing signal processing algorithms to aid in the assessment of clinical dysphonia.

A preliminary annotated database with 119 recordings of the sustained Spanish /a/ has been created. The voice samples, available under Links in the ATIC website (www.atic.uma.es), were labeled by 7 experienced experts in vocal quality analysis. Voice signals were recorded using a headset condenser cardioid microphone (AKG C-544 L) oriented towards the speaker's mouth and at 5 cm. The microphone was connected to a digital recorder Edirol R-09HR. Voice signals were digitized at 16 bits with 44100 Hz sampling rate. Speakers were instructed to sustain the Spanish vowel /a/ for 5 seconds. Then, each 5s voice sample was cut from 0.5 s to 3.5 s. The voice signals were labeled by using Sennheiser HD219 headphones using the Hirano GRBAS original scale, posteriorly modified by Dejonckere et al., [8]. Simultaneous perceptual analyses were performed by using a multi-channel headphone preamp Behringer HA4700 Powerplay Pro-XL.

The parameter G (grade of severity) is considered in the analysis of the audio processing scheme developed to assess the performance of certain audio signal descriptors aimed to aid in the process of voice quality evaluation. The Yin algorithm [9] was used to identify voiced frames and extract the fundamental frequency of voiced frames. Then, some simple parameters, as described in [6] were selected and plotted to identify their usability to aid in the voice quality analysis task, namely: degree of voiceless, absolute/percent jitter, soft phonation index and others.

The analysis showed that the database must evolve to include more samples more equally distributed among the different classes. Some features were found to attain unexpected low performance in the classification scheme selected. A process of selection of features is required as well as the evaluation of their performance against other parameters of the GRBAS scale and further development of the analysis features and classification schemes.

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CEPSTRAL PEAK PROMINENCE-BASED PHONATION STABILISATION TIME AS AN INDICATOR OF VOICE DISORDER

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A common feature of voice disorders is the impairment of the ability to initiate and sustain adequately periodic vocal fold vibrations. Traditional acoustic approaches that use sustained vowels in which initial/final portions are excluded have been criticised for poor validity and for exclusion of factors that may be a rich source of clinically relevant data e.g. regarding the onset of vocal fold vibration (Maryn and Roy, 2012).
Schaeffler et al. (2015) introduced a new measure of dynamic changes at onset of phonation during connected speech called phonation stabilisation time (PST). Using autocorrelation values, the periodicity patterns at the onset of voiced segments of connected speech were analysed. PST was defined as the time taken for the autocorrelation values to rise from a voicing threshold to a threshold of stable periodicity. Results of this approach were promising, but reliance on autocorrelation values may make the approach sensitive to pitch tracking errors. In the present study we therefore conducted a similar analysis, deriving PST from cepstral peak prominence (CPP) rather than from the autocorrelation function.
The aim of this study was to establish if PST, as determined by CPP, is useful as an indicator of voice disorders in connected speech. We had three main hypotheses: that disordered voices would have (a) greater mean PST and (b) greater PST standard deviation values than normal voices; and (c) that the proportion of voiced segments that reach the stable threshold of periodicity would be higher in normal voices. To determine if PST is able to identify disordered voices that are not detected by more conventional acoustic analysis, we analysed a subset of voices for which there was a clinical diagnosis of voice disorder, but acoustic analysis of sustained vowels showed acoustic parameters within the normal range.
Connected speech samples containing the first 12 seconds of the 'Rainbow Passage' were obtained from the KayPENTAX Disordered Voice Database. All samples were segmented into voiced/unvoiced portions using Praat, and CPP values were derived using VoiceSauce. PST was calculated as the duration between the beginning of the voiced segment and a threshold CPP value (23.14 dB as determined in a pilot study using normal speakers). For statistical analysis, the two gender groups were analysed separately, both for all speakers and for the subset of 'below threshold' speakers.
Disordered voices from all groups showed a significantly longer mean PST than normal voices from the same group ($p<0.001$ for all speakers, $p<0.005$ for 'below threshold' subset). Similarly, SD of PST was significantly larger for disordered voices in all groups ($p<0.001$ for all speakers and female 'below threshold' subset, $p<0.005$ for male 'below threshold' subset). The proportion of voiced segments that reached the stable threshold of periodicity were significantly higher for normal voices in all groups ($p<0.001$ for all speakers and male 'below threshold' subset, $p<0.005$ for female 'below threshold' subset).
Our results indicate that PST using CPP has potential to differentiate between the normal and disordered voices from the Voice Disorder Database, and outperforms our previous PST measure using autocorrelation, especially regarding male voices. The results for the 'below threshold' groups for both male and female are of particular interest. These results suggest that PST using CPP may be a potential indicator of voice disorder in cases where traditional acoustic analysis measures of sustained vowels do not show any pathological findings.

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THE AVQI WITH EXTENDED REPRESENTATIVITY: EXTERNAL VALIDITY AND DIAGNOSTIC PRECISION WITH 1058 VOICE SAMPLES

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Introduction: The Acoustic Voice Quality Index (AVQI) is a six-factor acoustic model based on linear regression analysis to measure objectively overall voice quality in concatenated continuous speech and sustained phonation segments. The new model of AVQI was found to be more representative and ecologically valid because the internal consistency of AVQI was balance out through equal proportion of the two speech tasks. The present investigation aimed to explore its external validation and diagnostic precision in a large dataset.

Methods: An expert panel of 12 speech-language therapists (i.e., professional experience in perceptual judgment of voice abnormalities ranged from 5 to 40 years) rated the overall voice quality of 1058 concatenated voice samples (i.e., 34 syllables of continuous speech and 3 sec. sustained vowel [a:]) varying from normophonia to severe dysphonia across various organic and non-organic etiologies.
The Spearman rank-order correlation coefficient (r_s) and the coefficient of determination (r^2_s) were used to measure concurrent validity. The AVQI's diagnostic accuracy was evaluated with several estimates of its receiver operating characteristics (ROC).

Results: Finally, 8 from the 12 experts were chosen because of acceptable reliability (kappa > 0.41). Then of the G-scores of the 8 raters (i.e., G-mean) was taken as the perceptual dysphonia severity level for every voice sample. A strong correlation was identified between AVQI and G-mean (r_s = 0.815, p= 0.000). It indicated that 66.4 % of G-mean's variation was explained by AVQI (r^2_s = 0.664). Additionally, the ROC-results showed again best diagnostic outcome at a cut-off score of AVQI=2.43 (i.e., sensitivity= 0.785, specificity= 0.932).

Conclusion: This study highlights external validation and diagnostic precision of the extended version of AVQI as a robust and ecologically valid measurement to objectify overall voice quality.

CEPSTRAL MEASUREMENTS: IN SEARCH OF THE OPTIMAL SPEECH SAMPLE, CEPSTRAL FEATURE AND NORMATIVE DATA

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Spectral-based measures show better correlation with perceptual voice classification than time based measures and provide valid evaluation of voice quality [1, 3, 4]. Until now, cepstral measurements are particularly performed in speech samples consisting of sustained vowels *or* running speech. In this study, in search of the optimal speech sample to assess voice quality, 6 speech samples of 112 subjects are used: (1) a 1 second sustained vowel /a/ (Sv /a/), (2) a continuous speech sample consisting of the 2 first sentences of a phonetically balanced text (Contsp1), (3) a continuous speech sample consisting of a merely voiced sentence (Contsp2), (4) a concatenated speech sample consisting of 1 and 2 (Concat1), (5) a concatenated speech sample consisting of 1 and 3 (Concat2) and (6) a continuous speech sample consisting of the complete phonetically balanced text (Contsp3). Looking for the type of cepstral feature providing the best validity, 4 cepstral measurements are done: cepstral peak prominence (CPP), cepstral peak prominence standard deviation (CPP SD), low/high-frequency spectral ratio (LH) and low/high-frequency spectral ratio standard deviation (LH SD).
5 experienced voice clinicians rated a speech sample consisting of (3) or (6), (4) and a sustained vowel /a/ (of at least 3 seconds). They judged on overall severity of dysphonia (Grade, G), Roughness (R) and Breathiness (B) using a 4-point equal-appearing interval scale. Spearman rank-order correlation coefficients (r_s) confirm a moderate to strong positive correlation (0.703 to 0.857), Cohen Kappa coefficients (K) a moderate positive correlation (0.360 to 0.642). CPP, in contrast to the other cepstral features, correlates moderately to good with G and B but only weak with R. This concurs with the study of Lowel et al and Brinca et al, who already stated that CPP is more accurate in expressing breathiness than roughness [2,4].
Furthermore, our study also demonstrates that the sensitivity and specificity of CPP is highest in Concat 1, a speech sample in which a sustained vowel is combined with a short phonetically balanced text. This suggests that concatenated speech samples are preferable to continuous speech or sustained vowels for assessing voice quality. Subjects (n = 20) are considered as vocally normal when the sum of the G-scores given by the 5 voice clinicians is ≤ 1. The median CPP of Sv /a/ is 12.53 dB for males (n = 10) and 11.6 dB for females (n = 10). For Concat1, median CPP amounts for 8.762 dB in the male and for 8.406 dB in the female population (Fig. 1).
The highest sensitivity and specificity is found for a CPP of 8 dB in Concat 1 (resp 76% and 80%)
An unpaired T-test indicates that the difference between the CPP of males and females for Sv /a/ and Concat1 is not significant: Concat1 ($t_9 = -0.143$, $p = 0.239$) and Sv /a/ ($t_9 = 0.818$, $p = 0.900$).

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W5-Singing Voice 3 (Room1)

ABSOLUTE VOCAL RANGE AND REGISTERS: AN INTERACTIVE WORKSHOP

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In this interactive workshop, participants will have the opportunity to participate in on-going research regarding extreme vocal range and exploration of 'chest' (Mode 1) and 'head' voice (Mode 2) at their extreme ranges.

Workshop will include demonstration of techniques to help determine absolute vocal range and absolute register capability. The goal is to separate vocal registers from traditional pitch constraints in order to help show the enormous untapped pitch and register capacity of human voices.

1- Mark X for lowest pitch

2 - Mark X for highest note

3 - Mark LH for lowest "head voice" note

4 - Mark HC for highest "chest voice" note

Sample:

W6-Singing Voice 4 (Room2)

WORKING WITH PRIMAL SOUND AND OTHER DEVICES IN POPULAR CHORAL MUSIC

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Over the past four years I have been implementing a pedagogical model of emotive, reflexive "primal sounds" in my work as a contemporary choral director. Using the body of work of Dane Chalfin, I have seen great benefit (both technically and stylistically) in the practice of applying these primal sounds in a choral context, using contemporary rock and pop repertoire.

This practical workshop will investigate the benefits and accompanying teaching practices associated with using primal sound in a contemporary choir setting. Central areas for discussion will include: stylistic awareness, the differences between classical and popular approaches to choral singing, and the technical application of primal sound in this setting. Adopting the intuitive language of primal sounds allows the singer clear access to different voice qualities without the need for prior knowledge or understanding of technical jargon, allowing for a more streamlined rehearsal process. As the descriptors of primal sounds (sigh, whimper, yell, etc.) are vernacular, they yield similar vocal output from most singers, regardless of their previous training. By using an "everyday" working language between director and singers we also achieve a more spontaneous and cohesive choral blend.

This workshop is designed to be highly interactive. Participants will be encouraged to sing and engage with direction from the workshop leader. The duration would ideally be forty-five minutes with audio/visual support throughout.

Craig is a vocalist, composer, arranger and choral director, working in contemporary voice pedagogy. Currently lecturing in Popular Voice at Leeds College Of Music, Craig also holds the post of 'Musician in Residence' for the West Yorkshire Playhouse's program for Young People, and is an in-demand choral director and animateur. He is a regular contributor to Voice Council Magazine and was recently one of only five recipients in the UK to be awarded the 'Sing For Pleasure Young Conductors Scholarship'.

Round Table 1 (Room3)

INHALING SINGING : HISTORIC, PHYSIOLOGIC, ACOUSTIC AND ARTISTIC ASPECTS

Moderator: P. H. DeJonckere[4]
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Reverse phonation means voice production during inhaling, thus with inspiratory airflow. The first report of this phenomenon seems to be due to Franz Merkurius Van Helmont (John Baptist's son) in 1657. Different designations of reverse phonation can be found in the literature and contemporary musical scores, such as 'Inhalatory', 'Ingressive', 'Inspiratory', 'Inhaling', 'In', 'Gasping', 'Inspirer', 'Aspirer', 'Einatmen'.

Physiologically, reverse phonation is well known as a transitional phenomenon occurring during normal speech: reverse phonation naturally occurs in different situations, including laugh, cry and sighs (Timcke & al., 1959). Birth cry is of course inspiratory, and children commonly produce inspiratory cries (Grau & al. 1995).

According to Eklund (2008), transitional ingressive phonation has been used for hundreds of years as a deliberate means of speech or sound production to achieve specific effects, and it is still being used for the same purposes, *e.g*. by shamans and ventriloquists. In normal spoken and spontaneous conversation – contrary to what is often claimed – present-day ingressive speech is not limited to Scandinavia or Nordic languages, but is instead found on all continents in genetically unrelated languages. Where ingressive speech occurs, it serves more or less the same paralinguistic functions, such as a feedback marker in a dialog. Further, pulmonic ingressive phonation is not exclusively used by humans but is encountered in the phonation of many animals, as already noticed *e.g.* by Charles Darwin in 1872 : frogs, dogs, foxes, cats, horses, donkeys, several monkeys and even birds, for example, make use of ingressive phonation.

Behlau & Pontes consider reverse phonation as an adequate exercise to loosen supraglottic constriction. According to Boone and MacFarlane, it should « tend to relax and open up the pharynx and laryngeal aditus ». Indeed, reverse phonation has been reported by radiologists (Powers et al.1964) as a possible maneuver for improving contrast visualization of the endolarynx, and helping in distinguishing supraglottic and glottic tumors from transglottic lesions. Also Kollar (1989) has recommended reverse phonation for indirect laryngoscopy when an endolarynx is difficult to visualize.

Habitual reverse phonation has also been reported as a pathological entity in a particular psycho-dysfunctional context (Wattremez & al, 2011).

Inspiratory speech has implications in voice and speech therapy: it has been suggested for treating psychogenic aphonia, mutational dysphonia, ventricular dysphonia and spasmodic dysphonia, but also unilateral vocal fold paralysis and even severe stuttering (Wattremez et al. 2011; Kenjo, 2005 ; Harrison et al., 1992 ; Orlikoff et al., 1997).

Reverse phonation also has artistic implications in contemporary vocal music, e.g. Helmut Lachenmann's temA (1968) for flute, voice (mezzosoprano) and cello, and Nicholas DeMaison's Ursularia (2006), a chamber opera in one act. A. DeBoer (2012) made an analysis of these and other works with regard to vocal technique, notation, aesthetic orientation and dramatic implications in her DMA-dissertation.

Françoise Vanhecke developed a new artistic singing technique, based on reverse phonation. By exploring and developing this completely new technique 3 styles of true singing (such as mastering melody, pitch, timbre,

W7-Speech Pathology/Therapy 2 (Room4)

LOGOPAEDIC EXPLORATION AND DIAGNOSTIC IN VOCAL TRACT AND ORAL FUNCTIONS

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CPLOL, "Comité Permanent de Liaison des Orthophonistes/Logopedes de l'Union Européenne." in its Professional Profile of the Speech and Language Therapist (SLT), puts in evidence the need for SLT to know tools helpful in assessment and diagnosis

"2.Assessment and diagnosis. …requires a comprehensive appraisal of aspects of communicative competence, … involves collaboration with professionals from other disciplines. The SLT makes diagnosis through objective testing and clinical observation.
3 – Intervention . An essential part… is the evaluation of its efficacy... in a multidisciplinary context.

IV. Competences and attitudes of SLT. SLTs should be " practising researchers ". They should … assess the client's communication skills and disorders …to plan a suitable programme of therapy…regularly evaluate outcomes and make adjustments on the basis of the new information obtained.

Phase 2:
Assessment and diagnosis. SLTs must :
- … use appropriately the chosen assessment tool / observation technique;
- …extract relevant information from their observations …" http://www.cplol.eu/eng/profil_professionnel.html

In his activity in Col.legi de Logopedes de Catalunya, E. Rios contributed to practically apply the statements of the professional profile, observing the need for SLT "to appropriate use of every required assessment tool".
ENT basic instrumental tools are widespread in practices where also SLTs work.
Sharing tools like a common code, permits observations complementary to medical ones in planning a therapeutical program, in assessing therapeutical outcomes and considering other aspects, which may anyway interfere with or condition the therapeutical program itself.
The Authors, an ENT and Phoniatrician, a Logopedist and an Occupational Psychologist planned a 15 hours-training basic course for SLT about ENT common instrumental tools' use : frontal lights, specula, tongue depressors, laryngeal and nasopharyngeal mirrors, pocket spirometers, and their own hands-fingers-eyes to assess patient's aspects in facial, buccal and vocal tract districts.
The course presents shortly anatomical and physiological topics for each district, how instrumentally evaluate them, including sterilization and self protection aspects.
At the end of each topic, participants are directly trained, examining each other, to assess "differencies in normality".
At the end of all sessions, a couple of "volunteers" patients present themselves to SLT, to let them instrumentally evaluate their cases. Last but not least , is provided information about costs/benefits .
The workshop presents a 2 years experience of the Authors in this course - four editions already performed-.

words, rhythm and expression) in combination with a specific notation were realized and implemented in compositions and performances using Inhaling Singing by Françoise Vanhecke (ISFV®) (Vanhecke 2013, 2014, 2015; Moerman 2014, Bilbao 2013; Verwee 2014; Vande Gorne 2015). The results of intensive research (artistic and empirical) and performances based on ISFV® will be presented in a doctoral dissertation.

The present Round Table aims to provide an overview of the literature about reverse phonation (particularly singing), including (ethno) musicological aspects, and further focuses on an advanced analysis of the mechanisms of artistic inhaling singing. This highly experienced professional singer, composer and teacher, who invented and developed inhaling singing (Françoise Vanhecke) has been exhaustively analyzed, and, for the first time, a detailed comparison can be made between exhaling and inhaling singing for a wide range of comparable vocal emissions in the same outstanding vocalist. The comparison deals with anatomical (MRI), physiological (single line high speed imaging, aerodynamics) and acoustical (formant analysis & spectrography, perturbation parameters, adaptive normalized noise energy etc.) data, as well as with voice range profiling. Aspects of singing technique and artistic expression are also discussed.

This Round Table further refers to a workshop on inhaling singing to be given by Françoise Vanhecke, within the same congress.

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W8-Singing Voice 5 (Room1)

MY DRAG ARTIST HAS LOST HIS FALSETTO! RETRAINING THE TROUBLED SINGING VOICE

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One summer, Saturday night I received an urgent phone call from a local Social Club where a singer I had been coaching for his "Drag" act was about to perform. He was recovering well from vocal nodules but I hardly recognised the deep bass voice that spoke to me. We went through his set 2 octaves lower than usual and he managed the performance. I met him later in the week, after he'd seen his Laryngologist, and we identified the culprit, an allergic reaction to new COLOGNE!

Patience, empathy and insight are some of the skills required of the singing teacher when working in the field of vocal rehabilitation. Singers come to us at their most vulnerable so our responsibility is enormous. We need teachers able to promote best practice throughout all the voice styles, with the ability to demonstrate the techniques required in all genres from Opera to CCM with equal enthusiasm.

In this Workshop we will try out some of the exercises I have used to help singers experiencing difficulties. The Classical Singer, especially choir members who have "blended" never finding their true sound; the Professional Vocalist needing basic training and awareness of voice care and the Tribute Band or Sound-alike-Artist forced to mimic a sound other than their own.

As a recommended singing teacher at the Queen's University Hospital, Nottingham, and Guy's and St. Thomas' Hospital, London, I feel continuity of care is a vital component in the singer's rehabilitation. The Speech and Language Therapy Department will have addressed vocal health issues, posture and breath control; my remit is to continue the training using the same terminology and ethos which gives the singer confidence to trust my approach hence my Individual Voice Care Package.

At my Voice Centre in the UK I have facilitated Voice Care Days, inviting health professionals to share their expertise. My Diploma and Teacher Training Course is now in its' eight year.

W9-Singing Voice 6 (Room2)

CHORAL PHONETICS - HOW VOWELS CONTROL INTONATION

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Tone information hidden in the timbe of vowels affects the intonation of a choir. Those unconscious tones derive from two partials, which are amplified by the first two vowel formants. Choir singers can be trained to hear and to control these partials deliberately. In an ideal homogeneous choir sound the formants within a voice section would be identical and they would match partials in the voice spectrum. Simultaneously, in the men's voices the second formant should emphasize those partials, which fit into the musical context and match partials in other voices.

The author demonstrates in live acoustic expamples with participants how intonation and homogeneity can be precicely adjusted in a completely new way by application of vocal pedagogy elements of overtone singing.

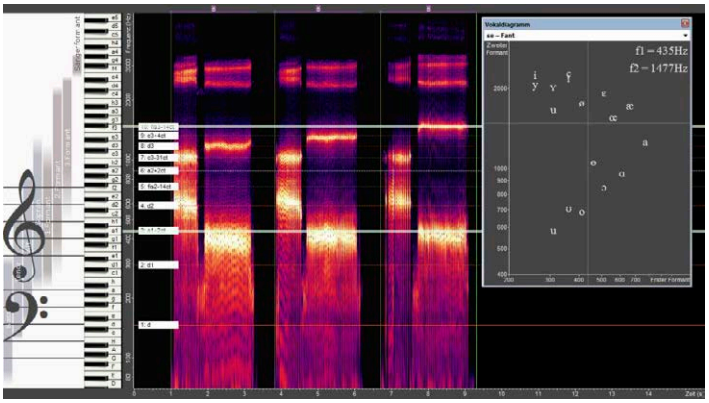
In conventional voice training the ways of controlling vowels are limited on the singers' skills in imitating timbres or in interpreting instructions like: „lighter“, „with a smile“. Professional choirs gain experience in *intuitively* (but not knowingly) choosing vowels which are well matched to each other and to the musical context. The better this intuition is, the better is the choral sound quality.

Overtone singers learn to exactly match their formants to partials of their voice spectrum. They achieve this by a special ear training that focuses on overtones instead of vowel sounds and by developing their fine motor skills of the tongue. Applying these skills to choir singing results in what I call “choral phonetics” - overtone controlled vowels. In choral phonetics vowels are nuanced reproducibly by listening to partials instead of timbre, which makes them adjustable up to 10-fold more precise than in speaking phonetics. Vocal formants thus turn into a musical instrument.

The first three formants are controllable. For choral singing the second formant is especially of importance because it evokes the clearest (though unconscious) pitch impression. The practice begins with an auditory training to become aware of the partials. Then, the tongue and mouth movements are trained to control the second and first formant. This puts the singers in the situation to tune their formants as precise as their vocal tones.

The singers precisely align the formants within a voice section and at the same time tune them on the partials of their singing tone. It gives the freedom to adapt formants in the musical context – within the flexibility that each vowel has in a language (Fig. 1). Just intonation can be accessed selectively.

Within a few hours experienced singers can learn to adjust the second formant to partials. The second formant is regulated by the epiglottis and base of the tongue. The choristers need to learn to consciously perceive the partials as separate tones and then turn their hearing focus away from the vowel towards the formant-partial interaction. Then they are able to deliberately controll these effects. They quickle learn to “feel” the formants' pitches. The result is a new tool for objective and reproducible control of the timbre. Homogeneity and intonation turn into a controllable and even composable factor of the chorus sound.



W10-Speech Pathology/Therapy 3 (Room4)

MULTIDIMENSIONAL ASPECTS OF HUMAN VOICE PRODUCTION: ANATOMY AND PHYSIOLOGY FROM THE STANDPOINT OF ARTS, MATHEMATICS AND SOUND PHYSICS

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Human voice is a multidimensional phenomenon. Understanding the whole picture can never be completed with the classical textbook knowledge including anatomophysiology and some acoustics. Bioenergetics, biomechanics, nonlinear mathematics and physics and many more disciplines are needed to explain the details of principles of voice production. One important way of understanding human voice is of course vocal pedagogy from which science of modern vocology is born.

Artists' way of understanding nature and their way of expressing the process may not be by numbers but by colors, shapes or sounds. Mathematics is the language of nature and is included in colors (frequency of light), shapes (metric measures) and sounds (frequency and amplitude of vibration) as well. Singing teachers make their explanations by using some terms such as Chiaroscuro, mask feeling, noble posture, noble posture, drinking the voice, etc. Many other recipes those used in vocal pedagogy are still yet to be explained in detail. They all indicate the motion and it takes years to put it into practice. Motion is the fourth dimension of anatomy and it is essential to understand motion to see the whole picture of voice production. Motion in the nature is complicated, non linear, and nearly impossible to predict with its infinite components. The formula of the complex dynamic processes in nature is simply (!) explained by an artist in a magic quote: 'Mobilis in mobili' which means motion in motion. With these words, Jules Verne summarized the formula of human voice as well.

Vocal pedagogy sheds valuable insights into the evaluation of human voice. Explaining the artistic way of understanding human voice, by the language of science, provides new opportunities of improvements that numbers may never can.

Round Table 2 (Room1)

FUTURE DIRECTIONS FOR THE VIRTUAL VOICE

Moderator: S. Ternström[1]
Participants: S. Moisik[2], P. Pabon[3], D. Howard[4]

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Current approaches to simulation of the voice - *Sten Ternström*
There are many potential reasons for simulating the processes of human voice production, including practicable speech output from machines, solving clinical voice problems, basic voice research, and supporting teaching about the voice. The choice of simulation approach in any given context will always be informed by the application interest or by the research question. In this Round Table, we will attempt to outline the major current approaches and to gaze into the future of voice simulation. As an introduction, Sten Ternström first presents a light overview of simulation techniques that are currently being reported at the leading edge of research.

Phonetics in silico – *Scott Moisik*
We still don't understand how some linguistic and extra-linguistic sounds are made by humans. Detailed computer models of the biomechanics of the voice organ can contribute to our understanding and appreciation of the sound generator we all carry within ourselves. The ArtiSynth simulation platform (created at the University of British Columbia) can be used to study phonetic laryngeal functions; for example, those aspects of laryngeal articulation which create biomechanical stability. Stable regions in articulatory space are thought to be important for increasing articulatory reliability in the presence of biomechanical and neuromotor "noise" and ultimately to form the basis of categorical units of speech. Among the phonetic postures examined are breath (glottal fricative), glottal stop, whisper (epiglottal fricative), and epiglottal stop. With the aim of giving some direction to future modeling work which couples biomechanical and fluid mechanical simulation, the talk will conclude with some speculation as to how laryngeal biomechanics might support similar stabilities within the phonetically relevant vibratory regimes of the larynx.

Machines that sing - why, and how? - *Peter Pabon*
The source-filter model will never sound like your favorite singer, simply because it is too general. It lacks the natural constraints and dependencies that exist within the voice production mechanism, and give it character. This is the real asset of physical models: the constraints and dependencies are native to the model. With its multiple non-linearities, a physical model can be as stubborn or strange in its dynamic behaviour as a real voice, and in fact it should be. What is the nature of the nonlinearities, and how influential are they in the real voice? The stronger the nonlinear interactions, the less we can see the system as independent parts that can be studied and optimized separately. Therefore, we would like to have models that integrate all elements of the voice production process. Typically, though, there are too many variables to control in a physical model, and it is hard to isolate the significance of any given control factor, as this may be very dependent on the setting where the model is tested. A way forward could be to analyse the physical models over large ranges of very different vocal settings; in effect, to make their voice range profiles (VRP). We are only at the beginning, but whatever we explore, we will have a great time letting our models sing for us.

Teaching about the voice - *David Howard*
The fact that the voice organ is hidden and hard to access has vexed pedagogues for centuries. High-fidelity simulations that have ”wow” factor offer great potential as a vehicle for engagement, vocational progression and public outreach, as well as an educational tool. What sort of simulations are plausible and how could they be of use in teaching? Or perhaps the ”old way” of working to imitate the teacher is still the best?

Expected topics:
- Will it ever sound natural? Does it matter?
- To whom am I talking – a machine or a human? Are there ethical aspects of artificial voices?
- If we have an artificial ’voice engine’, who will want to teach it to talk?

Aims
Participants at this Round Table will be updated on the current state-of-the-art in voice simulation, and will discuss potential needs and applications.

Round Table 3 (Room2)

PHONOSURGICAL CHALLENGES IN PROFESSIONAL SINGERS

Moderator: R.Eugenia Chavez
Participants: Josef Schloemicher-Thier, Gerrit Wohlt, Erkki Bianco, Markus Hess

During XX century the technological advances to perform phonosurgery in singers aloud to solve many vocal folds pathologies.
From Bruenning, von Leden, Timcke, Hirano, Kleinsasser,Wendler, Seidner,Bouchayer,Isshikki among many scientists in the first sixty years to the application of Laser techniques there have been many changes in the application of phonosurgery techniques.
Different approaches and experiencies have been summed to understand how the phonosurgery
improve the vocal quality and laryngeal anatomophysiology of the singers voice.
The use of stroboscopical procedure during surgery improve the functional results.
The possibility of high definition images and recordings of surgical procedures help to understand even more the gentle surgical manouvres that are needed in each case.
New precise instruments, better light quality and the application of deeper understanding in the fine histology of vocal folds gave great advantages to the phonosurgery .
Due to the development of the anesthesiological support some of the difficulties for a correct handle of the airway system have been diminished.
Nevertheless the personal anatomical characteristics of each patient and particular laryngeal pathology are a challenge for the phonosurgeon to decide which procedure has to be done.
Professional singers have a special personality and the fear for their careers is always present in a phonosurgical treatment.
Decortication, microflaps, coagulation among others techniques are part of these decisions that sometimes have to be made during phonosurgery.
Phonosurgical cases about rock singers, opera singers, popular singers are presented.
Phoniatrical and singing technique rehabilitation before and after phonosurgery are discussed.
Direct Microphonosurgery has shown advantages in precission but disadvantages in intubation and the lack of function during the procedure can take the patient to a second intervention.
Indirect endoscopical surgery aloud the presence of function during procedure without any tube disturbances and to have one hand available only, can limit the expertise of the phonosurgeon.
According to the experience from the past 50 years the limits for different techniques applications in singers are discussed.
The use of Laser in some parts of the vocal folds that can affect the vertical wave is discussed.
The free edge of the vocal folds with impact of the glottal closure has to be respected and if decortication is necessary the finest precission is necessary .

W11-Speech Pathology/Therapy 4 (Room3)

PSYCHOMOTOR EXERCISES FOR VOICE DISORDERS

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As apsychomotor physiotherapist in the voice team, I work with a variety of voice disorders, including VCD, both individually and in groups.

A primary problem is often insufficient fluency in breathing.This leads to muscular compensation and dysfunction of the voice.Symptoms such as pain in the throat and chest, throatclearing, and a sensation of press in the larynx are often reported.
A number of voice patients present withreduced balance, rigid postures, a stiff chest and increased tension in the muscles influencing breathing patterns. Bodily rhythm and coordination skills are also reduced. Many of these patients have experienced high levels of stress, both physical and psychological prior to the onset of the disorder.

The method Norwegian psychomotor physiotherapy is a dynamic oriented body examination that is a unique and dynamic instrument to discover the patients' potential for adjustment in musculature, posture, breathing and function. Teaching patients about the connection between brain, body, breath and voice is a valuable treatment approach. The examination focuses on the patients' own abilities toadjust and change both their muscular tonus and breathing pattern. The treatment consists of exercises, a targeted massage and counselling.The methods of psychomotor physiotherapy promoteself-awareness. Alertness is necessary for discovering new experiences and initiating a process of change. Integrating balance, free breathing and awareness withindaily movements is central to this process. Stability and balance result from the establishment of well-balanced posture containing free stretch and flexibility and are a prerequisite for further improvement.Inthis way the voice will be anchored in the bodyand thus improve its quality.

In my workshop I invite you to experience your own body awareness through a range of psychomotor exercises.We will also have a dialogue about incorporating these exercises within voice treatment.

Round Table 4 (Room4)

15 YEARS FROM 38/2000 : MEDICO LEGAL ASSESSMENT OF BIOLOGICAL DAMAGE IN LARYNGEAL IMPAIRMENT

Moderator: O. Calcinoni, P.H. Dejonckere
Participants: M. Limarzi, A.Ricci Maccarini

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In July 2000 Italy issued a new law, stating rules in medico-legal evaluation of occupational diseases and work accidents.
The Legislative Decree n.38/2000 established "biological damage" as the fundamental criterion to evaluate those lesions.
The biological damage, in Italian law, consists of infringement of the constitutionally guaranteed physical integrity of the person. This occurs in case of a physical injury or mental harm to individuals, permanent or reversible, which may give rise, however, to an impairment of vital activities of the subject, considered in the broadest sense.
From this point of view, an epochal change in the decree was stating that voice damage had to be evaluated by otolaryngologists and no more by neurologist : the evaluation was clearly related to endoscopic detection of glottal impairment, to abnormalities in voice parameters levels, and other speciality instrumental data, as expression of impairment of vocal activities of the subject – singing, phone calling, screaming,…-.

The percentages of damage recognized in this law became reference in other insurance evaluations. But occupational voice disease – in teachers, call centres, artists…- is still an "emerging" problem in our country.

After 15 years from Legislative Decree 38/2000, our round table aims to:

- critically observe results in preventing occupational pathologies of voice (Calcinoni)
- focus on implications for laryngologist and phonosurgeons (Ricci Maccarini)
- explain actual medico legal evaluation of dysphonia in Italy (Limarzi)

The invited moderator (P.H. Dejonckere) will link Italian to European and extra-European situation in protection from voice damage, as evolved in the same period.

W12-Speech Pathology/Therapy 5 (Room3)

QIGONGFOR MUSCULARTENSION DYSPHONIA

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Functional voice problems or muscular tension dysphonia (MTD) is a very common reason for referring patients to our Voice team in Oslo. MTD is related to vocal abuse, misuse, or overuse syndromes, often with components of psychological stress. This may be due to personality traits and difficulties in managing the different kinds of stress/press the person is exposed to.
The respiration is vulnerable to emotions and stress. Patients with stress management problems often have a costal breathing pattern with reduced diaphragmatic movement and abdominal support during voice production, a so called “held/locked” breathing pattern. This gives tension in the muscles of chest, neck and shoulders, and has an effect upon the position of the larynx. The muscular tonus and the air flow involved in voice production are not balanced and will not give the appropriate subglottic air pressure needed for good phonation.
Voice therapists have a number of strategies to help the patients. Additionally, I have experienced that simple qigong exercises may be a useful tool in voice treatment.
Qigongoriginated more than 3000-4000 years ago in China. Qi (chi): breath, vital/life energy. Gong: method, work, exercise, training. Qigong is “working with energy” or “working with breath”. It is based on the same principle as acupuncture. Medical qigong belongs to the traditional Chinese medicine, and keywords are: grounding, slow movements, free breathing flow, and mental awareness/mindfulness.
The breathing technique in qigong, with calm and harmonic movements, may increase the manifestation of good head and body posture, and help to establish and reinforce the natural diaphragmatic/abdominal breathing pattern. This is needed for natural breathing with a balanced subglottic air pressure and a good phonation flow.
The exercises can also reduce muscular tension, increase the ability to relax, and restore and balance the patient`s vital energy; eutonus, meaning the comfortable tonus. It may also influence the energy and effect of voice exercises, like for instance semi-occluded vocal tract exercises, the Accent method or H. Coblenzer`s rhythmic breathing and phonation method.
This workshop invites you to take part in simple exercises and discuss the combination of training voice and qigong.

September 1

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W13-Singing Voice 7 (Room1)

WORKING WITH SINGERS ON EXPRESSING THE MEANING OF TEXT

Mary Hammond L.R.A.M. F.R.A.M.
164 Camden road NW1 9HJ
www.maryhammond.co.uk

A practical w/shop working with singers who present a difficulty they may have with a phrase or sound that is needed to expressing the meaning of text.
Explanation of the choices made to solve the problem discussed with w/shop participants

In the genre of Musical Theatre,vocal choices need always to be used to express character and text---intergrating both acting and singing. A huge pallatte of vocal colour and skill is needed to fulfiill both the needs of lyrists and composer. An ever changing demand on the performer.

I was the first vocal coach on Les Miserables ,Miss Saigon and all the explosion of shows that opened in London at that time----new sounds for the through –sung musical that at that time had very different demands---we had to work out how to fullfill them.
Having now worked as a singing consultant and coach on more than 100 west end .national theatre.RSC.etc shows involving singing---in many genres ..i have found the information being explored by people interested in voice invaluable and the resource of being a long term member of the British Voice Association and knowing who to ask when I don't know has been-and is- of huge benefit.
My teaching practice also includes many pop groups which also demands understanding of many different genres.
I am constantly aware of how much more research is needed to give us answers

W14-Singing Voice 8 (Room2)

BEATBOX & BEYOND – USING THE VOICE AS AN INSTRUMENT

Tobias Hug
London, UK

Humans have always imitated the sounds that surround them - including instruments.
The imitation of drum and percussion sounds has in recent decades become a phenomenon known as beatboxing. But the tradition of 'vocal drumming' goes back millennia - most prominently in the indian classical/carnatic music that has its own codified drum language ('solkattu') - maybe the earliest form of beatboxing !

In this session, Tobias Hug takes you through the basics of contemporary beatboxing, teaching a series of simple sounds that combined can make up any rhythm.
You'll become a human drum kit, a massive beatbox choir creating rock, latin and jazz grooves on the spot as a choir.
Participants will also explore the idea of creating sound effects with their voices, becoming a Sound Effects Choir or a human soundtrack choir to an imagined movie.
In addition, participants will learn extended sounds like DJ-scratching and see how these sounds are produced.

The last segment is dedicated to the imitation of other instruments with our voices:
guitars, trumpets, bass, - we are becoming a vocal orchestra because the voice knows no limits ! This session is practical and fun, highly interactive and educational.

Some links as reference:

Sound Effects Choir
https://www.youtube.com/watch?v=gjyWP2LfbyQ

The Beatbox Choir
https://www.youtube.com/watch?v=MpweHkq0JYY

Beatboxing
https://www.youtube.com/watch?v=yy2UfR1crwA

W15-Singing Pedagogy 2 (Room3)

THE SINGING AND THE SPEAKING VOICE:EXPLORING A SHARED PEDAGOGY

Linda Gates
Head of Voice, Northwestern University Department of Theatre

In manyAmerican conservatories, voice training for actors and singers isgenerally taught as though the twopedagogies were not connected.Students of singing train in the music school and students of acting trainin the theatre department - rarelyis the pedagogy for both singing and speaking shared. There are a fewinstitutionsthat have musical theatre as well as acting programs, such as Northwestern University in Chicago, where I teach. At Northwestern the actingstudents participate in singing auditions to be chosen for the music theatre program butalso take classes to train the speaking voice and perform in plays as well as musicals, however,the singing and speaking classes are still separate. In the music school at Northwesternclasses in the use of the speaking voice and English diction for singers is not taught at all.Since this separation continues at a time when many opera companies are including musicals as part of their repertoire which requires that singers speak dialogue as well as sing,it might be useful to explore some of the ways in which a shared pedagogy can be beneficial to both.

A few years ago, I was asked to coach the singers in spoken dialogue atChicago Opera Theatre,very late in the rehearsal processbecause the singers were having difficulty with their speaking roles. The company was presentingShostakovich's *Moscow, Cheryomushki,* an improbable but charming operetta about the problems faced by young lovers due to the housing shortages in Moscow under communism. The libretto had been translated into English with the singers required to speak pages of comic repartee dialogue. In rehearsals, the spoken dialogue of some of the singers was not only unintelligible, but sounded tense and strained.The singers, while singing beautifully, had no idea about how to speak dialogue that could be heard and understood by an audience. We were given less than a week to correct the problem before the opera opened.

It turned out that the lack of intelligibility was mainly due to the singers' belief that their speaking voices should be a reflectionof their singing voice with the tenors and the sopranos speaking in tense head tones that were too high to permit a voiced consonant to be sounded. When I began trying to get the singers to ground their speaking voices using their optimal pitch by focusing on the consonants – some were afraid that it might affect their singing voices.When we started our coaching session, one of the male singers was speaking at such a high pitch that he suffered from vocal tiredness but explained that he had always been taught by his singing teachers to speak in high head tones to protect his singing voice. When he began to access the middle of his speaking voice or his optimal pitch, he not only sounded better, he sang better.In theatre circles the use of a high pitch for speaking is sometimes referred to as "singing teacher voice'.

I would like to propose a workshop at Pevoc to see if we could find some common ground between the speaking voice and the singing voice with both singing teachers and theatre voice teachers. It is often repeated by that the singing voice should come out of the speaking voice, "sing like you speak" singers are told. Is this true?
I have also found that when some of my acting students' begin singing lessons for musical theatre, their speaking voices begin to take on a nasal twang as they as trained to use the nasal resonator to belt high. Since the singing and theatre voice teachers are not working together this continues to become a problem.

Of course, this is really about singing and speaking in English sincespoken Italian seems to manage beautifully almost without consonants.However, since English has become an international language I would like to see if we could find some common ground with the focus on both the speaking and the singing voice in English. This seems to me to be necessary as more and moreopera companies are beginning to stage musical theater productions and operettas that require a lot of dialogue on the part of singers.For instance, next season at Lyric Opera of Chicago, Placido Domingo will be starring in *The King and I,*which will, of course, require speaking as well as singing.The presentation would consist of material that would be both spoken and sung – with lots of discussion from specialists in both singing and speaking.

FP-Linguistics/Emotional 1 (Room4)

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CREAKY VOICE IN SPANISH FEMALE SPEAKERS

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This study analyzes acoustically a special laryngeal setting, related to voice quality, which researchers have been referred to by different names: vocal fry, pulse register, strohbass or creaky voice. Creaky voice (henceforth) produces a perceptual effect "of a rapid series of taps, like a stick being run along a railing" [1] or "the sound of popping corn" [3]. Physiologically, the majority of researchers consider that this type of phonation is produced by a tight compression of glottis area, resulting from the highest arytenoids adduction and the least longitudinal tension of vocal folds. Nevertheless, Esling and Harris [2] think that this special setting is produced by the effect of aryepiglottic folds. As acoustic consequence, all of them agree with the fact that this setting causes the lowering of fundamental frequency (F0 henceforth). Creaky voice is an increasing preferred phonation among English female speakers in USA. The harmonic structure for creaky voice observed until present in English female speakers consists on a drop of F0 and a negative value for the difference between the two fist harmonics H1-H2 [4, 5, 6], and also a negative value for the difference between the first harmonic and the third formant H1-A3 [5]. By now, there is no work about Spanish monolingual speakers or Spanish language related to creaky voice production, and this is the goal of the present study: to know more about the laryngeal setting that Spanish European speakers use to create creaky voice.

A group of young Spanish European female speakers aged between 25 and 35 years old have been analyzed. Since most of the research is done on (English) female speakers, Spanish female speakers were also chosen in this research. They were asked for producing neutral voice (modal voice) and creaky voice. To accomplish the task they had to read a nonsense word, <gálibo>, within the carried sentence: "*Diga* ['CV.CV.CV] *despacio varias veces*" ('say gálibo slowly several times'). Recording were made in the silent room of the Phonetics Laboratory at Spanish National Research Council (CSIC), using a Roland Audio Capture UA-25EX, a condenser microphone E6i Omnidireccional Earset Audio, a Windows PC and Adobe Audition 1.0 program. To examine the acoustic settings, a spectral cut were made on a stressed central vowel [a] in both kind of productions, neutral and creaky. They were analyzed in detail using Praat program (version 5.3.56), and the subsequent statistical analyses have been carried out with the help of SPSS Statistics for Windows (version 17.0).

Preliminary results indicate a drop on F0 also in Spanish women creaky productions, even though no lineal relationship between the drop and the value of the dropping has been found. Negative values have been observed in the harmonic analysis, second harmonic is higher than the first one, but the relationship is lineal inverse now: the larger the H2, the smaller the F0. Spanish female speakers show a drop in the fundamental frequency to produce creaky voice, as English speaker women do. The same acoustic results founded in both languages suggest that creaky voice setting is created in a similar way in both languages, which means, as expected, that it is a universal configuration of voice, not characteristic of the spoken language or the so called speech. What is interesting now is to find out whether or not there is any acoustic difference between men and women in both languages producing creaky voice, what will confirm the relationship between different physiological configuration and phonation strategies.

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THE IMMEDIATE EFFECT OF THE KNEE-BOUNCING EXERCISE WITH PHONATION ON THE FUNDAMENTAL FREQUENCY (F0) IN CONNECTED SPEECH. A SINGLE CASE EFFICACY STUDY REPEATED ON 10 FEMALE UNIVERSITY STUDENTS

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There is a vast amount of research investigating the efficacy of voice therapy programs, which show positive results, however there is a lack of research investigating the immediate effect of an isolated vocal exercise. This is of great importance in securing an evidence-based practice within the field of voice therapy.
This study wishes primarily to investigate the immediate effect of the *knee - bouncing exercise with phonation* on the fundamental frequency in connected speech on 10 young women.
Secondarily, the study wishes to investigate the immediate effect of the *knee-bouncing exercise with phonation* on five sensory symptoms and six positive sensations in connection to the vocal tract. The *knee bouncing exercise with phonation* is a grounding exercise which main focus is relaxation of the external and internal laryngeal muscles in the form of rhythmic bouncing movements.
This investigation uses a multiple baseline single subject experimental design, repeated on ten female university students, 20 – 26 years of age without voice disorders. The experiment consists of five phases: Phase one to three consists of three baseline recordings on three different days, phase four consists of an intervention using the *knee – bouncing exercise with phonation* for a duration of approximately eight minutes, and phase five consists of a post intervention recording, immediately after the intervention. The results are processed using the voice analysis program Praat, and the authors further analyzed the data visually.
The results show that the *knee – bouncing exercise with phonation* has several different effects on the participants' fundamental frequency in connected speech. The mean fundamental frequency increases in one participant, partly due to the elimination of vocal creak. The variation in fundamental frequency decreases in four participants due to the voice stabilizing qualities of the exercise and the variation in fundamental frequency increases in two participants due to the greater flexibility induced by the exercise. The mean fundamental frequency does not decrease in any of the participants, possibly due to the fact that none of the participants showed a fundamental frequency above average for this population. An eliminating effect is furthermore seen on creaky voice in three of the participants. Furthermore, the results of the self - evaluation scale show a predominantly positive assessment after the intervention.
The knee – bouncing exercise with phonation is a recommended exercise in the management and treatment of voice disorders. Further investigations are needed to assess *the knee – bouncing exercise with phonation* on individuals with voice disorders.

THEATRICALITY IN FREQUENCY AND INTENSITY: ANALYSIS OF THE PLAY "STEPS" OF THE OBRAGEM GROUP OF THEATRE AND CO

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INTRODUCTION: From the late nineteenth century, the Western Theatre underwent a re-evaluation of its fundamentals with the intention to overcome limitations imposed by movements such as the classic and the naturalist, where the construction of the scene were organized according to the dramatic text. In this context, the vocal work was oriented to produce a very well articulated and declamatory voice aiming that the text did not lose its significance and thus ensuring the accuracy of the dramatic plot. Stage directors started to experience different proposals from plastics and / or visual, sound and / or vocal elements, which gained a more theatrical feature. With specific regard to the actor's voice, its role in the theatrical scene assumed different logics. In Brazil, these theories had much influence on many groups of theatre, including Obragem Group of Theatre and Co. In the artistic processes of this group, one realizes the significant aspect of the voice as a theatrical elements. Wishing to contribute to a better undersanting of the vocal preparation work offered to the contemporary actor, the objective of this research was to identify and to describe, through perceptual, acoustic and matricial analysis, the markers of vocal theatrics produced in the play "Steps" from the Obragem Group and Co.

METHODS: The corpus of the research was constituted by the audio of the play filming. From the careful listening of the researchers, a total of 79 speech fragments, ranging in length from 5 to 30 seconds, were analyzed. The excerpts were selected according to the subjective criteria of "theatricality". To analyse the fragments, 03 matrix were builted [6]. In the construction of the first vocal matrix, the 79 fragments were called *elements*. For each of the elements, a *procedure* were described (matrix zero). Then, they were regrouped in 12 matrices (primary matrix) and then again, they were regrouped in 05 matrix (secondary matrix). These elements and procedures were also related to the interpretation. However, this will not be addressed here. An acoustic computerized analysis of the fundamental frequency variations, intensity and pauses was also carried out with Praat program.[7-8]

RESULTS: In Table 1, the final Matrix are presented.

Table 1. Vocal theatricality matrices identified in "Steps" theater play

Secondary Matrix / Elements	**Primary Matrix / Procedures**		
Fragmented Speech	*Deformed Words*	*Timbre Variation*	*Vocal Spasms*
Repeated Sonority	*Repeated Phrases*	*Repeated Words*	*Abrupt Vocal Attacks*
Expanded Pronunciation	*Duplicated Tonic Vowels*	*Prolonged Tonic Vowels*	
Undefined Prosody	*Contradictory Intonation*	*Heigh-Pitched Voices*	
Mechanical Voice	*Recorded Text/Voices*	*Dialogue And Music*	

DISCUSSION: To enlarge, to expand, to dilate, to exaggerate. This implies in to deform, to strange, to become grotesque. To conduct the sound to new ways, foreign to its usual nature. To provide through the expansion of the words melody, a new encounter. A purely artistic encounter - sound and music - in which the artist plays with the melodics possibilities of the word pronunciation and with the ear of the beholder. To prevent the reduction of the words to its meaning in order to create new combinations, new sounds: strange, grotesque, deformed, poetic, artistic. So, it was understood that in "Steps", the **hyperbole** worked as the driver of vocal theatrics. Based on the waste and excess, aiming to reprogram speech beyond their daily habit, has the eminence of a voice without strictly sublime characteristic, without pre-assembled feelings and expected behavior. Thus, in the construction of theatrical matrices which were based on hyperboles as the conducter element, the Obragem Group gave rise to an exuberant mix of elements and procedures. In vocal preparation of the contemporary actor, one has to give space to these events that enhance the expressiveness.

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W16-Singing Voice 9 (Room1)

SING SELF-CONFIDENT
HOLISTIC APPROACH: PSYCHOLOGY, VOCAL COACHING AND SPEECH THERAPY

Cordula Klein Goldewijk, Hanneke Bax, SanneSpronk
The Netherlands

A speech therapist, psychologist and singing teacher: working together to help singers be confident on stage!
The presenters developed a course for singers with stage fright or negative thoughts restraining their performances.
The student learns how to deal with the thoughts, the voice and the body. The goal is to trust their voice and improve their performance. The course is also very suitable for singing teachers to improve their approach to their students with struggling thoughts about their voice and performance.
The psychologist is doing exercises based on cognitive behavioral therapy to teach the singer how to detect and change the blocking thoughts before, after and during singing. The speech therapist lets the singer experience the effect of stress on the body and voice. The singing teacher works with singing technique and shares her own experience and strategies.
It is important to use evidence-based methods to gain real confidence on stage. In the mental coaching of singers there is a tendency to use quick fixes, but this course aims for real, lasting change.
During a workshop at PEVOC, Cordula and Hannekeshare theimportance and benefits of working togetherto ensure the singer is able to implement the benefitsof the new coping strategies in their daily life. They also demonstrate howto integrate psychology, speech therapy and singingtechnique in exercises.
Quote from a singer who followed the course:
“I see now that I told myself during singing that I would never be able to reach that high pitch. After some exercises I could replace these thought for helping thoughts and suddenly the pitch was much easier.”

W17-Singing Voice 10 (Room2)

SCIENTIFIC SECRETS OF BREATHING FOR SINGING

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The energy source of voice is the potential energy of the compressed air in the lungs. Simply, the vocal system works on production and transformation of energy. In other words, the phonation process goes on between two physiological events: subglottic pressure and glottic resistance. It comes easy on the ear with this simple explanation, but understanding the interactions between force and resistance is not so easy. In vocal pedagogy, the Italian term appoggio, which means 'lean on' in English, is widely used especially in classical singing pedagogy to point out the support. The main idea is balance and control in movements during singing.

The fact under the meaning of abdominodiaphragmatic respiration technique is controlling the diaphragm (slowing down the elevation of diaphragmatic muscle) through training the muscles of posture and the diaphragm itself. Posture is the missing element in general; why is posture important for breathing? The answers lie in the scientific explanations of the instructions used in vocal pedagogy such as noble posture, singing as if breathing in, open throat, etc.

Breathing and phonation processes are always interrelated but in terms of sports physiology, they must be separated. The technical recipes seem to be paradoxal but pedagogical vocology aims to find out how it works.

FP-Medical 2 (Room3)

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RADIESSE VOICE GEL™ Vs. RADIESSE VOICE™ INJECTION FOR UNILATERAL VOCAL FOLD PARALYSIS

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Introduction: Vocal fold injection augmentation is an acceptable procedure for the correction of glottal insufficiency in patients with unilateral vocal fold paralysis (UVFP). Injectable substances differ in the duration of integration and are thought to vary in their specific viscoelastic properties and biocompatibility. Radiesse Voice™, comprised of microspheres of Calcium hydroxylapatite (CaHA) in a carboxymethylcellulose carrier, is considered a long-term injection material with duration of up to two years. In contrast, Radiesse Voice Gel™, is the carrier substance, (carboxymethycellulose) used for durations shorter than the longer lasting Radiesse Voice. The substance typically lasts 2-3 months after injection, thus considered to be a shor- term injection material. The aim of this study was to compare the clinical outcome of Radiesse Voice Gel™ and Radiesse Voice™ injection in patients with UVFP.
Methods: Twenty one patients with UVFP were examined. Eleven patients were treated with Radiesse Voice Gel™ and ten were treated with Radiesse Voice™. All patients were injected in an outpatient clinic setting, under topical anesthesia. The site of injection was certified by fiber-optic visualization. Patients were evaluated before, and one week after the procedure. Perceptual voice evaluation was obtained using the GRBAS scale. Digital voice recordings were performed with a smpaling rate of 44.1kHz (16 bit), on a single channel. Acoustic analysis parameters included mean fundamental frequency, Jitter, Shimmer and Noise-to-Harmonic ratio. Aerodynamic parameters included: maximum phonation time, mean aerodynamic efficiency and mean glottal resistance. These were obtained using the KayPENTAX PAS-6600.
Results: Perceptual voice evaluation revealed a statistically significant improvement after injection for all measures ($p<0.05$), with the exception of the "R" scale of the GRBAS, which failed to reach statistical significance. No significant difference was found between the two groups (Radiesse Voice™ versus Radiesse Voice Gel™) ($p>0.05$). Mean aerodynamic efficiency, maximum phonation time and aerodynamic resistance improved significantly following the procedure ($p<0.05$), with no group effect. Of the acoustic measure, Jitter, Shimmer and Noise-to-Harmonic Ratio, decreased significantly after treatment for both groups.($p<0.05$), with no significant group effect.
Discussion: Literature has already shown that vocal fold augmentation injection has favorable results for treating glottic insufficiency in patients with UVFP. Injectable materials vary in the duration of integration and in their viscoelastic properties. This variability influence the amount of force required to inject the substance through the syringe into the tissue. We hypothesized that the pressure reflected on the surrounding tissue will be affected by the viscoelastic properties of the injected material, as it might affect scattering of the injectable material in the recipient tissue. Nevertheless, results from this preliminary study did not reveal a statistical difference between the clinical manifestations of the two substances. Hence, our results suggest that, when considering the two substances examined here, the clinical decision of whether to use one substance or the other, should be governed primarily by the desired duration of integration.

BENEFIT OF THE EARLY TRANSIENT VOCAL FOLD AUGMENTATION WITH HYALURONIC ACID AT ACUTE VOCAL FOLD PARESIS – WHAT DOES THE PHONIATRICIAN NEED TOKNOW FOR EFFECTIVE INDICATION

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Introduction: There is no doubt that vocal fold paralysis is a debilitating condition affecting an individual's general health and quality of life. A complete battery of assessments is essential, including perceptual, aerodynamic, acoustic, and stroboscopic measures and should be obtained to distinguish the cases of surgical and nonsurgical patients.

Material: Two male and two female patients with acute idiopathic unilatera vocal fold paresis came to my office within the same period, were examined with videostroboscopy, and underwent objective and subjective voice assessment. All the patients took part in a vocal rehabilitation program. The next examination was performed after six weeks. Two of the patients decided on an early transient vocal fold augmentation with hyaluronic acid because of the persistent vocal fold insufficiency and proceeded with a postoperative vocal rehabilitation program. The other two patients declined the augmentation but proceeded with the vocal rehabilitation program as well. After twelve weeks, the next phoniatric examination revealed the vocal fold parameter of the two patients after vocal fold augmentation were much better than the patients with the vocal rehabilitation program alone.

Methods: Each patient was examined with videostroboscopy and underwent objective and subjective voice assessment. Hyaluronic acid was injected surgically in local anesthesia. In both cases, scars were removed from the vocal folds during the procedure. The patients after hyaluronic acid augmentation took part in the rehabilitation program that included a series of voice exercises before the operation and up to two months after the procedure. Examinations were performed 1, 6 and 12 weeks after injection.

Discussion: There a number of questions. What objective phonatory measures should be assessed before and after the intervention, and at what intervals? When should voice therapy (first) be initiated and for how long and when should surgical intervention be decided upon, when the vocal function might not occur? Can we better define vocal parameters that help to predict which patients may need surgery rather than therapy?

Conclusion: Optimal management of a patient with vocal fold dysfunction is obtained by a phoniatric-trained otolaryngologist, together with a speech scientist and speech-language pathologist. Resulting in detailed objective videostroboscopic evaluation of glottal configuration during phonation, acoustic and aerodynamic measures, laryngeal EMG (if appropriate), and the patient's self-rating of vocal disability. Early injection of hyaluronic acid to the vocal folds is an efficient method improving quality of voice in vocal fold paresis and can be a safe supplement for the vocal rehabilitation program. The method is simple, effective, and a quick means to improve voice disorders.

NOVEL MODIFICATIONS TO A FENESTRATION APPROACH FOR ARYTENOID ADDUCTION UNDER LOCAL ANESTHESIA

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Introduction*:* Arytenoid adduction was first reported by Isshiki. For patients suffering from severe unilateral vocal cord paralysis, arytenoid adduction (AA) is considered an important procedure because it can close a wide posterior glottal chink and correct vertical difference between the two vocal folds. However, the original procedure reported by Isshiki must be performed under general anesthesia. A fenestration approach for AA reported by Tokashiki in 2007 is less invasive and requires only local anesthesia, but securing the surgical field is difficult and the working space is tight. We therefore modified this approach to address these limitations.

Methods: Between September 2013 and December 2014, 10 consecutively treated patients with unilateral vocal fold paralysis underwent the fenestration approach for AA with the following distinctive modifications. First, a wound retractor was used to secure the surgical field through a small incision, and second, a 12-mm, 7/16R, insert-molded taper needle with 3-0 nylon suture was used to secure the arytenoid cartilage.

Surgical procedure: All patients underwent surgery under local anesthesia. A transverse incision of 3–4 cm in length was made on the affected side. A wound retractor was inserted in the layer under the sternohyoid muscle. An arytenoid cartilage was pulled following the fenestration approach reported by Tokashiki using new suture nylon with an insert-molded taper needle developed by us [4]. We evaluated our modifications based on skin incision length, operating time, total blood loss, existence of troubles, and postoperative improvement of voice.

Results: Ten patients underwent AA using the modified fenestration approach. Nine of 10 patients also underwent type 1 thyroplasty, while one patient underwent AA only. The average skin incision length was 3.65 cm. The average operating time was 92.5 minutes and in all cases the total blood loss was less than 10 ml. There were no major complications. All patients achieved a maximum phonation time of over 11 seconds. The mean airflow rate improved to less than 250 mL/second after surgery.

Discussion: Use of a wound retractor was very effective in securing the surgical field during the fenestration approach, and the new insert-molded taper needle was useful given the small window in the thyroid cartilage. Because the wound retractor self-expands omnidirectionally into a round shape, it effectively enlarged even the small 3-cm incision and reduced the need for surgical assistants. Wound retractors were originally used to protect wound edges during abdominal endoscopic surgery, and it did so efficiently in the neck. We inserted the retractor in the layer under the sternohyoid muscle and did not resect the muscle; there was therefore no dead space and the wound healed well cosmetically.

We were able to approach the arytenoid cartilage directly through the skin incision and the hole in the thyroid cartilage, and performed the procedure without complications. Because the new insert-molded taper needle has no sharp edges at either the body or tail, it did not cause the cartilage to split during suturing. It was straightforward to manipulate the needle through the small 1-cm hole of the thyroid cartilage. All patients tolerated the procedure well under local anesthesia. We were able to hear patients' voices intraoperatively and adjust the tension on the nylon suture thread. Patients were not intubated and thus movement of the arytenoid cartilage and suture placement were easily observed intraoperatively using a flexible laryngoscope.

The fenestration approach for AA was achieved effectively in conjunction with the use of a wound retractor and a new 12-mm insert-molded tapered needle with 3-0 nylon.

PIN-UP GLOTTOPLASTY: A NEW TECHNIQUE TO MEDIALIZE OR LATERALIZE THE VOCAL FOLD IN RECURRENT NERVE PARALYSIS

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Rationale: In unilateral vocal fold paralysis, the position of the immobile vocal fold determines the quality of voice production. For permanently medializing the paralyzed vocal fold, thyroplasty is a gold standard procedure. However, thyroplasties necessitate open neck surgery with a significant exposure of the thyroid ala. We propose a new technique with only minimal skin incision for a permanent medialization glottoplasty approach in general anesthesia. As a first step, this investigation is a proof-of-principle approach in excised human larynges.

Methods: In general, a straight rigid wire (or 20 G cannula) is saggitally fed totally intrachordal through both insertion points of the immobile vocal ligament and finally fixed posteriorly in the cricoid cartilage. More specifically, the wire is passed through a small external anterior thyroid cartilage hole (an access quite similar to Steven Gray's minithyrotomy approach), routed within the vocal ligament in an anterior-posterior saggital vector, all the way to the vocal process. To force the vocal process and the whole vocal fold to stay in a median position, the wire has to be fixed at the back. This is achieved by posterior advancement until the wire finally penetrates into the cricoid cartilage posterior to the vocal process (this resembles a ‚pin-up' procedure).

Discussion: The paramedian position and stiffness of the intraligament wire will enable a favourable phonatory function. The stability of the wire position is ensured by the well chosen fixation points anteriorly and posteriorly. This method theoretically also allows for a lateralization procedure in cases of bilateral vocal fold paralysis, when the posterior fixation point would be chosen at a lateral cricoid point.

Conclusion: With this pinning-up of an intrachordally placed, stiff wire at the cricoid region next to the vocal process, a stable positioning of the entire vocal fold is ensured. Thus, it is conceivable that clinical medialization and lateralization glottoplasties may be facilitated with this approach. More studies in excised larynges and future clinical investigations are needed to prove if this approach can be an alternative to state-of-art medialization thyroplasty techniques.

CAN TYPE I THYROPLASTY IMPLANTS DIRECTLY MEDIALIZE THE VOCAL PROCESS? – AN ANATOMICAL STUDY ON EXCISED LARYNGES

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Rationale: In type I medialiazation thyroplasties it is an ongoing discussion if a perfect implant could be able to directly touch and medialize the tip of the vocal process of the arytenoid cartilage. If not, there woud be a strong argument for additionally using the arytenoid adduction procedure to medially rotate the vocal process. However, if the vocal process could always be reached and moved by a medialization implant, then it would 'only' need a highly precise technique to directly get to the vocal process and to push it to an ideal medialized position. It was therefore the aim of this excised larynx study to find out in a series of human cadaver specimens how the three dimensional anatomy would or would not allow for such an ideal implant.

Methods: Twenty excised human larynges (male and female) were dissected and skeletonized so that the laryngeal cartilages and their ligaments, including the vocal ligament, were saved. Typical thyroplasty windows were carved and visual estimation of a possible direct line from the thyroplasty windows to the vocal processes in their medialized positions were explored. All examinations were extensively foto-documented.

Results: It could be demonstrated that in all larynges the vocal process was not only visible in the resting position through the thyroplasty window, i.e., paramedian to intermediate position, but that also in forced adduction even with an inferior anterior vector the entire tip of the vocal process was visible and directly accessible.

Discussion: There is an ongoing controversy about the theoretical (in)accessibility of the vocal process in Isshiki type I medialization thyroplasty by the inserted implant. It was argued in the past that the tip of the vocal process is hidden behind the up-sloping lateral superior rim of the cricoid cartilage. This notion is disproven in our excised laryngeal studies by visualizing the arytenoid cartilage in skeletonized excised larynges.

Conclusion: According to the results of this study, it should be possible to manufacture ideal thyroplasty implants that can reach and medialize the tip of the vocal process as well as the ligamentous part of the vocal fold. More clinical studies, e.g. with Digital Volume Tomography, are needed to prove that this conclusion also holds true in clinical situations.

FP-Linguistics/Emotional 2 (Room4)

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EXPRESSIVE RESOURCES CHARACTERISTICS USED BY ACTORS AND ACTRESSES IN DRAMATIC TEXT

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I. Introduction: Transforming dramatic text in speech is part of the actor's craft, using oral expressive resources to propose different types to say the dramatic text. The oral expressive resources are several, as well as the meaning elapsed. Madureira [1] declares about the oral expressivity that the speech, by phonation and articulation, expresses some kind of emotion, faith, physic or social state. Therefore, the speech is recognized as sound material filled of meaning attributed by the listener. The expressivity of speech is revealed by segmental elements (vowels and consonants), prosodic (rhythm, intonation, voice quality, utterance rate, pauses, and accent standards) and also by the relation between sound and sense. Viola [2] reports that oral expressivity is the result of several aspects such as phonetic segments, prosody, including the voice quality and dynamic, emotions, attitudes, and the speaker style. The purpose of this study is to categorize and analyze marking proposals regarding the expressive resources used in a dramatic text by theater students.

II. Methods: The studied group was composed by eight women and six men; aged from 20 to 29 years old, all students of the 3rd year in theater art graduation in a university in São Paulo. Their curriculum includes the subject entitled "Voice Expression". The methodology applied had the following steps: 1) the students received the excerpt of the text "*O Santo Inquérito"* (The Holy Inquiry) by *Dias Gomes*, and were guided to register in the text, personally and freely, the intention of expression in the dramatic reading, 2) each participant performed the dramatic reading of the text according to their marks and the readings were recorded, 3) each participant marks were recognized, categorized, and analyzed as expressive resources. The adopted criteria to categorize were based on Madureira [1] and Viola [2] works.

III. Results: Twelve categories were described, divided in three types, according to the expressive resource characteristic, as follow: intern action (IA); physic action (PA), and prosodic element (PE). Intern action is related to the subjectivity area, once it depends on emotions, attitudes, proposals, and the idea about the text comprehension to sustain the expressive proposal; the physic action is directly related to performing some body gesture, and the prosodic element is related to time properties of enunciation, as pause, voice quality set, articulation and resonance set, emphasis/accent, speed rate, and others, therefore proposing a more objective expressive resource. Most students (65%) reported to use marks of expressive resources that they intend to use on the text. The type of expressive resource prosodic element most used was pause (22%), followed by accent (17%), glottis set (13%), and speed (7%). Most students use the intern action (specifically intentional/attitude and emotional) expressive resource.

IV. Discussion: The use of score in dramatic texts is described by voice coaches. Gayotto [3] proposes the actor to do the vocal score; using marks on the text that signalize which voice resources are going to be applied to the performing speech. She points out to be fundamental to the actor to carve with sounds the wills and needs of the character. Quinteiro [4] reports to be necessary the actor to adapt the written text to the oral communication, proposing the use of signs to breathing pauses and its durations, relating them to the logic thinking, the situation and feeling. In this study, the recurrent use of pauses by the students points out how much they value the effect of this expressive resource. The use, by most students, of the intern action expressive resource reveals the importance they attribute to emotion, the intention, and the meaning from the text comprehension to build the dramatic reading. Bakhtin [5] reports that we do not say or listen to words, but truth or lies, good or bad, important or trivial, pleasant or unpleasant things, etc. Machado et al. [6] discussing the *Emotion Theory* described by Vigotsky, points out that emotion is related to imagination and to thinking assuming active role, which triggers actions, and are not only triggered by them. He considers being an active participation of emotional life in cognitive sphere of thinking and in creator movement, which is imagination. The use of marks of expressive resources in dramatic texts by actors and actresses may contribute to the creative process of meaning, with the validation and repetition of the proposal of expressive performing and the perception and monitoring the effects of their own oral expression. To the vocal coach, knowing the expressive resources used by actors allows the recognition of the needs of the technical work to fulfill expressive demands, therefore promoting a practice in agreement with the expressive intention of actors.

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BECKETTIAN SONORITIES: VOCAL PREPARING IN SAMUEL BECKETT'S THEATRE.

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INTRODUCTION: The act of speaking at Beckett's theatre does not fit in what is traditionally supposed to be the function of elocution in theatrical performances or an instrument that makes the dramatic action advance, giving meaning to what is seen in a logical chain of events. Under some plays' rubrics, Beckett gives very precise indications about the acting, covering references about the vocal work. From the point of view of vocal performance, one can infer that the level of detail proposed by Beckett in his rubrics would require intense and specific technical/expressive preparation. This study aimed to investigate the creating process and vocal preparation in the staging of Samuel Beckett's short plays, played by Brazilian actors, with a view to vocal pedagogy.

METHODS: The proposed research is directed according to criteria and conceptions of qualitative research. Seven theatrical artists were interviewed, between directors and actors, with recognized expertise in theatre, with more than 10 years of profession and that staged in professional circuit some of Samuel Beckett's short plays on the period from 1980 to 2012, in Brazil. The short plays were chosen for presenting both a more complex than other texts from the author vocal demand as a greater radicalization of their theatrical aesthetic. To direct the interviews, were drawn up fourteen topics: 1- Beckett's theatre: first contact; 2 - a theatre that questions the theatre; 3 - rehearsal; 4 - vocal work and preparation; 5 - sonority in front of text understanding; 6 - materiality and musicality of what is said; 7 - rubrics: the author's almost omnipresence; 8 - actor creation: the actor's place in the process of staging; 9 - difficulties on creating and performance; 10 - represent versus execute: a text that is not represented, is not interpreted, a bereft acting; 11 - building images by speech: the interaction of text with images; 12 - the contribution to actor's work; 13 - life post Beckett; 14 – Beckett in contemporaneity. All the interviews were recorded on audio and transcribed so it could be done a content analysis i.e. material pre-analysis, its exploration/coding/classification and treatment of obtained results as regards inferences and interpretations made by researcher from what was said by respondents.

RESULTS: Generated through content analysis, only subcategories that were common to the following topics will be emphasized: vocal work and preparation, sonority in front of text understanding, materiality and musicality of what is said, rubrics, actor's creation and building images by speech, which are the directly related to the vocal work topics. Subcategories were summarized to the following points: 1 - actor's indulging; 2 - character; 3 - the relation between body and voice; 4 - vocal work itself.

DISCUSSION.

Actor's indulging: The requirement of an absolute surrender to theatrical experience, the belief that they would have to abandon their "ego" and the need to break their limits in acting were the main points that emerged from the interviews and that directly reflected on vocal work and creation. **Character:** Although the term "character" has appeared frequently, the actors say there was no "character-building" based on Beckett's work because it's not possible to be guided by a traditional notion of character creation, like Stanislavski's work, facing psychological or realistic aspects. **Relations between body and voice:** Most actors reported having worked with a lot of physical training and that the voice was a consequence of it, in intimate connection with body. **Vocal work:** Vocal creation is always a consequence from a broad creating work and in this context, most of actors noted that experimentation was the master guide of this process, when there was an effort to make the voice alive, instead of formalized.

CONCLUSION: It's interesting to highlight one of the reflections enabled by this research: how Beckett's theatre may require a great technical rigor vocal performance, often guided by rubrics, without, however, being unlinked from a physicality also strict, forcing the actor to break his bounds, in an attitude of absolute delivery to theatre creation. Starting from Beckett's short texts, pedagogical possibilities of deepening the actor's vocal preparation can be observed, both for beckettian scene as for theatre in general. One of pedagogical possibilities is giving the speech the same value of others scene/stage components, not even superimposed or subjugated to them, but as another element on which the actor can work from scratch. A kind of preparation where grows up the speech rhythmic perception, tone and intensity variations, the relations between movement and elocution, using the various sounds of speech, like the sounds of consonants or breathing, as integral parts of the text scenic materialization, certainly will allow a vocal preparation enrichment both to actors in training as to professional ones. The authors acknowledge the financial support for research of FAPESP.

HOW DO LARYNGEAL AND RESPIRATORY FUNCTIONS CONTRIBUTE TO DIFFERENTIATE ACTORS/ACTRESSES AND UNTRAINED VOICES?

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Introduction: Since the 1980s, research regarding the actor's voice has intensified intending to improve both, vocal technique and pedagogy. Most studies on the actor's voice focused on acoustic and auditory-perceptual analysis of the voice. The present study aimed to compare actors/actresses's voices and nonactor/actresses's voices through aerodynamic and EGG used simultaneously. We hypothesized that glottal and breathing functions should reflect technical and physiological differences between vocally trained and untrained subjects.
Methods: A total number of 40 participants, 20 theater actors and 20 nonactors, were included in this study. Acoustic, aerodynamic, and EGG signals were captured simultaneously during all phonatory tasks. Aerodynamic data were collected with a Phonatory Aerodynamic 205 System (PAS), KayPENTAX, model 4500 (KayPENTAX, 206 Lincoln Park, NJ). EGG data were obtained with an Electroglottograph, model 6103 (KayPENTAX). In the present study, three protocols of PAS software were used: Comfortable Sustained Phonation with EGG, Voice Efficiency with EGG and Running Speech. Participants from both actor and nonactor groups were asked to produce different phonatory tasks depending on the protocol used in three different levels of loudness - habitual, high, and low. For statistical analysis, Wilcoxon signed-rank test and *t* test, multivariable linear regression models and Pearson correlation coefficient were used with the statistical software Stata 13.1. Data were collected in the Voice Research Laboratory at University of Chile.
Results: For Comfortable Sustained Phonation Protocol, when gender was compared, mean F0 and mean phonatory airflow demonstrated significant differences. Mean phonatory airflow was the only variable showing significant differences between training status. Mean SPL and mean F0 evidenced differences when habitual and high loudness levels were compared. Mean SPL and CQ were found to be different comparing habitual and low loudness productions. Correlation analysis evidenced no strong correlations. For the Voice Efficiency Protocol, differences were found for mean SPL and for mean subglottic pressure, both at high loudness level. Gender differences were observed for mean phonatory airflow, aerodynamic efficiency, and CQ. Training status differences were shown for mean SPL and mean subglottic pressure. All variables except mean phonatory airflow were significantly different between groups for habitual and high loudness levels. Mean SPL, mean subglottic pressure, and aerodynamic resistance demonstrated significant differences when comparing habitual and low loudness productions. Correlation analysis evidenced strong correlations for mean SPL v/s mean subglottic pressure, v/s aerodynamic power and v/s aerodynamic efficiency. For the Running Speech Protocol, when trained and untrained subjects were compared by intensity level, significant differences were found for mean SPL at high loudness level, inspiratory airflow duration at low loudness level, mean phonatory airflow at high loudness level and low loudness level, mean inspiratory airflow at high loudness level and inspiratory volume at high loudness and at low loudness productions. Gender differences were observed for almost all variables. Training status differences were observed for all parameters. When comparing habitual and high loudness level, all variables showed significant differences. Only mean SPL, mean F0 demonstrated significant differences when habitual and low loudness productions were compared. Correlation analysis evidenced good correlations only for mean SPL v/s mean phonatory airflow, mean SPL v/s mean inspiratory airflow , mean SPL v/s inspiratory volume.
Discussion: Based in our findings, apparently the glottal source has a weak contribution when differentiating the training status in speaking voice. More prominent changes between vocally trained and untrained participants are demonstrated in respiratory-related variables. Specifically, actors and actresses seem to reflect a greater degree of vocal training through higher subglottic pressure, higher phonatory airflow, longer time for inspiration, higher values for mean inspiratory airflow and also higher values for inspiratory volume than untrained subjects. These findings may be related to the better management of breathing function in vocally trained participants.

EMOTIONAL COLORING OF THE SINGING VOICE

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INTRODUCTION: In music performance emotional expressivity is essential. Given the metrical and melodical constraints of a musical composition, it is a relevant question how a vocal artist conveys emotional information in performing vocal music. A central instrument to evoke the subtle shadings of emotion is the human voice. In fact, singers are often judged in terms of their ability to produce the emotional modulation of their vocal performance that is considered appropriate to nature of the emotion to be portrayed. Previous investigations have focused on various performance aspects such as tempo, intensity, aperiodicity, pauses, and formants [1]. Laukkanen and associates [2] also studied contributions of the voice source to emotional expressivity in three Finnish speaker voices. Here we report a case study, in which we examine changes of glottal parameters and their effects on acoustic parameters related to spectral slope in examples sung by an internationally touring tenor soloist expressing different emotions.
METHODS: The singer volunteered to perform a set of examples in eleven different emotional colours, using a standard nonsense sentence and sustained vowel /a/. These performances were analysed with respect to long-term-average spectrum and glottal voice source properties, which were derived from the audio signal by means of inverse filtering using the custom made Decap software (Svante Granqvist, KTH). MFDR, pulse amplitude, closed quotient and normalized amplitude quotient were examined in terms of their deviations from the values in Neutral.
RESULTS: We present examples of the major results of the study. As to the acoustic parameters measuring different aspects of the LTAS, we used five types of singing samples as observations and computed a repeated measures ANOVA over the eleven emotions. The results showed strongly significant emotion effects for Alpha ratio, Hammarberg index, Proportion energy below 500Hz, Proportion energy below 1000Hz, Spectral flatness, Spectral centroid. All of these parameters are highly correlated and thus showed consistent findings. Systematic examination of the means showed that sadness had the steepest spectral slope and Anger and Contempt the flattest. The significant results are most likely due to this strong difference. The other emotions had spectral slope values that were on a comparable level.

The fine-grained analysis of glottal voice source properties confirmed that Sadness and Anger are diametrically different showing the lowest and highest MFDR values, respectively. Sadness and Tender were also highest in both H1-H2 and in NAQ, suggesting that they were produced with a low degree of glottal adduction while Anger assumed the opposite extreme in Naq.
DISCUSSION AND CONCLUSION:The investigation showed strongly significant emotion effects for all measured spectrum characteristics. The MFDR differences between Sadness and Tender on the one hand and Anger and Arousal on the other suggest subglottal pressure differences. The singer also seemed to use glottal adduction as an expressive tool, increasing it for Anger and Arousal and lowering it in Sadness and Tenderness. The method used appears promising, suggesting that the experiment should be repeated with several singers.

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GENDER DIFFERENCES IN IDENTIFYING EMOTIONS FROM AUDITIVE AND VISUAL STIMULI

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Introduction. The present study focused on gender differences in emotion identification from auditive and visual stimuli. The idea was to study how do auditive stimuli convey emotional content of speech, and whether visual nonverbal communication without auditive stimulus can convey emotional content of speech. The aim was to get better knowledge of vocal attributes and a more holistic understanding of nonverbal emotional communication.
Methods. Emotional nonsense sentences, sentences in Finnish language and prolonged vowels [a:], [i:] and [u:] (N = 80) were produced by professional actors of both genders (N = 4). Four emotions were expressed: anger, contented, excitement and fear. The recordings were made in a soundproof studio, using Logic Pro X workstation and Brüel & Kjær 4006 microphone. The samples were studied for the acoustic parameters by Praat software, and the statistics were analysed by SPSS22. Perception tests for emotion identification were conducted for randomly chosen volunteers, 25 males and 25 females, native speakers of Finnish language. The forced choice tests were conducted one by one with the participants in a soundproof studio. One loudspeaker and a screen were replaced in front of a participant. One half of the samples (N = 40) were replayed without video, thus, voice only was available. The other half (N = 40) was replayed without voice, thus, picture only was available.
Results. Voice quality parameters F2, F3, F4 and number of voice breaks were statistically significantly connected to the identification of emotions in males (One-way ANOVA, $p < 0.01$). Shimmer and harmonics to noise correlated significantly with emotion identification in females ($p < 0.01$). Significant correlations between the voice quality parameters were found. Anger was best identified of the four emotions by both genders. Contented was most frequently chosen for an answer. In regard to emotion identification from voice and video, visual stimuli seemed to be easier to recognize: in males, 64% of the non-identified samples were auditive, and in females 71% respectively. However, females tended to manage better than males in the identification: Share of "correct" answers in males was 1676/2000 ("false" answers 324/2000), in females share of "correct" answers was 1771/2000 ("false" answers 229/2000). Thus, gender difference in emotion identification was statistically significant ($p < 0.001$). Emotions expressed tended to be easiest to identify from nonsense sentences (771/800), and secondly from Finnish language (732/800). Emotions conveyed by the vowels tended to be more difficult to identify.
Discussion. A statistically significant difference was found between the genders in emotion identification from auditive and visual stimuli, females being more accurate in the identification. Voice quality parameters played a role in the identification in both genders. Emotions seemed to be easier to identify from visual stimuli than from auditive stimuli. Even though the subjects in production and perception of the stimuli were native speakers of Finnish, nonsense sentences conveyed best the emotional contents of the expressions, perhaps because no attention had to be paid on linguistic content. Visual information of speech may not be connected to the language, instead, it may be linked to the motor control theory and the evolutionarily based human ability to understand kinetic movements in speech production more easily than the characteristics of the acoustic cues.

F0 AND INTENSITY IN CHARISMATIC POLITICAL SPEECH: A CROSS-CULTURAL STUDY

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Charismatic leaders manipulate vocal quality to convey different traits and types of charisma, arouse emotional states, achieve goals, and to be recognized as group leaders [1]. Fundamental frequency (F0) and intensity (dB), as part of overall vocal quality, are important characteristics to convey emotional states and social status in both spontaneous and non-spontaneous speech (e.g., [2] for F0, [3] for intensity). In this work we studied F0 and intensity performance by charismatic political leaders from different languages and cultures, involved in different communication contexts. Our main hypothesis was that charismatic speakers use significantly different F0 and intensity ranges in different communication contexts, following cognitive strategies of persuasion. When the main goal of political speakers is to persuade followers to vote for them, they stretch their vocal range to its highest and lowest acoustical limits so as to arouse higher emotionally negative (i.e., anxiety) and positive states (i.e., reassured). When the main goal is to persuade peers with similar social status, such as other politicians, they restrain their vocal range so as to mostly activate negative emotions (i.e., fear) and convey dominance. Finally, when the speakers do not deal with any political topic the persuasive goal changes and speakers use an even narrower vocal range, much closer to his normal phonatory range (i.e., healthy voice.)

Results show that political leaders speaking different languages and from different cultures use a similar vocal strategy that we called *Vocis Variatio Delectat* [see also 1]. According to this strategy, politicians speak with F0 and intensity ranges which are significantly correlated to the context of communication. This last depends on the speakers' persuasive goals, the political vs. informal topics they address, the chance to be chosen as leaders and/or the risk to loose the leadership status, the diversity (gender, age, education, ethnical group, social status) and the size of the audience. The formal-monologue communication context (MON) is very risky for leadership status in democratic groups, as it depends on the listeners participating in the communication who will have to choose their political leader. In this context, emotional states and persuasive strategies used by the leader to convey beliefs and achieve goals have a high psychological activation. The wide vocal range used in this context of communication seems to be used by the leader as an expression of social attractiveness and dominance [1]. Leaders may use greater F0 range to also reach a diverse audience. Lower F0 is used to convey dominance and attractiveness (as also shown by [4] and [5], to both genders, e.g. [4], and in different species, e.g. [2]. Higher F0 is used to convey competence, reassurance, calmness, benevolence [1], and submission [2]. Wide range and high mean intensity are related to high activation of positive emotions [3]. The communication context of a formal conference (CON) could also be described as risky for leadership. Leaders have to persuade an audience composed of peers and try to sound more dominant. One important difference from the MON communication context is the average F0. During CON, leaders use a lower mean F0. This is because of the social status and gender of the audience: the audience members are mostly leaders from other social groups or sub-groups, and they are also mostly males. As stated above, leaders who wish to convey traits of dominance must also modulate their F0 according to the listener [6], and more generally according to the social status of the audience listeners [1]. Therefore, the speaker may try to convey more dominance in this communication context by lowering his F0. The persuasive strategies used during an informal interview (INT) are different from those used in the other two communication contexts. The politicians do not strain their voice for persuasive purposes or arouse emotional states in listeners.

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W18-Singing Voice 11 (Room1)

THE FEMALE MIDDLE SINGING VOICE EXPLORED WITH NON-INVASIVE FEEDBACK FROM AUDIO AND EGG SIGNALS

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Using recorded non-invasive signals of VoceVista (spectrum analysis and EGG), objective characteristics of the female middle register are described in some detail as they occur in classical singing, "mix," and belting. These characteristics include two points of transition: 1) from the lower ("chest") register, and 2) the move to the upper extension at secondo passaggio; as well as varied resonance adjustments of the first and second formants in these transitions.

The workshop will first present recorded files that can be considered model approaches to the critical transitions that characterize the middle register. Subsequent exploration of the transitions with live voices should then help reveal the complexity of the factors that the singing teacher needs to consider with respect to both voice type and individual variation.

W19-Singing Voice 12 (Room2)

BELTS, ROCK BELTS AND SCREAMS. BELTING AT A HIGHER LEVEL

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In the pop, rock repertoire singers often love to sing extreme high notes that really sound loud, strong, metallic, chesty, emotional and really powerful. Nowadays in some musical productions female singers are asked to audition with a high belt even to Bb5. And in Jesus Christ Superstar male singers love to sing Rock Belt-screams notes to G5. Is it possible to Belt these high notes or is Belting only correct when its sound is produced in Mechanic 1 (M1)?

In this workshop we will first listen to the lower Belt sounds and after that the high Belt sounds. What are the sound parameters that define Belt quality and what is the difference with these high Belt sounds? We will show the parameters in our Universal Voice System. After this we will present how these Belt sounds are made. We will explain what happens in our body, power, source and filter. And at last we will make the High Belt sounds more Rocky and exciting?

We did examine many professional belters with (High-Speed) Video Laryngoscopy and Electroglottography and used this data for our Universal Voice System.
We will lead the workshop participants through the vocal system. How do you want to sound and what do you need to do to get the sound? Therefor, what do you do in your body-posture, and how does your body support the sound? What happens with your power, how much breath pressure or breath flow do you need for your highest Belt? What is happening in the source, the vocal folds, how long is the closed phase? And how do we shape our vocal tract, the filter, to enhance the sound? If we know what to do in our body, power, source and filter, we get an easier access to this specific Belt sound. Then we will be able to learn it in the most effective, quick and simple way.

We invite our workshop visitors to participate and we will teach the Belt sounds first in an easier lower range and make it progressive more and more challenging. This teaching and training is done with orchestral/band-accompanied exercises to get the right style, sound and feel. To make singing High Belt Sounds more fun, easier, simpler and very effective!

This workshop is a small demonstration of our new book: The Universal Voice Guide.

W20-Singing Voice 13 (Room1)

UP-DOWN AND BACK-FRONT EFFECTS FOR SPEAKERS AND SINGERS

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The UP-DOWN effect:
There are two ways to go from one pitch to another :
By STEPS (like a staircase)
UP-DOWN effect : Reinforcement of the upper harmonics in the low pitch giving impression that the sound goes *up* in the *low notes*. Reinforcement the lower harmonics in the high pitch giving impression that the sound goes *down* in the *high notes.*

The BACK-FRONT effect :
Reduction of intraglottal pressure when going to *high* pitches.
Feeling of *pulling* the sound *backwards*.
Increase of intraglottal pressure when going to *low* pitches.
Feeling of *pushing* the sound *forwards*.

Acoustic analysis examples are shown of he differnt effects with their emotional impact :
The same chromatic descent in Wagner by two different singers. One using the *steps down*, the other the *Up-Down effect.*
Examples of operatic and popular music using the *Back-Front effect.*
Acoustical modification of the intensity of the harmonics sung phrase goig from one effect to the other

FP-Singing 2 (Room1)

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THE EFFECTS OF BREATHING EXERCISES WITH THE FLOW BALL

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INTRODUCTION: In breathing exercises with the flow-ball a light plastic ball is kept floating evenly and as long as possible at a fixed level by the expiratory air stream. Several effects have been reported: constant phase of expiration, a focused and steady breath, control and the stability of the expiratory airflow, sustained and controlled breathing and increased lung volume.
These breathing exercises are used by musicians and singers and proved to be of benefit in practice. The effect of breathing exercises with the flow ball have been measured by aerodynamic parameters. The aim of this ongoing study is to assess the effect of flow ball exercises using also various voice parameters

METHODS: The pilot study was performed in nine student singers and three young professional singers. Before and after the exercises with the flow ball various parameters were recorded: glottal closure (videokymography (VKG) and electroglottography (EGG)), maximum phonation time (MPT), voice range profile (VRP) measurement. In the EGG the Closed Quotient was determined. The intensity and frequency range (IR and FR) were derived from the VRP.
The flow ball exercises consist of: The Singer sings the first two lines (with text) of Schuberts “Ständchen”: "Leise flehen meine Lieder" in the for the type of voice best tonality Medium or High on comfortable loudness. Thereafter, the Singer vocalises the same melody with the flowball. The flowball has to show a stable floating between 5 to 10 cm above the basket. Immediately after the use of the flowball, the singer repeats the first two lines of Ständchen.

RESULTS: The Closed Quotient was shorter after the exercises in most cases. No changes of the frequency range were observed after the flow ball exercises. After the exercises, the maximum phonation time and intensity range were increased in most cases. Generally, the videokymographic examinations went more easy to perform and the closed phase of the mucosal wave had increased in most cases. A more detailed description of the results is presented in Table 1.

DISCUSSION: The results of the CQ values and the glottal closure as observed in VKG do not correspond very well. More research of the relation between EGG and VKG is needed to explain this finding. The increase of the intensity range after the exercises is remarkable. This indicates a better control of expiratory air stream and this is in line with the findings of an increase of MPT in many cases and the reports of improvement of breathing. Long term effects of this ongoing study will be presented on the conference.

Table 1. Number of subjects performing equal, decreased and increased values for the parameters in post- compared to pre-test conditions. For explanation of the abbreviations: see text.

	CQ	IR	FR	MPT	VKG closure
Equal	1	0	1	2	2
Decrease	7	2	5	3	2
Increase	4	10	6	7	7
Not available					1

VOICE DISORDERS AND VOICE KNOWLEDGE AMONG CHOIR SINGERS

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The vocal mechanism is the most important instrument for singers. It could be assumed that singers care for their voices in order to sustain and improve their voice quality and function [1, 2]. Good voice care presupposes knowledge about the voice anatomy, physiology and voice ergonomics. Singers have reported higher prevalence of vocally harmful behaviors, vocal symptoms and voice disorders than non-singers [3, 4, 5]. The purposes of this study were to investigate the prevalence of voice disorders among choir singers and to discover the risk factors associated with voice disorders. Another purpose was to explore the choir singers' knowledge about the voice anatomy, physiology and voice ergonomics.

The data was collected with a web-questionnaire sent out via e-mail through two choral associations in Finland. A few choirs that were not part of any of these associations were also contacted personally. The questionnaire included demographic questions and questions about vocal symptoms, vocal habits and voice knowledge. A functional voice disorder was defined as when a person has two or more weekly or more frequently occurring vocal symptoms [6]. In the knowledge-based questions about voice anatomy, physiology and ergonomics, the participant picked one or several answers from a number of options. 315 adult choir singers aged 19–82 participated in the study, 65 % of whom were women, and 35 % men.

Of the choir singers, a fifth experienced two or more frequently occurring vocal symptoms, which could be defined as a functional voice disorder. No significant gender differences in the prevalence of vocal symptoms were found in this study. The most common, frequently occurring vocal symptom among the choir singers was throat clearing or coughing. Choir singers with a vocally demanding profession were almost twice as likely to report several frequently occurring vocal symptoms. Health-related risk factors, such as inhalant allergy and asthma, had a significant relation with the number of vocal symptoms. The voice knowledge among the choir singers seemed limited, although the scores were normally distributed. The understanding of the anatomy in the vocal fold area was limited, since a fifth was of the impression that water goes directly through the vocal folds. The voice knowledge was higher among women, younger participants, and among those who had singing education.

The prevalence of voice disorders among choir singers seems to be similar to the prevalence rate among professional voice users [6]. Choir singers with a vocally demanding profession are at a higher risk of developing a functional voice disorder. Choir singers who suffer from, for example, inhalant allergy, asthma and reflux disease also run a greater risk of developing a voice disorder. The results of this study raise the importance of educating choir singers about the voice, in order to prevent development of voice disorders.

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THE IMPACT OF FUNCTIONAL REHABILITATION ON DYSPHONIA TREATMENT IN SINGERS

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INTRODUCTION

Singers represent a group of professional voice users with the highest risk of voice disorders. Temporary voice problems affect all singers and are most often functional.

In the treatment of singers' voice disorders, to often pharmacological management with corticosteroids is used, the use of which is fraught with major side effects. There is a growing need to introduce new treatment methods for singing voice disorders, one of which should be functional rehabilitation.

PURPOSE

The evaluation of functional rehabilitation's effects, carried out in singers in the Phoniatric Ambulatory of the Warsaw Medical University from 2010-2013.

METHOD

The subjects consisted of 40 singers (20 in the study group and 20 in the control group), aged from 15 to 56 years. The study was conducted in the Phoniatric Ambulatory of the Warsaw Medical University in the years 2010-2013.

In the study group, after an initial voice assessment, singers underwent functional rehabilitation (10-15 sessions) and a final voice evaluation. In the control group, the voice assessment was carried out twice, with an interval of at least 3 months in between.

The following set of data was collected for each singer: voice history, an ENT physical examination, perceptual voice assessment, palpatory evaluation of the vocal tract in speaking and singing, maximum phonation time, acoustic parameters, videolaryngostroboscopy, flexible fiberoptic scopes of the throat and the larynx activities, VHI score, the knowledge of the vocal tract physiology assessment and the self-consciousness of the singer's vocal tract evaluation.

The primary aim of applied rehabilitation was the rationalization of the singers' vocal tract's functional activities due to the improvement of the respiratory function, increasing of sensorimotor awareness and auditory training.

The applied rehabilitation was a compilation of different rehabilitation techniques, including: Lessac, Alexander Therapy, Chewing (Froeschels) technique, Accent Method, relaxation techniques, Feldenkrais Method, Lax-Vox, Manual Therapy, Singing Techniques and auditory training. The rehabilitation was adapted to the individual needs of the singers.

RESULTS

For palpatory assessment, speaking and singing voice perception, voice range profile, theoretical knowledge of voice production and self-assessment of singing voice disorders the values in the study group were improved, which revealed statistical analyses. The maximum phonation time were reduced after rehabilitation.

CONCLUSIONS

1) Functional rehabilitation is an effective treatment of singers' voice disorders. 2) Palpatory evaluation of the vocal tract, perceptual voice assessment and acoustic parameters are the most sensitive methods in detection of small changes in the vocal tract function. 3) At the beginning of the functional rehabilitation process, maximum phonation time may be reduced.

PHONATORY STRATEGIES OF VOCALISTS AT SINGING DIATONIC SCALES WITH VARIOUS DYNAMIC SHAPING

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Background

Professional vocalists have to cope with different musical tasks at wide pitch and dynamic range while pronouncing the text and maintaining control over the overall timbre of their voice. According to the source—filter theory of voice production, the acoustical properties of the voice depend on the working regime of the vocal folds, as well as on the shape of the vocal tract, which acts as the resonator (Sundberg, 1987). It is possible to produce the voice at the same pitch and loudness with different phonatory characteristics, although to maintain the stability of phonation these characteristics must stay within certain limits defined by the laws of physics (Titze, 1994). Produced glottal source power depends on glottal adduction and is greatest at closed quotient values somewhere between Qx = 0.4 and Qx = 0.5 (Titze, 1994). Closed quotient depends also on the laryngeal mechanism, and its value tends to be higher in the case of the chest voice compared to the head voice (Henrich, et al., 2005). Howard (1995) has reported that in the case of female singers Qx tends to increase for pitches higher than B4 with training, but Sundberg (2013) claims that professional singers avoid such "automatic" changes of phonation.

Aims

The aim of this work was to investigate the phonatory strategies of professional vocalists when singing ascending and descending diatonic scales with various dynamic-shaping tasks.

Method

Professional singers and singing students sung diatonic scales at different tonalities over their voice range using different vowels. Three dynamic tasks were used: (1) sempre *f*, (2) crescendo from *p* to *f*, and (3) diminuendo from *f* to *p*. A glottogram (EGG), reflecting the laryngeal activity of the singers, was registered with a laryngograph, and the acoustical signal was also recorded.

Results

Different singers used different phonatory strategies which were expressed: (1) by the pattern of how the value of the contact quotient (Qx) measured by the EGG changed in response to the ascending and descending pitches of the scale; (2) on how the value of Qx changed in response to the increasing or decreasing sound pressure level; (3) on how different voice registers were used. In many singers the Qx value also depended on the vowel used.

Conclusions

Singers tend to use their individual phonatory strategies quite consistently. Some strategies are more common and may depend on the training and the expertise of the singer .

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FP-Acoustical/Mechanical Analysis 3 (Room2)

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LARYNGOTOPOGRAPHY FOR INTUITIVE EVALUATION OF SPATIAL CHARACTERISTICS OF VOCAL FOLD VIBRATION IN NORMAL AND PATHOLOGICAL VOICES

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Introduction: Laryngotopography is an analyzing technique for vocal fold vibration via high-speed digital imaging using fast Fourier transform. Laryngotopography is effective in the spatial vibratory features regarding amplitude, frequency and phase. This method was first proposed by Granqvist et al. in 2001 [1-2], and was further developed into laryngotopography at our institution [3-6]. Hereby, we applied laryngotopography to high-speed digital images of normal and various pathological voices, and evaluated their spatial vibratory characteristics.

Methods: Subjects were 46 vocally healthy subjects and 304 cases with various voice disorders (e.g., vocal fold atrophy, sulcus vocalis, vocal fold paralysis, vocal fold scar, vocal fold polyp, vocal fold nodule). High-speed digital images of a sustained phonation /i/ at a comfortable frequency and sound pressure level were recorded at 4500 fps, and recorded data were analyzed by laryngotopography.

Results: The amplitude panel showed frequency–related change in vibrating area in normal subjects: vibrating areas showed a negative correlation with frequency. Vibrating areas in vocal fold nodule, vocal fold atrophy and sulcus vocalis were likely to be reduced. Non-vibrating areas were noted in vocal fold scar, vocal fold cyst and laryngeal cancer. The frequency panel showed two different vibrating areas with different fundamental frequencies in diplophonic cases, and multiple different vibrating areas in irregular voices, especially in cases with supraglottal hyperactivity. The phase panel showed a various extent of lateral and longitudinal phase differences in both normal and pathological voices.

Discussion: Various disease-specific findings as to *amplitude*, *frequency* and *phase* were observed by laryngotopography. Laryngotopography was considered helpful in the detection, diagnosis, estimation of severity and treatment of voice disorders.

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VIDEOKYMOGRAPHIC ANALYSIS OF VOCAL FOLD VIBRATION IN UNILATERAL VOCAL FOLD PARALYSIS

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I. INTRODUCTION

The study investigated vocal fold vibration in patients with unilateral vocal fold paralysis with the aim of answering the following questions: I) Does the paralyzed vocal fold tend to vibrate faster or slower than the healthy vocal fold? II) What are the most important features that distinguish the vibration of the paralyzed from the healthy vocal fold?

II. METHODS

A systematic protocol, which visually rates 33 vibratory features of the vocal folds using pictograms, was used to evaluate videokymographic images obtained from 46 patients diagnosed with unilateral vocal fold paralysis. The evaluation was done independently by four evaluators. Statistical analysis of the parameters was performed using the R GNU and G-power software.

III. RESULTS

The results revealed a statistically significant tendency of the paralyzed vocal fold to vibrate with different frequency, amplitude and phase than the healthy vocal fold. However, there was no clear tendency of the paralyzed vocal fold to vibrate slower or faster than those of the healthy vocal fold – both of these possibilities were observed.

The most prominent features for distinguishing the paralyzed vocal fold from the healthy one (approaching but not reaching statistical significance) were a) the reduced sharpness of lateral peaks and b) increased amplitude of the paralyzed with respect to the healthy vocal fold.

IV. DISCUSSION

The paralyzed vocal fold tends to behave differently in different patients. These intra-individual differences should be taken into account for diagnostic and therapeutic purposes. The data can also be used for refining the biomechanical models of the vocal folds in voice disorders.

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REPRODUCIBILITY AND ERROR ESTIMATIONS OF AREA AND VOLUME MEASURES OF THE LOWER VOCAL TRACT OBTAINED BY MRI DURING SUSTAINED PHONATION

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During human voice production the vocal tract (VT) acts as a resonator which filters the glottal voice signal and modifies the spectrum of the emitted sound. Thereby the VT defines vowel quality and voice timbre characteristics likewise, which are important not only for speech communication but also for vocal arts. The modus operandi of the VT is the adjustment of its morphology. The state-of-the-art visualisation-technique for the VT at a functional state has become magnetic resonance imaging (MRI). It facilitates image aquisition during sustained phonation rendering detailed three-dimensional models of the VT at work. This methodology allows deep insights into the physiology like morphologic VT adjustments during special tasks like classical singing [1].

Yet for interpretation of the data, knowledge about its accuracy and fluctuation range of the procuded measurements is needed. In a study by Aalto [2] movement artefacts during a MRI sequence were analysed for a single subject and found to be in the range of 1-3 mm for the position of the tip of the tongue and the air space posterior to the tongue.

In the presented study we wanted to look at the lower vocal tract which is particularly relevant to voice timbre. We wanted to clarify the reliability of the data obtained during sustained phonation in an MR-tomograph? What fluctuation range has to be considered when interpreting lower vocal tract measures derived from such data?

One male subject (aged 46 years) was asked to produce a sustained vowel /a/ at 220 Hz (A3) in a 3T MRI machine (Verio, Siemens Medical Solutions, Erlangen, Germany). The task was to be executed in a classical singing style at a medium loudness with a rather low vibrato. It was repeated twenty times. The acquisition time was 12.1 seconds for each recording. During the MRI-recording an audio-recording was made by means of an optical microphone (MO 2000, Sennheiser). The image data were segmented with a centerline-based approach. A centerline of the vocal tract from the uvula to the upper anterior arytenoid rim was inserted in a mid-sagittal image for segmentation of the lower VT. The image stack transformed to a set of images whose planes were orthogonal to the tangent of the centerline. With help of a semi-automatic algorithm the resulting images were segmented along the air-tissue-border. The assembled two-dimensional segmentations allowed for measurements of the lower VT within the centerline-based coordinative system in three dimensions.

The data document the reproducibility and accuracy of lower VT measures based on MRI-recordings during sustained phonation.

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AIR PRESSURE AND GLOTTAL CONTACT QUOTIENT MEASURES DURING DIFFERENT SEMI-OCCLUDED POSTURES IN SUBJECTS WITH DIFFERENT VOICE CONDITIONS

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Vocal exercising through phonation into a tube has been reported to modify oral, subglottic and transglottic air pressure (Poral, Psub, Ptrans) and vocal fold contact quotient (CQ) in healthy voice users [e.g.1-3]. Phonation into a tube submerged in water has been used for different types of patients [4]. Thus, different changes would be expected in aerodynamic and glottal parameters depending on the vocal condition of the subjects. This study concerns these parameters in four groups of subjects.

Forty-five participants were included in this study. They were divided into four groups: 1) subjects with normal voice and without voice training, 2) subjects with normal voice and with voice training, 3) subjects diagnosed with hyperfunctional dysphonia , and 4) subjects diagnosed with unilateral vocal fold paralysis. Participants produced at a comfortable pitch and loudness repetition of [pa:] (baseline), and thereafter in random order phonation on :1) drinking straw with the free end in air, (2) stirring straw with the free end in air, (3) silicon tube (lax vox) with the free end in air, (4) silicon tube with the free end submerged 3 cm below the water surface, and (5) silicon tube with the free end submerged 10 cm below the water surface. Aerodynamic, acoustic and electroglottographic (EGG) signals were captured. An estimate of subglottic pressure was obtained from Poral during [p:] in [pa:] and during shuttering of the outer end of the tube. Each phonatory task was analyzed to obtain the mean CQ, fundamental frequency, Psub, Poral (obtained during non-shuttered phase), and mean transglottal pressure = P(sub)-P(oral). Numerical variables were described by median and interquartile range, and compared by phonatory task and vocal status using Kruskal-Wallis test. A generalized multivariable linear model was fitted to observe the joint influence of phonatory task and vocal status in the vocal parameters. Separate subgroup analysis for minimal and maximal supraglottic pressure in both "tube in water " groups was also performed. Overall correlation was studied with Pearson correlation coefficient.

All exercises had a significant effect on Psub, Poral and Ptrans, and CQ ($p<0.05$). For all subjects regardless of the vocal status, phonation into the tube submerged 10 cm in water and into the stirring straw resulted in the highest values for CQ and Psub, compared to baseline. Poral reached the highest values for tube submerged 3 and 10 cm in water. Poral and Psub correlated positively.

During semi-occlusion exercises most variables behaved in a similar regardless of the vocal status of the participants. This means that if different outcome is expected in different patients, different instructions are needed. Avoidance of stirring straw and tube 10 cm in water may be safest for patients with hyperfunctional voice disorder, while they may be a good option for subjects with hypofunctional dysphonia.

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VOCAL FOLD POSTURING AS A FUNCTION OF THE ACTIVATION OF THE INTRINSIC LARYNGEAL MUSCLES

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INTRODUCTION: Neuromuscular control of the larynx plays a crucial role in phonation. Previously, using the in vivo canine laryngeal model, the pre-phonatory impact of the intrinsic laryngeal muscles was studied, both individually and in combination [1-3]. Despite the importance of such studies in assessing the contributions of individual intrinsic laryngeal muscles, crude control over the stimulation levels prevented comprehensive studies of neuromuscular control of phonation from being conducted. In particular, these studies implemented only coarse "on-off" or "absent-low-high" settings to stimulate the individual laryngeal muscles. To obtain fine control over laryngeal posturing and phonatory output, graded stimulation of the laryngeal nerves and muscles is needed. Recently, Chhetri et al. [4-5] presented a method to achieve graded stimulation in the in vivo canine larynx. In this study, we utilize this method to study vocal fold posturing as a function of the activation of the laryngeal muscles of the larynx, including the cricothyroid muscle (CT), the thyroarytenoid muscle (TA), the interarytenoid muscle (IA), the lateral cricoarytenoid muscle (LCA), and the posterior cricoarytenoid muscle (PCA).

METHODS: Using methods of graded stimulation to the intrinsic laryngeal muscles described previously [4-5], we studied vocal fold posturing as a function of the activation of the intrinsic laryngeal muscles. Specifically, we quantified the shape of the medial surface of the vocal folds as a function of these muscular activations using a hemilarynx-stereoscopic imaging methodology described previously [6-7].

RESULTS: Our results quantify vocal fold length, glottal adduction, and the shape of the medial surface of the vocal folds as a function of the activation of the intrinsic laryngeal muscles.

DISCUSSION: Despite the influence of glottal posturing on the resultant vocal fold vibrations, few, if any, systematic studies of the pre-phonatory shape of the vocal folds have been previously performed as a function of the activation of the intrinsic laryngeal muscles. Thus, these data yield new insights into how activation of the intrinsic laryngeal muscles influence vocal posturing and the resultant vocal fold vibrations and acoustic signal.

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LARYNX UNDER ULTRA-HIGH SUBGLOTTAL PRESSURE: MEASURE OF CONTACT FORCE BETWEEN VOCAL FOLDS IN EXCISED HUMAN LARYNGES.

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Objective: Subglottal pressure is often considered as a clue of vocal abuse, and this parameter is supposed to be at the origin of the phonotraumatism. This study is based on experiments on excised human larynges. The objective of this study was to analyze the contact pressure between the vocal folds during phonation and its relation with subglottal pressure until very high values.

Material and methods: 7 human excised larynges were set on the experimental test-bench. The vocal fold adduction was determined before the tests, using concomitant arytenoid adduction and membranous vocal fold medialization with Montgomery implants. The subglottal pressure (SGP) increased from 0 to 200 hPa. The contact pressure was measured with a pressure sensor placed between the vocal folds, the tracheal airflow and subglottal pressure were measured 1 cm under the glottis, the electroglottography (EGG) was recorded, as well as the audio signal (microphone distance: 15cm from the larynx).

Results: At the phonation threshold, contact pressure appeared at the same time as the first activity of EGG, before the onset of the glottal cycle, then rapidly increased until a plateau. The maximal values of the contact pressure were very variable between the larynges (range: 0,7-12kPa). This contact pressure was not proportional to the subglottal pressure.

Discussion: These results question the role of subglottal pressure as the main factor of phonotrauma in vocal abuse when glottal configuration is constant. The adduction forces between vocal folds may be more relevant but very difficult to measure in patients.

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RESULTS OF SURGICAL TREATMENT OF PATIENTS WITH SULCUS VOCALIS

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Introduction: Sulcus vocalis is considered as the most difficult to diagnose and treatment vocal folds pathologies. Bouchayer and Cornut classified a linear depression along the medial margin of the vocal folds as sulcus vergeture and an invaginated vocal fold epithelium attached to the vocal ligament as true sulcus vocalis. Sulcus leads to glottal dysfunction with glottis gap, a breathy component of the dysphonia, and a stiffness of the vocal folds. Its etiology is poorly understood.
The aim: of the study was to assess of the results of the surgical treatment of patients with sulcus vocalis.
The material: included 24 patients with sulcus vergeture (16 subjects) and true sulcus vocalis (8 subjects). In 10 subjects we diagnosed bilateral sulcus and in 14 one-sided sulcus.
Methods: All studied patients underwent otolaryngological and phoniatric examination included videolaryngostroboscopy (VLS), perceptual (GRBAS) and acoustic analysis of voice (MDVP). Evaluation was done before surgical treatment and 6 months in the follow up.
Nine patients were treated surgically with augmentation of hyaluronic acid; 13 subjects underwent sulcus resection using CO2 laser with hyaluronic acid injection; in 2 patients we performed only surgical resection of sulcus. Postoperatively, the patients had underwent speech therapy sessions that continued out for 2-3 months after injection to release hyperfunctional compensatory mechanisms devoleped after the onset of the disease.
Results: The preoperative videolaryngostroboscopic examination of all patients during voice tasks confirmed existence of glottal gap. After treatment, in all the cases the phonatory gap was partially or totally closed. Mucosal wave was postoperatively better but still reduced. As a result of treatment patients presented an increase in voice loudness and a slight fall in pitch, a voice range widen. The results were dependent on location of sulcus. Better voice improvement was observed in unilateral sulcus because of the smaller glottal gap presented preoperatively.
Postoperative voice therapy resulted in further improvement of voice and appearance of mucosal wave in the stroboscopic examination.
Conclusions:

1. Surgical treatment of sulcus vocalis should be considered in patients with severe voice problems
2. Combination of surgery and postoperative voice therapy gives the best voice results
3. The type of surgical method is individualized in each patient
4.

Key words: sulcus vocalis, sulcus vergeture, augmentation,CO2 laser, voice therapy

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COGNITIVE LOAD OF VOICE THERAPY CARRY-OVER EXERCISES

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BACKGROUND: Cognitive load is the effort required by a person's cognitive system during the performance of a task. This load seems relevant to the order in which a speech language therapist selects carry-over exercises, to have a new speech behavior successively automatized in a patient's spontaneous everyday speech. Automatic speech, such as reciting the days of the week can be assumed have a low degree of cognitive load, and thus to increase the potential of realizing the 'each time–every time principle', meaning that a new behavior is fired consistently, each and every time a stimulus is presented. This is an important factor, in order to have a new behavior become stable and automatized [1, 2]. Semi- spontaneous speech on the other hand, such as to narrate or describe something, requires more focus on the content and may therefore have a greater amount of cognitive load.
AIM: The present investigation aimed to test the hypothesis that three carry-over exercises differ from each other with regard to their level of cognitive load, as measured by performance of a secondary task and by post-task subjective ratings of participants. In addition, the vocal output of the exercises was acoustically analyzed.
METHOD: Subjects were 12 healthy female university students, age range 19-39. The three speech tasks were (A) Automatic speech; repletion of the weekdays over and over again, (B) Sentence construction in a set form with a single element of free choice; e.g., 'Monday I will ride my bike, Tuesday I will meet a friend etc.' and (C) Semi-spontaneous speech; a detailed description of the preparation of a pasta sauce. Cognitive load of the speech tasks were measured by means of accuracy and reaction times of a visual discrimination task, performed simultaneous to speaking. Thereby different speech tasks could be compared as to their level of cognitive load using the same secondary task [3, 4]. For each speech task condition 30 visual discrimination items were presented, making a total of 1080 responses (30 presentations X 3 tasks X 12 subjects). Subjective ratings of cognitive load were made in a questionnaire after each of the speech tasks. Here, the subjects rated 8 items reflecting their mental state during the performance on a 5-point equal appearing interval scale. These data were submitted to Principal Component Analysis (PCA). The results of the PCA were used in a mixed logit model of the response time data from the visual discrimination task. Audio recordings of the speech tasks were analyzed with regard to three acoustic parameters using the Praat software [5]: mean fundamental frequency (F0) in Hz, reflecting average speaking pitch; central 50% speaking range in Hz, reflecting the variation of speaking pitch; and mean H1-H2 in dB, i.e. the average level difference between the first and second harmonics of the voiced segments, reflecting glottal compression.
RESULTS: Response times of the secondary task showed a significant effect of speech task with the lowest response times for automatic speech (A), somewhat higher for semi-spontaneous speech (C) and the highest values for sentence construction in a set form (B). The self-ratings mirrored these results, showing the lowest group mean for task (A), somewhat higher in task (C) and highest in task (B). The regression modeling showed interesting associative links between the questionnaire responses and response time data, that seem meaningful in order to predict cognitive load from subjective ratings.The acoustic analysis showed no difference in mean F0 between the three speech tasks. However, both central 50% speaking range and mean H1-H2 showed a significant main effect of task. These findings show, aside from the main effects on cognitive load measurements, that the three carry-over exercises induced prosodic and behavioral speech differences.
DISCUSSION: These empirical data document a hierarchical structure among three speech activities used in behavioral voice therapy, with regard to their level of cognitive load. Clinical-pedagogical implications of the results are discussed with regard to behavioral learning and long-term effects of voice therapy. Finally, the finding of a difference between tasks in central 50% speaking range and mean H1-H2 of the vocal output, reflecting a difference in speaking intonation and glottal compression will be discussed.
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RELATIONSHIP BETWEEN QUALITY OF LIFE INSTRUMENTS AND PHONATORY FUNCTION IN TRACHEOESOPHAGEAL SPEECH WITH VOICE PROSTHESIS IN MALES

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INTRODUCTION: Total laryngectomy is the removal of the entire larynx and separation of the airway from the mouth, nose, and esophagus. Recently, use of tracheoesophageal speech with voice prosthesis (T-E speech) has become more common as a phonation method to regain voice. The two primary QOL instruments used are the Voice Handicap Index-10 (VHI-10) and Voice-Related Quality of Life (V-RQOL). Although the VHI-10 and V-RQOL are highly correlated, these questionnaires are related to voice and do not assess comprehensive health-related QOL. For this purpose, the MOS 8-Item Short-Form Health Survey (SF-8) has been frequently used. However, the impact of phonatory function on the QOL of persons using T-E speech has not been studied. This study aimed to clarify the relationship between comprehensive health-related QOL and phonatory function in persons using T-E speech.

METHODS: Subjects of this study were males using tracheoesophageal speech with voice prostheses after total laryngectomy due to laryngeal cancer or hypopharyngeal cancer. Patients who visited the outpatient clinic of the Department of Head and Neck Surgery of the Tottori University Hospital were enrolled. Females and subjects who could not use phonation were excluded. At a visit to our clinic, the subjects completed three questionnaires, the SF-8, VHI-10, and V-RQOL, and underwent a phonatory function test using the Model PS-77E device (Nagashima Medical Instruments, Japan). Subjects were asked to produce the /a/ vowel sound for several seconds at whatever voice pitch and intensity were most comfortable. Both pitch and intensity, as well as exhalation flow rate, were measured during sound production.Correlation coefficients were calculated to examine the relationships of the SF-8 with the VHI-10 and V-RQOL, and between the phonatory function test results and the SF-8 with the VHI-10 and V-RQOL. Pearson's correlation coefficient was calculated for normally distributed data, and Spearman's correlation coefficient was calculated for non-normally distributed data. A significance level of $p=0.05$ was used for all tests. SPSS Statistics Ver. 19 (IBM Japan, Japan) was used for all statistical analyses.

RESULTS: A significant correlation was observed between the Physical Component Summary (PCS) of the SF-8 and the physical domain of the VHI-10. In addition, significant correlations were observed between the Mental Component Summary (MCS) of the SF-8 and all domains of the VHI-10 and V-RQOL, and correlation coefficients were 0.500 or higher in all domains.Strong correlations were observed between voice intensity in the phonatory function test and all domains of the SF-8, VHI-10, and V-RQOL. A significant correlation was also observed between the SF-8 and the PCS, but not with the MCS. In the VHI-10, significant correlations with total, functional, and physical domains were observed. In the V-RQOL, a significant correlation with the physical functioning domain was observed.

DISCUSSION: A significant correlation was observed between the SF-8 MCS and all domains of the VHI-10 and V-RQOL. Furthermore, there were significant correlations between voice intensity and the physical functioning domain of V-RQOL as well as with the total, functional, and physical domains of the VHI-10. In contrast, voice intensity did not directly correlate with the SF-8 MCS. However, it is considered that the V-RQOL score is improved by improvement of the intensity of voice, and this results in improvement of the SF-8 MCS. In addition, there was a significant correlation between voice intensity and the SF-8 PCS. Therefore, it is suggested that improvement of the intensity of voice results in improvement of SF-8 MCS. This study showed that voice intensity had an effect on comprehensive QOL, including physical and psychological functioning, in persons using shunt speech after total laryngectomy.

EFFICACY OF THE PROPRIOCEPTIVE-ELASTIC (PROEL) METHOD IN VOICE THERAPY

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The Proprioceptive-Elastic Method (PROEL) is a method for voice therapy that has been developed in our Centers over the last 15 years. The work is formalized in 5 phases: 1.Control of risk factors, especially inflammatory factors and problems of hydration and lubrication; 2.Shock stimuli on the vocal tract (especially proprioception using dumbbell weights, ice , vibrators, TENS ...); 3.Distension of muscular rigidity seeking elasticity using unstable equilibrium, generation of energy through motion; overhead body suspension using elastic trapeze ropes that eliminate weight; 4.Projection and resonance with counter-resistance systems, for instance, speaking inside a mask immediately opens cavities of the vocal tract; 5.Sensation of comfort. An experimental learning method is used where the dysphonic patient compares his/her voice before and after performing a proposed task. This task creates an immediate change in the voice that the patient experiences and assimilates. This method has been applied on more than 2000 patients showing different pathologies, with good results. The mean duration of therapy was 12 sessions.

The PROEL method breaks the mold of many concepts of classical vocal therapy. Patient acceptance is optimum, as they not only achieve control over their problem but also experience a fun and emotional sensation. The patient with dysphonia feels they have learned, acquired and assimilated a different way to talk and one with which they feel comfortable.

From January 1st to December 31th, 2013 52 patients with dysfunctional dysphonia have been studied, treated with the PROEL method. Assessment of dysphonia on these patients before and after 15 sessions of voice therapy was done with the basic protocol of clinical-instrumental investigations suggested by the European Laryngological Society which provides for perceptual evaluation of dysphonia with the GIRBAS scale, Patient's self assessment of dysphonia with the Voice Handicap Index-10, Laryngostroboscopy, Maximum Phonation Time,.

Variables before and after voice therapy have been compared through Wilcoxon test or Fisher exact test as appropriate. MPT improved from 14.2±2.7 sec to 18.3±4.6 ($p = 0.0001$); perceptual assessment improved from 1.7±0.7, 0.2±0.5, 1.0±0.7, 1.3±0.7, 0.6±0.7, 1.0±0.8 respectively for G,I,R,B,A,S to 0.3±0.5, 0.0±0.0, 0.1±0.3, 0.3±0.5, 0.0±0.2, 0.1± 0.3 ($p = 0.001$ for all parameters).
VHI scores improved from to 10.4±4.7 to 4.2± 2.4($p = 0.0001$). On stroboscopy an irregular vibration was found in 13 patients before voice therapy and in 5 patients after words ($p = 0.001$); although glottal closure and mucosal wave improved in 5 and 6 pts rispectively the difference was not statistically significant.

The analysis of the data obtained from the results of this study showed a statistically significant improvement of VHI-10, MPT, GIRBAS scale and laryngostroboscopic Periodicity after voice therapy with the PROEL method, suggesting its efficacy in the treatment of dysfunctional dysphonia.

ONE-YEAR FOLLOW-UP OF DYSPHONIC PATIENTS' REPORTS OF DYSPHONIC SYMPTOMS AND LIFE QUALITY ALONG VOICE THERAPY USING "LAX VOX TUBE" INSERTED IN WATER

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A short-term voice therapy approach was developed for the clinical practise in Department of Phoniatrics in Tampere University Hospital. It included 3-5 therapy sessions. This paper is a part of the "one-year follow-up project of the outcome of a short-term intervention in voluntary dysphonic patients". They went through the study procedure using a silicon tube (35 cm long, nine mm in diameter). 35 of them had completed all questionnaires along the procedure.
The short-term therapy method includes ergonomic information incorporated in training of self-care of voice with the simple tool, named LAX VOX tube. The main exercise was to keep the flexible silicon tube in water while phonating through it. The procedure gives multiple biofeedback of balanced voice production to the user. The patient's opinions were followed by questionnaires on dysphonic symptoms, and on life quality estimated by the Voice Activity and Performance Profiles (VAPP), on visual analogue- scale. The questionnaires were filled up five times: before and immediately after the short-term therapy. The measurements were repeated three, six and twelve months later.
Results: The common symptoms: voice fatigue, voice losses, hoarseness, the need for throat clearing and laryngeal sensations were alleviated statistically significantly. In line with that the life quality expressed by the VAPP results shows statistically significant improvement. (Non-parametric paired samples tests were used.) The good experiences motivated the professional speakers to daily voice care.

DIFFERENTIAL ELECTROMYOGRAPHIC ACTIVITIES OF THE THYROARYTENOID MUSCLE DURING HUMMING/UM-HUM ASSOCIATED WITH EXPERIENCE OF VOCAL TRAINING

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INTRODUCTION: Humming and um-hum i.e. humming with pitch raising as if agreeing with someone are vocal training techniques used in voice therapy against diseases as well as music training. We have already investigated immediate effects of humming/um-hum on the vocal and physiological conditions in patients with muscle tension dysphonia (MTD) and non-dysphonic speakers, and demonstrated that in even nondysphonic speakers, these vocal training techniques immediately improve the values of the electroglottographic perturbation parameters. This result suggest that humming/um-hum have an effect to augment the regularity of vocal fold vibrations, and hypothesize that these vocal training techniques directly change the physical property of the vocal fold. In the present study, to determine whether humming/um-hum directly affect the physical property of the vocal fold, we compared the electromyographic (EMG) activities of the thyroarytenoid muscle during natural, humming and um-hum phonation in nonsysphonic speakers. In addition, these changes may be affected by a long-term learning effect due to experience of music training (EMT) in individuals. Accordingly, we compared the EMG changes between participants with and without EMT.

METHODS: Two participants having EMT more than 5 years and 3 participants without any EMT were enrolled. Each participant was inserted a 30 gauge concentric needle electrode via the cricothyroid membrane from the cervical skin, and, while the EMG signals were recorded, asked to perform three phonatory tasks for over 3 seconds: 1) natural phonation /e:/, 2) humming phonation /m:/, and 3) um-hum phonation, i.e. extended phonation after humming with excursion as if agreeing someone sincerely. The EMG signals were presented in acoustic analysis software, Praat, and the spike numbers per 2 seconds, spike amplitudes and intervals up to the next spike were measured by two examiners. These values were presented in scatter plots. In addition, the mean and the standard deviation per mean were calculated, and subsequently the changes in these values were investigated.

RESULTS: In scatter plots for the spike amplitude and the interval up to the next spike, the participants with EMT showed humming increased spike amplitudes and inter-spike intervals during humming phonation. In contrast, the participants without EMT exhibited no remarkable change for either amplitudes or intervals during humming phonation, and increased amplitudes during um-hum phonation. In addition, concerning the changes during performing the three tasks, the participants with EMT exhibited the highest values for the amplitude ratio and inter-spike interval during humming phonation. However, the untrained participants did not show substantial changes during humming phonation.

CONCLUSION: The present study showed that the participants with EMT showed increased spike amplitudes and inter-spike intervals during humming, suggesting that humming could change the mechanical property of the vocal fold by changing the EMG activity of the thyroarytenoid muscle, particularly, in speakers with EMT. In contrast, the present study showed that the nondysphonic participants without EMT showed such EMG changes, although our previous study demonstrates that humming and um-hum immediately decrease the values of the EGG perturbation parameters in the nondysphonic participants without EMT. These results suggest a long-time learning effect is required when humming can change the thyroarytenoid muscle activity, leading to changing the mechanical property of the vocal fold, and hypothesize that in nondysphonic participants without EMT, humming decreased the irregularity of the vocal fold vibration by other mechanisms than changing the thyroarytenoid muscle activity, for example, source-filter interaction brought by closing the mouth.

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ACOUSTICAL ANALYSIS OF VOCALIZATIONS DURING THERAPY IN 2-5 YEARS OLD AUTISTIC CHILDREN

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Introduction: Technology plays an increasingly significant role for diagnosis and rehabilitation to support the observation of behaviour in subjects suffering from Autism Spectrum Disorder (ASD). However, existing systems do not include the acoustical analysis of vocalic emissions and speech during therapy. An automatic method for the estimation of acoustical parameters of vocalizations and verbalizations could provide a valuable support to both the diagnostic methods and the perceptual subjective therapeutic approach currently in use for the analysis of communication and interpersonal skills in preschool and school age children. Tracking of these parameters could also allow the objective assessment of the effectiveness of therapy. This paper presents first results regarding the acoustical analysis of vocalizations of a child during the *Thérapie d'Échange et de Développement* (TED) held at Child Neuropsychiatry Unit, ASL11, Empoli, Italy.
Methods: Vocalizations were manually selected from the audio tracks of two children during TED therapy, one with ASD and the second with ASD and mental delay (ASD-MD). Video recordings of the ASD child were performed at 28, 40, 41, 46 and 56 months of age, those of the ASD-MD child were performed at 28, 59, 82, 85, 86, 87 months of life. Six different categories were considered: vocalizations, verbalizations, animal sounds, emitted spontaneously or by imitation, laughs, cries and screams. Each recording was analysed with BioVoice, a software tool capable to automatically detect voiced/unvoiced frames and compute the following features: vocalic percentage; vocalization, scream, cry and laugh occurrences (to check whether the therapy has led to an improvement of communication skills); fundamental frequency F_0; the first 3 formant frequencies F_1, F_2 and F_3; jitter (F_0 irregularity) and melody (F_0 shape over time).
Results: ASD diagnosis was assessed at 26 months of age through the ADOS test for the ASD child (score:18) and at 21 months of age for the ASD-MD infant (score:19). Preliminary results show that the number of vocalizations/sounds per minute gradually increases along the years, starting from 0.3/min at 28 months up to 2.5/min at 56 months. In addition, the vocalic percentage increases. According to the child's growth, a decrease of F_0 mean was observed during the whole period. The automatic method allows to distinguish F_0 of vocalizations and laughs (230-600 Hz), from that of screams (600-1200 Hz) and cry (450-760 Hz). The delay in the child response to the therapist stimuli was manually measured as the temporal distance between the end of the stimuli and the beginning of the child vocalization. This measure was performed only for verbalizations, vocalizations, laughs and animals sounds. Results show a decrease of the delay from 1.46s at 28 months to less than 0.52s at 56 months of age.
Preliminary results for ASD-MD child show a fluctuating trend over the years for the number of vocalizations/sounds per minute, starting from 0.67/min at 28 months up to 1,77/min at 4 years and up to 1,05/min at 5 years. The vocalic percentage does not increase but is variable. According to the child's growth, a variable trend of F_0 mean in vocalizations and pre-verbalizations was observed during the whole TED period. No animal sounds imitation were included in the recordings. The automatic method allows to distinguish F_0 in vocalizations and laughs (320-480 Hz), from that in screams (420-850 Hz) and cry (440-600 Hz).
Concerning the delay of the child response to the therapist stimuli results show a variability of the delay from 0.68s at 28 months to 0.58s at 4 years and to 0.92s at 5 years of age.
Discussion and Conclusions: These preliminary results confirm in a quantitative and objective way the positive therapeutic results: speech activities gradually increase from a limited number of vocalizations to several syllables and words starting from 48 months of age in ASD. This kind of analysis could be useful to assess differences between ASD and ASD-MD children. Further developments will concern a larger number of case studies, the comparison of patients with a healthy control group and the definition of reference frequency ranges for the different sound categories.

NEWBORN CRY ANALYSIS: THE MELODY SHAPE

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Introduction: The acoustical analysis of infant crying is a promising non-intrusive and cheap aid to the early diagnosis of neurological disorders in the newborn. Recently cry melody, the trend of the fundamental frequency f0 over time, was shown to give additional relevant information.
The aim of this work is to set up an automatic system that estimates the f0 values in each cry unit (CU) and objectively classify the melody of newborn infant cry according to some basic shapes.
Four main f0 shapes exist: rising, falling, symmetric and plateau, whose prevalence or absence may be related to neurological diseases (cerebral palsy, preterm babies, high risk of autism, etc). In the rising pattern, a frequency peak appears near the end of the CU, the falling pattern is characterised by a frequency peak at the beginning of the CU; the symmetrical pattern is represent by a frequency rising and falling around a central peak; the plateau consists of an almost flat shape (f0 variation < 100 Hz around its mean value).
Through a user-friendly interface we propose a fast automatic software tool for melody assessment. It also supports thee qualitative visual analysis of f0 shape that today is rarely performed by clinicians both because there is no reference standard and as it requires some time often incompatible with the pace of work of medical specialists.
Methods: After filtering out outliers, f0 is estimated in each CU with the BioVoice software tool in a specific frequency range [150-900] Hz. In addition to the four basic shapes the software is able to automatically detect six more shapes, as reported in literature, for a total of 10 different shapes. First, the algorithm finds out the so-called "short" CUs (i.e. those lasting < 400ms) and "not a cry" CUs (CU < 260 ms of duration, or made by scattered points only). After a smoothing step based on an empirical threshold applied to the standard deviation of f0, the plateau shape is detected as well as other shapes: frequency step, period doubling, two-components (up-low/low-up) and complex. Finally, a polynomial fitting (order 2 to 4) is applied to the f0 values of CUs not belonging to the shapes above. The polynomial corresponding to the best fitting (according to RMSE) is selected for that CU and its skewness is computed to determine the rising, falling or symmetric shape.
Results: The method is tested on a set of feeding cry recordings coming from 28 healthy newborns. Several cry sequences (multiple cry units - CU) of 2 or 3 minutes were manually selected. For these subjects a prevalence of falling and rising melodies is found, while the symmetric and plateau shapes are almost entirely absent.
First results of the comparison between perceptual and automatic analysis are encouraging, with 90% of match.
Discussion and Conclusions: Work is ongoing on a larger set of both healthy and preterm subjects to test the robustness of the method and detect possible differences between the two groups. When validated, this contact-less, cheap and non-invasive method might support clinical investigation in neonatal intensive care units.

PARENTS EVALUATING THEIR CHILDREN'S VOICE: DIFFERENCES BETWEEN MOTHERS AND FATHERS

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Background: Dysphonia among children is reported to occur in 6-24% of children, and it is reported to significantly affect their quality-of-life. However, the importance of inclusion of standardized subjective self-evaluation in the diagnosis of pediatric dysphonia has only recently been acknowledged. The Pediatric Voice Handicap Index (pVHI) is an accepted tool for quantifying the impact of dysphonia in the pediatric population, and it was translated to many languages. This study was aimed to translate and adapt the pVHI to Hebrew, while assessing its reliability and a validity. It was also aimed to evaluate possible differences between mothers and fathers in their evaluation of their children's dysphonia, as all previous studies in the field combined responses from both mothers and fathers.
Methods: The original pVHI was translated to Hebrew by three native speakers of Hebrew, highly proficient in English. It was, then, translated back by three native speakers of English, who are also highly proficient in Hebrew. A final version of the questionnaire was compiled from the items that translated most accurately using this process. The final version was evaluated by two English-Hebrew bilingual judges, to confirm its clarity and coherence. A total of 141 parents of children under the age of 14 participated in the study. Eighty-three parents (49 mothers and 34 fathers) reported having a child with no voice problem, while 58 parents (32 mothers and 26 fathers) reported having a dysphonic child. Each parent completed the Hebrew pVHI, as well as a short anamnesis questionnaire. Reliability was evaluated using internal consistency. Cronbach's Alpha coefficients values varied between $0.965<\alpha<0.970$. Test-retest evaluation was conducted using forty-four participants who completed the questionnaire twice within ten days. Results confirmed no statistically significant differences between the repeated completions of the questionnaire ($p>0.05$). Pearson correlation coefficients between the two completions of the questionnaire also yielded high values ($0.837<r<0.866$, $p<0.001$). Validity was evaluated by means of correlation between the pVHI's total score and a general score of parents' concern on a 7-point analog scale. Correlation was $r=0.869$ ($p<0.001$).
Results: A significant main effect for Group was found for the Functional, Physical and Emotional subscales, as well as for the Total score [($F_{1,137}=99.43$, $p<0.001$), ($F_{1,137}=258.32$, $p<0.001$), ($F_{1,137}=128.01$, $p<0.001$) and ($F_{1,137}=364.41$, $p<0.001$), respectively]. A significant main effect for Parent's gender was only found for the emotional subscale ($F_{1,137}=8.28$, $p=0.005$), as mothers rated their children higher on this subscale than fathers (4.01 versus 2.80). In contrast, all other subscales did not reveal significant parent's gender differences ($p>0.05$). A significant Group X Parent's gender interaction was found for the emotional subscale ($F_{1,137}=10.90.001$, $p=0.001$) and for the total pVHI score ($F_{1,137}=4.51$, $p=0.036$).

In addition, responses from both parents of 46 children (20 dysphonic and 26 non-dysphonic) were compared separately. A significant main effect for Parent's gender was found for all subscales [functional ($F_{1,44}=5.12$, $p=0.029$); physical ($F_{1,44}=14.30$, $p<0.001$); emotional ($F_{1,44}=14.78$, $p<0.001$); and total score ($F_{1,44}=17.14$, $p<0.001$)]. In addition, a significant Group X Parent's gender interaction was found for all subscales [functional ($F_{1,44}=4.73$, $p=0.035$); physical ($F_{1,44}=15.40$, $p<0.001$); emotional ($F_{1,44}=18.22$, $p<0.001$); and total score ($F_{1,44}=21.36$, $p<0.001$)]. Post-hoc comparison confirmed that mothers of the dysphonic group rated their children significantly higher than the fathers on all subscales [functional ($t_{(19)}=2.12$, $p=0.047$); physical ($t_{(19)}=3.71$, $p=0.001$); emotional ($t_{(19)}=3.64$, $p=0.002$); and total score ($t_{(19)}=4.20$, $p<0.001$)]. In contrast, within the non-dysphonic group, both parents rated their children similarly [functional ($t_{(25)}=0.12$, $p=0.90$); physical ($t_{(25)}=0.19$, $p=0.85$); emotional ($t_{(25)}=1.07$, $p=0.30$); total score ($t_{(25)}=0.67$, $p=0.51$)].
Discussion: The Hebrew version of the pVHI is a valid and reliable instrument. Moreover, this study is the first to demonstrate that mothers and fathers of dysphonic children evaluate their child's dysphonia differently, and that this has to be taken into consideration when interpreting their responses on the pVHI.

FACTORS ASSOCIATED WITH VOCAL IMPAIRMENT AND VOICE PROBLEMS IN PRESCHOOL-AGED CHILDREN

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INTRODUCTION

Research has shown that voice problems in children negatively affect their health, social and educational participation and later vocational success. Although there are hypotheses as to the contributing factors for development of vocal impairment in young children, there is little substantive evidence of relationships between these factors and vocal difficulties in children.

METHODS

This study investigated a community sample (n=1623) of four-year-old children. Parents reported on the frequency with which their child experienced a range of vocal symptoms, as well as reporting on the presence of a voice problem. A stratified subsample (n=150) was further evaluated by expert auditory perceptual judgment of the children's vocal pitch and quality characteristics. Parents also responded to a range of questionnaire items regarding demographic, environmental, child and family factors, which were examined to identify the factors associated with the children's development of vocal impairment and voice problems. The relationship between the children's voice use patterns and these child, family and environmental factors was also investigated. Additionally, the relationship between vocal impairment, voice problems and speech and language difficulties was evaluated.

RESULTS

This study provides the first empirical evidence of the relationship between vocal impairment, voice problems and phonotraumatic behaviours of children and some of the variables previously speculated to be associated with vocal impairment. Vocal impairment was associated with child factors such as phonotrauma, temperament, behaviour and emotional stability and family factors such as maternal mental health and family dynamics. Children's use of phonotraumatic behaviour was related to their temperament, behaviour, and emotional factors, family dynamics and maternal mental health. Further, vocal impairment was associated with children's speech difficulties.

DISCUSSION

Prevention and management of voice problems in children are reliant on reliable and valid data. The findings reported in this research contribute to this evidence base. This study has advanced our understanding of the environmental, family and child factors, as well as speech and language co-morbidities, that are associated with vocal impairment and voice problems in young, preschool-aged children. Some of these factors have not been the primary focus of previous research. Identification of these factors has provided valuable and much-needed evidence on which to base further investigations and, potentially, to guide clinical practice.

AERODYNAMIC MEASURES: ACCURACY IN CHILDHOOD DYSPHONIA

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Introduction: The importance of measurement instruments that reflect the magnitude of voice problems and the efficacy of Speech Therapy is enhanced. The number of children with dysphonia has been increasing as well as the professional interest on it. Aerodynamic measures are easily collected and, according to some authors, clinically reliable. This paper aims to identify which aerodynamic measures are meaningful to assess speech therapy efficacy in children with dysphonia, as well as compare with normative data.

Methods: The studied sample is composed by 41 pediatric patients (until 14 years) with bilateral vocal fold nodules. A retrospective analyses of patient charts was done and the maximum phonation time (MPT) of /s/, /z/ and /a/ was collected. The pre and post therapy results were measured using a standardized assessment protocol, which includes laryngeal, acoustic, audio perceptual and aerodynamic measures of voice production. The statistical analysis was made with SPSS 21.0.0.

The following research questions were formulated: (a) are the pre and post aerodynamic measures statistically different?, (b) is the MPT normalized in the end of therapy?, (c) which aerodynamic measures should be present in a childhood voice assessment protocol?

Results: The pre and post therapy aerodynamic measures were all statistically equal, excepting for the MPT of /a/.

The s/z ratio was also the same in these two moments. The disagreement of the measures relating them to the child chronological age showed a statistically significant result, revealing that at the end of the therapy the MPT was different of children age.

Discussion: The MPT of /s/ and /z/ as well as s/z ratio prove not to be sensitive to measure the efficacy of speech therapy in childhood dysphonia. The obtained data do not support the presumption that MPT must be the same of the chronological age in normal paediatric voices. Only the MPT of the vowel /a/ revealed statistically significant differences with the speech therapy intervention. Other aerodynamic parameters should be included in the assessment protocols used with this population.

DOES A DYSPHONIC VOICE IN BACKGROUND NOISE AFFECT CHILDREN'S PERFORMANCE AND ATTITUDES?

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Back-ground noise and adverse room acoustics have been shown to affect listener's memory and recall of information. Children's comprehension and learning is severely challenged by adverse listening conditions that can be assigned to a range of external and internal factors. The child's perception of the speaker's voice quality and the possible consequences for comprehension and learning has however, rarely been researched. The teaching profession is acknowledged as an occupation with high vocal demands that may be manifested as dysphonia. Only a couple of studies have so far investigated the impact of teacher's voice quality on children's listening comprehension. They have concluded that dysphonic voice hamper children's comprehension and also risk being judged more negatively. We hypothesized that the content communicated by a dysphonic voice may cause the child to allocate cognitive capacity to the processing of the voice-signal at the cost of comprehension; and that a dysphonic teacher-voice in combination with background noise will affect the child's performance more severely. Further, the children's working memory capacity and executive functioning will be important for their performance. *Methods*: In two studies, data from 95 + 86 8-year old children in mainstream school classes were collected. The children were tested for cognitive capacities (working memory capacity and executive functioning) and language comprehension. Two equal groups were constructed and digitally presented with the Test for Reception of Grammar (TROG-2, Swedish version) through recordings of the same female speaker in different voice qualities, Group A with a typical voice, and Group B with a dysphonic voice. For the first study, the voices were recorded in silence and for the second in ambient babble-noise. The TROG-2 and the voices were presented to the children individually via laptop. Response times were registered as the time that elapsed from the end of the question till the child clicked the computer mouse. The children rated the effort of listening to the teacher and the concurring noise and also their attitudes to the different voices qualities. An expert panel assessed the voices and the differences between the dysphonic and the typical voice were significant. The voices recorded in babble-noise were considered aligning with expected voice characteristics when speaking in noise. *Results:* We found no overall effect of voice quality on the TROG-2 total results, but the children listening to the *dysphonic* voice achieved significantly lower TROG-2 scores for sentences in the more complex blocks of the test ("the man but not the horse jumps"). These children also made significantly more self-corrections than those listening to the *typical* voice, but only on less complex sentences ("the girl is sitting") Further, the measure of executive functioning was significantly correlated to the TROG-2 results. Similarly there were no overall difference between the groups as to the TROG-2 results when the sentences were read in concurrent babble-noise. However, significant differences between voice conditions were found for the interaction between cognitive capacities and linguistic complexity of the task. In the *dysphonic* voice condition, cognitively stronger children scored significantly higher at the easier blocks whereas, in the *typical* voice condition the cognitively stronger children scored higher on the more difficult blocks. The response-times increased with task difficulty in both conditions. Girls in the *dysphonic* condition used significantly longer response times for the more difficult items, compared to the rest of the children in both conditions, in silence and in babble-noise. The subjective assessments of perceived listening effort revealed that children in the dysphonic condition assessed the *dysphonic* voice significantly worse than the *typical* voice. They also expressed themselves more negative towards the *dysphonic* voice than to the *typical* voice. *Conclusion*: Our results indicate effects on listening comprehension for children in class-rooms with a dysphonic teacher and also when dysphonic teachers tries to make themselves heard in noise. The decreased accuracy in more complex tasks was interpreted as indicating that the dysphonic speaker's voice force children to allocate capacity to the processing of the voice signal at the expense of comprehension, particularly when linguistic difficulty is just within the child's grasp. The child's possibility to grapple the message spoken by a dysphonic voice is thus, also dependent on the child's cognitive capacities. This taps into theories of cognitive load. The increased response times specifically in the girls in the dysphonic group also indicates that the effect of the dysphonic voice is most obvious in relation to task complexity.

FP-Singing 3 (Room1)

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THE EFFECT OF DIFFERENT LOUDNESS CONDITIONS ON VOCAL TRACT CONFIGURATIONS IN PROFESSIONAL SINGERS

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Introduction: Dynamic real time magnetic resonance imaging (MRI) has reached a growing interest in order to study vocal tract shapes in singers (Echternach *et al.*, 2012). Especially, vocal register conditions were associated with differences in vocal tract configurations. However, it seems possible that the observed differences could be also associated with other factors, such as singer`s Fach and loudness. With regard to Fach it was found that articulation shows greater modifications for dramatical voices in comparison to lyrical ones (Echternach *et al.*, 2014). The aim of this study was to examine this effect of different loudness levels in professional singers.
Methods*:* The vocal tract profiles of 14 professional classically trained singers of different categories were analyzed using dynamic real-time MRI with 25fps. The singers were asked to sing ascending scales with respect to their category in different loudness conditions (soft, middle, loud) on the vowel /a/. Sound during the experiment was recorded in the MRI using a dual optical microphone system (CONFON HP-SI 01, MR confon GmbH, Magdeburg, Germany), simultaneously. MRI noise cancellation was performed using the software Digital Audio Presentation Center (CONFON DAP-center mkII+, MR confon GmbH, Magdeburg, Germany) and Adobe Audition (Adobe, San Jose, USA). From the MRI data different articulatory measures were extracted, as described before (Echternach et al., 2014): The lip opening, the jaw opening, the jaw protrusion, the pharynx width, the tongue height, the uvula height, the larynx height, and the laryngeal angle.
Results*:* Results show that there are differences in vocal tract shape with respect to the loudness condition. In this respect, especially the pharynx width and lip opening was increased for the louder conditions. Furthermore, the difference of values for the three loudness conditions (soft, middle, and loud, respectively) were found much greater for higher fundamental frequencies.
Discussion*:* These data suggest that vocal tract differences should be interpreted with respect to loudness.

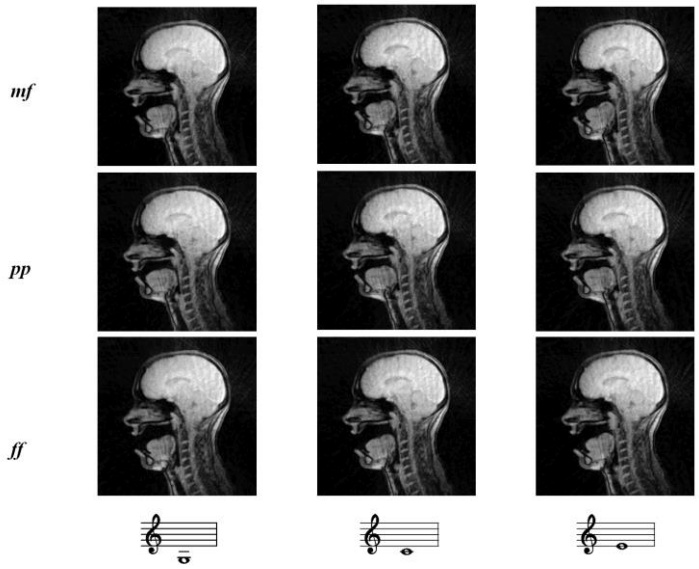

Figure: Vocal tract profiles for the pitches G3, C4 and E4 and the three loudness conditions (mf, pp, ff) for a mezzo soprano subject.

A PRELIMINARY STUDY ON DIAPHRAGM MOTIONS AND VOCAL TRACT CONFIGURATIONS DURING SINGING: ANALYSES OF REAL-TIME MRI AND ACOUSTIC DATA

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The diaphragm, one of the major respiratory motor organ, is considered to play an important role in professional singing[1]. Our previous study[2] using real-time scans with magnetic resonance imaging (MRI) showed consistently lower positioning of the diaphragm during low-high-low octave excursions for a professional singer, which suggests a controlled, gradual rise of the diaphragm during each task when compared with a student. The lower positioning of the diaphragm is assumed to pull down the trachea, which may contribute to preventing larynx elevation and pressed phonation. In this present study, therefore, the activities of both the diaphragm and the vocal tract during singing were examined by real-time MRI and the recordings of the singing voice were performed to illustrate the effects of diaphragm motions on phonation.

Two sopranos participated in the experiment: a professional singer and an undergraduate student of voice major. The task was the same as the previous study: singing of four sets of low-high-low octaves in succession in different pitch ranges, i.e., A3 (220 Hz) -A4 (440Hz)-A3, C4 (262 Hz)-C5 (523 Hz) -C4, G4 (392 Hz)-G5 (784 Hz) -G4, and Bb4 (466 Hz)-Bb5 (932 Hz) -Bb4 on the vowel /a/ according to up-down ramps of the guide tones delivered from a PC-based triggering device. The participant took a supine position in the MRI gantry and sang the octaves along with the guide tones, while two images of MRI were scanned with audio recording of the singing voice: a parasagittal image at the center of the right thoracic cavity for the diaphragm and a midsagittal image for the vocal tract. For clean audio recording for the analysis, additional sessions using the same task and guide tones were performed in an anechoic room soon after the MRI experiments.

The similar trends as the previous study were observed from diaphragm MRI; the controlled, lower positioning of the diaphragm was found in the professional singer, while less control with higher positioning was shown in the student. Differences in configuration and movement of the apparatus in the vocal tract were also found between the two participants; the professional singer demonstrated consistency in the height of larynx and round shape of the tongue, while the student indicated features including elevated larynx and retracted tongue. A post-hoc acoustic recordings were performed by the same professional singer to mimic the student's vocal tract conditions as a reference. To investigate the causal relationship between configuration of the vocal tract and acoustic features common to both participants, acoustic data are being analyzed. The relationship between the diaphragm motions and the changes in the vocal tract configurations are also being speculated. This work was supported by JSPS KAKENHI Grant Numbers 25370117 and 24500233.

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VOCAL TRACT MORPHOLOGY IN INHALING SINGING: AN MRI BASED STUDY

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Introduction: Inhaling singing is a recently developed singing technique explored by the soprano singer Françoise Vanhecke. It is based on an aspiratory airflow instead of an expiratory airflow. Based on the spectral analysis and on the fact that there is no audible difference between the tones sung by the in- or exhaling technique [1], we hypothesize that the vocal tract remains the major determinant of the resonance features. However, we expect the subglottal region to narrow in inhaling singing, secondary to the inverse airstream. Meanwhile we also question if the morphology of the supraglottal vocal tract would significantly alter.

Methods: A female professional singer and composer (second author) sung 6 prolonged tones starting at F5 and chromatically rising up to Bb5 on the vowel /a/ in a decline position under MRI, both in the exhaling and inhaling manner. All images were performed on a Philips 1.5 T Philips Achieva scanner (Philips Medical Systems, Best, The Netherlands) by using sensitivity-encoding 16 channel head and neck coil. This provided 12 midsaggital images (2X6). Various anatomical structures (distances, angles and areas) were measured.

Statistical analysis

Wilcoxon directional testing was performed on all measurements (Table 1 –not included due to limited length).

Results: A statistically significant difference is found for the area of the complete vocal tract (features 17+18+19 in table 1). The vocal tract is larger in exhaling singing compared to inhaling singing. Focusing on its components we notice that there is no statistically significant difference for the volume of the area of the anterior oral cavity (feature 17 in table 1), nor for the area of the oro-hypopharyngeal region (feature 18 in table 1) or the sum of both. The statistically significance is mainly due to a decrease of the subglottal area in the inhaling singing condition (feature 19 in table 1). There is also a statistically significant change in the tongue configuration (feature 3, 4, 5 in table 1), in the distance between the teeth (feature 1 in table 1), in the length of the floor of mouth (feature 14 in table 1), and in the position of the epiglottis (feature 10 and 11 in table 1).

Discussion: The narrowing of the subglottis is considered to be secondary to suction forces used in the inhaling singing technique. Vanhecke et al. described a similar frequency distribution in the in- and exhaling condition, which concurs with an audible alikeness between in- and exhaling singing tones but they also state that the harmonic structure is less rich[1]. This suggests a similar vibration pattern at the glottal level and the role of the vocal tract as the most important resonator, albeit in a more rigid way. The preserved distance between the posterior tongue and posterior hypopharyngeal wall (feature 7 in table 1), the distance between the tongue dorsum and the palate (feature 8 in table 1) and the angle between the mandibulo-hyoidal line and the tongue thickness- line (feature 9 in table 1) indicate that the two major dimensions of the tongue positioning for the vowel /a/, namely back and low, do not differ in the two singing techniques. However, we observe a statistically significant decrease of the anterior-posterior diameter of the tongue, the tongue thickness and the tongue tip curvature (feature 1, 3, 4, 5 in table 1) in inhaling singing. These findings in contrast with the preserved vocal tract volume and the preserved place of articulation strengthen our presumption that the tongue plays a larger role than merely a resonance modulator. We suspect that the more vertical position of the epiglottis in inhaling singing suggests an adaption of the vocal tract to facilitate the airflow immediately above the glottis. The significant increase in the distance between the chin and prelaryngeal soft tissue, independently from the angle (features 14 and 15 in table 1), suggests that no laryngeal elevation takes place. Elongation of the submental muscles indicates a tension raise and hence a strengthening of the floor of the mouth which no doubt assists in the tongue positioning and morphology.

The vibratory pattern of the vocal folds is currently under research.

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The full article of this manuscript is in print (Journal of Voice, 2015)

DOES LOWER VOCAL TRACT MORPHOLOGY IN SINGING DEPEND ON VOWELS? YES, IT DOES!

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INTRODUCTION: The formation of vowels is a result of articulatory changes of the vocal tract (VT). The main focus in this respect was set on the articulators of the oral cavity and the base of the tongue, where systematic vowel-dependent changes could be shown. Lower vocal tract morphology was reported not to react upon those morphologic adjustments during vowel formation [1]. With material from an extensive MRI-study we wanted to shed light on the relation of vowel formation and lower vocal tract morphologic behaviour.
METHOD: Thirteen male subjects (aged between 20 and 22 years), who were all studying classical singing at the Dresden University of Music were asked to produce sustained vowels in a 3T MRI machine (Magnetom Trio Tim, Siemens Medical Solutions, Erlangen, Germany). Sustained vowels /a/, /e/, /i/, /o/ and /u/ were performed on pitch A3 (220 Hz) at a medium loudness with a projected voice like in classical singing. The acquisition time of the applied MRI-sequence was 9 seconds. After the MRI-measurements an audio recording was made with the same instructions.
The image data were segmented with a centerline-based approach. A centerline of the vocal tract from the uvula to the upper anterior arytenoid rim was inserted in a mid-sagittal image for segmentation of the lower VT. The image stack transformed to a set of images whose planes were orthogonal to the tangent of the centerline. With help of a semi-automatic algorithm the resulting images were segmented along the air-tissue-border. The assembled two-dimensional segmentations allowed for used to determine measures of the lower VT within the centerline-based coordinative system. A reference plane, representing the exit of the epilarynx, was identified as the first segment just below the uppermost complete posterior closure of the arytenoid cartilages. An endolaryngeal cross-sectional area (ELA) was measured five segments (about 2 mm) below this plane within the epilarynx tube. The second area measure reflecting the hypopharyngeal width was taken 30 slices (10 mm) above the reference plane. This area is mostly located slightly below the valleculae and the top part of the piriform sinuses. It typically showed the hypopharyngeal width at the level of the top part of the piriform sinuses. This measure is referred to as the hypopharyngeal area (HPA).
Two corresponding volume measures, an epilaryngeal (ELV) and a hypopharyngeal (HPV) were defined. The inferior limit of the former was located at the level of the ventricular folds, where the distance between them reached its minimum, while the epilaryngeal exit reference plane was chosen as its upper limit. The HPV was measured between the HPA and the epilarynx exit reference plane. The position of the larynx was measured in relation to the cervical spine and measured by means of helplines as distance to the 7th cervical vertebra. An analysis of variance of the selected two area and two volume measures with the within-subject factor vowel was computed to look for significant differences.
RESULTS: Area and volume measures were found to vary with different vowels. Analysis of the factor vowel as within subject factor showed significant effects on ELA, HPA, HPV and LH but not on ELV. DISCUSSION: The findings support the notion that lower vocal tract morphology adjusts in dependence to the articulated vowels in singing.

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BREATHING STRATEGIES IN PROFESSIONAL SINGERS – A DYNAMIC TWO- AND THREE-DIMENSIONAL MAGNETIC RESONANCE IMAGING STUDY

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Breathing strategies in western classical trained singers are considered essential for a good voice quality and thus have been in focus of voice physiology studies for many years. Here, different techniques have been applied to singers for visualization of the breathing apparatus with limited success due to technical restrictions. Accordingly, essential parts of the breathing system in singers are yet not well understood. Dynamic Magnetic Resonance Imaging (MRI) has been used to evaluate the configuration of the vocal tract during phonation[1]. The aim of this study was the application of this technique to evaluate breathing strategies for different phonatory tasks in trained singers.
In this study MRI was applied to professionally trained singers. The movement of the diaphragm and the lungs was imaged two and three dimensionally with an acquisition time of 3 f/s (2D) and 1 f/s (3D) for different phonatory tasks including pitch jumps, abrupt changes in sound pressure level (SPL) and maximum phonation time at different pitches in supine position in a 1.5T MRI system (Tim Symphony, Siemens). This was done in a combination with MRI compatible electroglottography[2] (EGG, EGG-D400, Laryngograph Ltd. London) that could provide simultaneous information on the glottal cycle while the singer sung in the MR scanner. The acquired images where evaluated concerning the vertical extent of the lung in coronal slices and the width of the rib cage in sagittal slices of the right lung.

The diaphragm was positioned downward for the inspiration and moved upwards while singing in different speed according to pitch and loudness. The movements of the rib cage and the diaphragm contributed inter-individually in different amounts to the volume changes of the lung but the movements were intra-individually very reproducible. For most of the tasks the diaphragm was simultaneously positioned upwards for the right and left lung. For pitch jumps upwards at the end of the lung volume the right and the left part of the diaphragm were positioned upwards with a different speed (see fig. 1). For pitch jumps down and sudden reduction of SPL a displacement of the diaphragm in caudal direction was observed (see fig. 1).
The dynamic imaging of the lung movement during singing revealed different breathing strategies that where conducted to perform the required tasks. As high pitches and SPL require frequently more subglottic pressure compared to low pitches and SPL [3], it could be speculated, that the diaphragm, was used to suddenly reduce the subglottic pressure. This was necessary to compensate the elastic restoring forces of the lungs. Side-differences in the elevation speed of the diaphragm could arise from the different configuration and attachment of the inner organs that are located below the two sides of the diaphragm. The data suggest that MRI is a useful tool in the visualization of breathing strategies in singers.

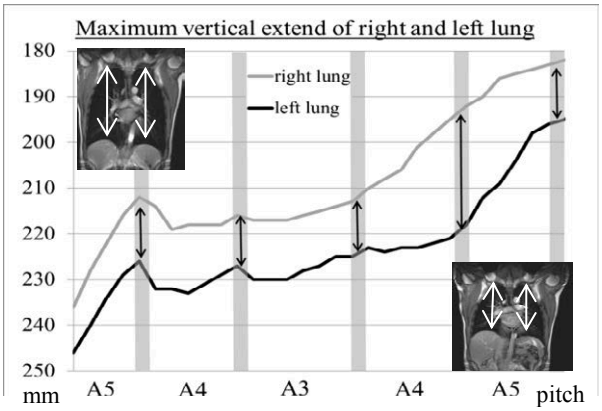

Figure 1: Maximum vertical extend of both lungs in mm, acquired in a 2D coronal plane whith an acquisition time of 3f/s of a female subject singing pitch jumps (A5-A4-A3-A4-A5). While the diaphragm is positioned upward in the phonation process, the pitch jumps (grey bars) in downward direction initiated a displacement of the diaphragm in caudal direction.

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DIFFERENCES IN VOCAL TRACT RESONANCES INTRODUCED BY MRI CONDITIONS IN A MALE AND FEMALE SINGER (PILOT STUDY)

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This study investigated the differences in resonance tuning techniques in singers between "normal" performance conditions (standing in an anechoic chamber), and simulated MRI conditions (supine, with MRI noise played over headphones). Subjects were a male and female singer of similar age and level of singing experience, and have both sung solo and chorus in professional operas and choirs in the UK.

MRI techniques are central to providing insights on the physiology of the human voice, and provide a wealth of detail inaccessible by any other methods. Therefore it is increasingly important to understand how the measurement process influences the results obtained, particularly in view of the highly unconventional situation in which the singer is required to perform, and be aware of any measurement errors introduced during the process. It is hoped that these results may assist in the interpretation of data from previous studies, and inform future research on vocal tract resonances utilising MRI techniques.

Studies have been carried out on the changes arising in the vocal tract due to the position of the subject during speech [1], but there is a lack of understanding of changes arising during singing. This is of particular interest as both male and female singers are known to "tune" their vocal tract resonances during singing [2], and it is not known exactly how their position affects the resonance tuning techniques used. This experiment will investigate the range over which resonance tuning is employed, and which techniques are used in the different conditions investigated.

The resonances of the vocal tracts were measured using a method pioneered by Epps et al [3], and used by others including Garnier et al [4] and Henrich et al [2], which involves placing a microphone and an acoustic current source side by side on the singer's bottom lip, and exciting the vocal tract using a synthesised broad-band signal while they sing. The pressure response at the mouth is first measured with the mouth closed (P_{closed}), and then whilst singing (P_{open}), and the ratio P_{open}/P_{closed} is calculated, which is related to the ratio of the impedances of the vocal tract and the surrounding air, and shows peaks at the resonant frequencies of the vocal tract.

The first part of the procedure involved the subject standing in an anechoic chamber, singing as normally as possible with minimal vibrato. The tasks were (1) to read a phonetically balanced text, (2) sing chromatic scales on three different vowels, holding each note for approximately 5 seconds (during which the resonances of the vocal tract were measured using broad-band noise excitation), and finally (3) to sing 4 pitches on each of the three vowels, holding each note for 16 seconds (as in the MRI machine). The second part of the procedure involved the subject lying down on a padded board, with recorded MRI noise played over headphones, to simulate the conditions in the MRI machine. The same tasks were then repeated.

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FP-Acoustical/Mechanical Analysis 4 (Room2)

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CONTROL OF THE INTENSITY OF THE HARMONICS AND OF THE INTRAGLOTTIC PRESSURE FOR VOICE QUALITY. ACOUSTICAL EXAMPLES

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Abstract not available at time of publication

DIRECT MEASUREMENT OF SOUND LEVEL JUST ABOVE THE GLOTTIS FOR ACOUSTIC ANALYSES IN HUMAN SUBJECTS

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I. INTRODUCTION

Human voice originates following the intermittent airflow through the larynx caused by vibration of the vocal folds produces the origin of the human voice. The acoustic analysis approach provided a better understanding of the voice production. Recently, we developed a new direct sound level measurement device at the tip of the flexible transnasal fiberscope. Acoustic measurements were taken at approximately 1cm above the glottis in human subjects.

II. METHODS

A probe-microphone that was airtightly connected to the channel for inserting the biopsy wire. (Figure 1) The output of the microphone was recorded via the channel of the endoscope. The fiberscopic examination was performed transnasally to enable observation of vocal fold vibration. Acoustic intensity was obtained through the fiberscopes' channel.

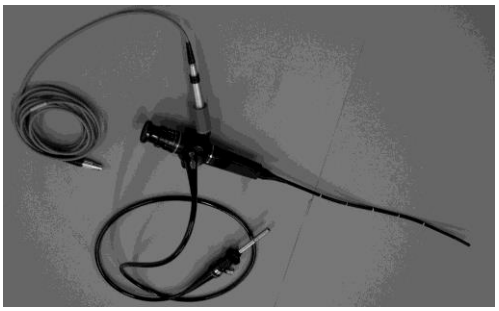

Figure 1. probe-microphone was airtightly connected to the channel

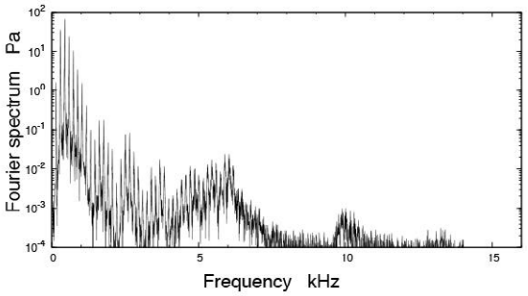

Figure 2. The acoustic intensity and frequency distributions

III. RESULTS

Direct measurement of acoustic intensity (sound pressure level) was obtained just above the glottis in human subjects.
Figure 2 shows sound level and Fourier spectrum of phonation just above the glottis. The sound pressure levels are extremely large just above the glottis and frequency distributions have containing a high frequency component. Strongest sound intensity was found at the midline of the vocal folds.

IV. DISCUSSION

In this study we developed a novel direct sound level measurement device for acoustic analysis in human subjects. The sound frequency distributions have containing a high frequency component as well as glottal velocity distributions. These results suggest that glottal jet flow surrounding the vocal folds vibration that may contribute to voice quality because velocity distributions may include high frequency harmonics.

INFLUENCE OF SUPRAGLOTTAL BOUNDARY CONDITIONS ON PHONATION IN A SYNTHETIC MODEL

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Phonation is the result of a fluid-structure-acoustic interaction. Within the last few decades, the vocal folds have extensively been examined as the source of the phonation process. In addition to that, the boundary conditions, as prescribed by the supraglottal channel, have recently been found to strongly influence the flow field as well as the resulting acoustics. Chan and Titze found the phonation threshold pressure to be strongly dependent on the existence of the supraglottal channel. Additionally, the oscillation onset was found to be influenced by acoustic coupling onto the vocal folds with respect to the supraglottal channel geometry and the vocal fold stiffness. The previously described experimental studies were based on simplified supraglottal channel geometries. When it comes to a more realistic approach, little is known with respect to the phonation process in a synthetic human larynx model. Therefore, the main focus in this study lies on the inclusion of realistic, yet representative channel geometries.

The investigations of this study were all based on a synthetic human larynx model consisting of several devices for producing and conditioning the flow required for the induced oscillation of the synthetic vocal folds. The whole setup was configured to match human dimensions. It includes vocal folds as proposed by Thomson et al. which are based on the geometry of the M5 model by Scherer et al.; they show flow-induced oscillations to represent the fluid-structure-acoustic interaction of the human phonation process.

As a first step, ventricular folds were included into the already existing model, which has a constant cross-section. With this modification, we applied a phase-triggered PIV technique in order to analyze the phase-averaged flow field in the supraglottal region. The glottal jet was constantly deflected to one supraglottal channel wall. When compared to the same supraglottal channel geometry without ventricular folds, the mass flow required for stable vocal fold oscillations dropped considerably, which also led to a decrease of the mean subglottal pressure. Therefore, the ventricular folds have a stabilizing effect and they cause a reduction of the transglottal pressure drop.

In order to investigate the influence of the supraglottal channel length, the same cross-section as in earlier studies was used, but the new supraglottal channel was designed to allow channel length variation between 0 cm and 59 cm in steps of 5 cm. The onset/offset pressure of the vocal fold oscillations as well as the oscillation frequency and the applied air mass flow were recorded. We investigated a constant decrease of the mass flow/subglottal pressure required for stable vocal fold oscillations when approaching longer channel lengths. Additionally, the oscillation frequency was slightly lower for longer channels. Hence, with large supraglottal channel lengths, an acoustic coupling effect is clearly recognizable. This results in a mass flow drop from 90 l/min down to 23 l/min for the longest investigated channel. This mass flow is comparable to what can be found in humans during phonation. Another effect is the approximation of the vocal fold oscillation frequency towards the acoustic resonance frequency of the supraglottal channel.

The main part of this study is the investigation of more realistic supraglottal channel geometries. Therefore, we included several 3D-printed versions based on Story et al.. Different cross-section shapes (circular, rectangular, elliptical) were included to find the best compromise between realistic geometry and optical accessibility for later optical measurements. As for the supraglottal channel with inserted ventricular folds, a lower mass flow / subglottal pressure was needed for stable vocal fold oscillations for the investigated MRI-based shapes. The transglottal pressure drop, which is generally thought to be a decisive factor for the phonation onset, is modified in a beneficial way.

VOCAL EFFORT AND INTELLIGIBILITY. A PRELIMINAR STUDY WITH AERODYNAMIC MEASURMENTS DURING PHONATION OF CONSONANTS

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Vocal effort in speech has been studied during the production of vowels in particular in terms of increased subglottic pressure (SGP) and laryngeal resistance (LR=SGP divided by the Intra Oral Pressure IOP). But few studies have been devoted to the study of the same phenomena when performing consonants, which are nevertheless key elements of intelligibility. Our overall goal is to ensure that, when making a vocal effort, at least in normal subjects, there is also an increase in the resistance of the articulator feature of the consonant. For practical reasons, we chose to carry out a feasibility study for the voiced and unvoiced consonants /f/ and /v/ in which there is a constant airflow, on the one hand, and a very anterior second constriction.
We used the principle of direct pressure measurement subglottic pressure; the intraoral pressure and air flow of phonation with EVA equipment. We studied on the same speaker, six successive productions of a series of words including the contrast /f/-/v/ in twelve different vowel contexts and four speech modalities characterized by an increasing in vocal effort. We asked the subject to be himself the judge of the correct realization of the set procedures for such speech. To speak the threshold, we asked him for the lowest intensity possible, for comfortable voice, we asked for the spontaneous intensity that did not require him any effort, for the "clear voice" we asked him to think of a dictation, for the loud voice, we asked him to imagine a listener located at 4 meters. The productions were asked randomly. Our hypothesis was that in strong and clear voice there is an increase in the resistance of the articulator that is to say the lips for the voiceless consonant /f/ and to a lesser extent for the voiced consonant /v/ (due to a drop in subglottic level because of voicing).
Our results are perfectly consistent:
For the voiceless consonant /f/, the pressure difference values (PSG-PIO) found for different speech modes are 3.63 hPa for voice in threshold, 4.19 for comfortable voice, 7.14 for clear voice and for loud voice 16.87. The values of resistance at the lips are also perfectly consistent 13.67 cm3 / hPa for voice at threshold, 17.75 for comfortable voice, 27.61 for clear voice and 35.62 clear for loud voice. All the differences are significant in pairs (with $p < 0.01$). In addition we also found significant differences in pressure differential values (SGP-IOP) found for different speech modes which are 3.63 hPa for voice at threshold, 4.19 for comfortable voice, 7.14 for clear voice and 16.87 for loud voice. Other results will be given during the communication.
We also studied, in the unvoiced consonants, the correlation between the measurements of IOP and SGP in order to determine an indirect method of estimating the Sub-Glottal Pressure similar to the method called /papapa/ but leaving more space to the study of the articulation of speech. This correlation is excellent with a determination coefficient greater than 0.92.
These results demonstrate that the use of a "clear" voice that aims to improve the intelligibility in some circumstances is based on more energy than the confortable voice. These preliminary results need to be confirmed by studies with various normal and pathological subjects. But these initial results confirm that the vocal effort must be integrated into a unified approach to speech production including vowels and consonants and not considered only at the glottal function.

Key words:
Vocal effort - voiced/unvoiced consonants - Transglottal Pressure - intelligibility

COMPUTATIONAL STUDY OF THE TRANSGLOTTAL AERODYNAMICS DURING SUSTAINED VOWEL PHONATION

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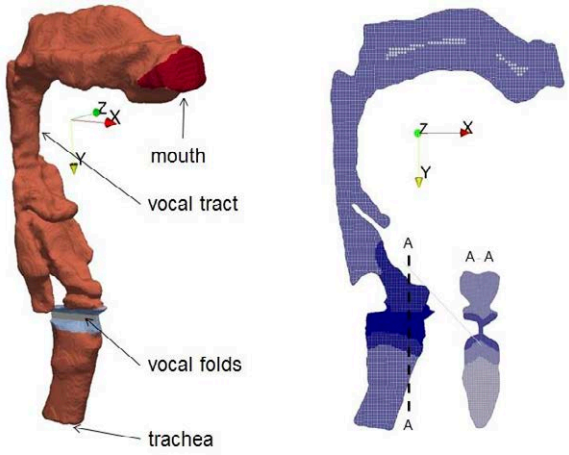
The transient, three-dimensional transglottal air-flow through the vibrating vocal folds is the source of sound during the process of human phonation. Aerodynamically generated sound due to vortical flow structures in the supraglottal region is always inherent in this process. In case of normal healthy phonation this sound source plays a minor role and the amplitude of its frequencies is orders of magnitude lower than the dominant amplitudes of fundamental frequency and its harmonics that are generated by the oscillating vocal folds. But in case of breathy phonation for example, whether it is pathological or desired whispering, this sound source is relevant and not negligible. The mechanism of this aerodynamically generated sound is related to three dimensional, transient flow phenomena and accessible in detail with computational fluid dynamics [1].

A three dimensional time resolved Finite-Volume-Method is used to numerically solve the conservation equation of mass and the Navier-Stokes-Equation. MRI scans of the vocal tract of several subjects during sustained vowel phonation of the german vowels /a/,/e/,/i/,/o/ and /u/ were used to generate three dimensional models of the vocal tract. The subjects were professional singers, so that they are able to reproduce the vowels in a congruent manner inside and outside the MRI scanner. The MRI scan was used to extract the three dimensional shape of the vocal tract during sustained vowel phonation. Outside the MRI device electroglottography (EGG) was used to derive the temporal pattern of the moving vocal folds and set it as a boundary condition to the computational model [3]. A fixed subglottal pressure was applied as a Dirichlet boundary condition (fixed value across the tracheal cross section). See figure 1 as an example for sustained vowel /a/.

The supraglottal flow fields were analyzed concerning the temporal and spatial frequencies of the occurring vortical flow structures. The highest values of velocity, vorticity and pressure forces that are exerted on the walls of the vocal tract are caused by vortical fluid motion in the near supraglottal flow field up to the epiglottis. This epilaryngeal tube is the most significant region for aerodynamic sound generation inside the vocal tract during sustained vowel phonation, because one can find a strong constriction combined with vortical fluid flow. Comparisons between the five vowels for one subject and between subjects are drawn to derive the amount of aeroacoustic sound generation during vowel phonation in a next step.



This study provides insights of the three dimensional supraglottal flow field in a realistic geometry of the human vocal tract during sustained vowel phonation. In order to evaluate the influence of the discussed vortex sound for the emitted sound pressure at the mouth the aeroacoustic wave propagation should be included into the modeling procedure as done by Fleischer et al.[2].

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FINITE ELEMENT GENERATION OF DIPHTHONGS USING TUNED TWO-DIMENSIONAL VOCAL TRACTS AND INCLUDING RADIATION LOSSES

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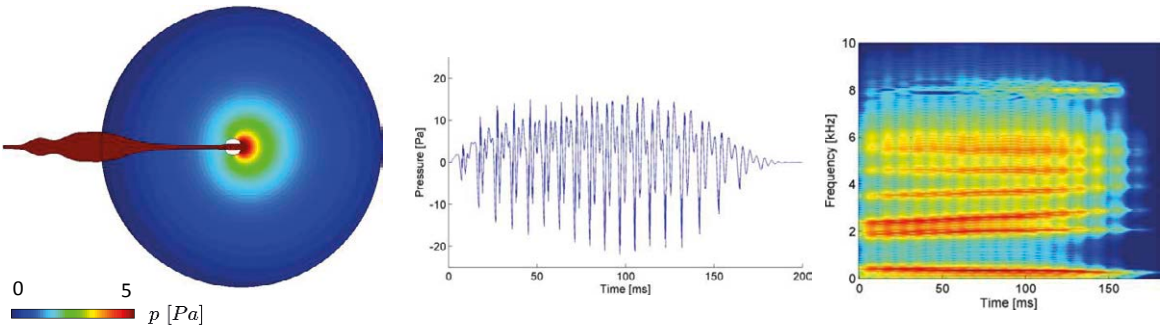
Numerical simulations to generate vowels using three-dimensional (3D) vocal tract geometries have become feasible in recent years (see e.g., [1,2,3]). High quality sounds can be produced though the price to be paid is that of a high computational cost. That was strongly reduced in [4], with almost no sound degradation, using a two-dimensional (2D) approach which relied on a tuning process of the midsagittal cut of a 3D vocal tract. The procedure was lately extended to generate diphthong sounds [5] that exhibit 3D acoustic behavior [6]. However, in those works zero pressure release boundary conditions were assumed at the mouth exit. The important effects of radiation losses are incorporated to the 2D tuning approach for diphthongs in the present work. An optimization process is purposed, which allows one to match 3D radiation losses at each time step of the 2D simulation. The mixed wave equation expressed in an Arbitrary Lagrangian-Eulerian (ALE) frame of reference [5,6] is numerically solved by using a subgrid scale stabilized finite element method [7,8]. As an example, diphthong /ei/ has been simulated resulting in fairly good quality sound (see Fig. 1).



(a) (b) (c)

Fig. 1 – Finite element numerical simulation of diphthong /ei/. (a) Snapshot of the acoustic pressure during the articulation of vowel /i/, (b) acoustic pressure evolution at the mouth exit, (c) and spectrogram of (b).

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PARTICIPATION TIME IN A VOCAL LOADING TASK AND ITS RELATION TO SYMPTOMS OF VOCAL FATIGUE IN 6 VOCAL SUBGROUPS

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Introduction: Vocal fatigue is a central concept in clinical management of functional voice problems. Manifold researchers call for more knowledge on what constitutes vocal fatigue (e.g. Hunter & Titze, 2009). Vocal function associated with vocal fatigue has been explored, often following a vocal loading task (well accounted for by Remacle et al., 2012). The present study had two specific aims: 1) explore the end point in time for participating in a vocal loading task depending on vocal subgroup affiliation, 2) examine how symptoms of vocal fatigue correlate with length of time spent in a vocal loading task.

Method: A total of N=51 subjects were included, divided into six vocal subgroups: 1) n=14 (10 female, 4 male) pre vocal fold surgery of benign lesions, ages 28–69, 2) n=5 (3 female, 2 male) >4 months post vocal fold surgery of benign lesions, ages 28–69, 3) n=16 female functional voice patients, ages 24–70, 4) n=8 females with high everyday vocal load and vocal complaints, ages 33–60, 5) n=5 females with high everyday vocal load and no vocal complaints, ages 34–65, 6) n=3 female voice healthy controls, ages 42–67. The subjects were asked to make themselves heard through ANL multi speaker speech-babble aired in free field at 85 dB A in a sound proof booth. The subjects read a text out loud continuing until (if) they experienced a distinct discomfort in the throat, at which point the task was terminated and the subjects reported current voice condition in a voice activity questionnaire and through a visual analogue scale. Participation time was noted. Signal-to-noise ratio was tracked online. Subjects were prompted to read louder if levels of phonation dropped below 85 dB SPL. Based on clinical understanding, symptoms of vocal fatigue were defined as: coughing, throat clearing, noticeable swallowing with head movement and drinking water (e.g. Lyberg Åhlander et al., 2010). The symptoms were noted and recorded online by the test leader (SW). Methodological details in Whitling et al., 2015.

Results**:** Participation time in the vocal loading task ranged from 16 to 30 minutes (maximum time). All participant apart from one voice healthy control reported vocal fatigue following the vocal loading task. A one-way between-groups ANOVA ($p \leq .05$), exploring mean participation time in minutes, showed a statistically significant difference in time of participation among the 6 vocal subgroups [$F(5, 45)=3,5$, $p=.009$]. Effect size, calculated using eta squared, was .28. Post-hoc comparisons using Fisher's least significant difference test indicated the mean time for group 1 (M=16 min, SD=8.80) being significantly lower than that of group 3 (M=27 min, SD=6.39) and of group 5 (M=28 min, SD=4.60). The mean time for participation in group 3 was significantly higher also in comparison to means of group 2 (M=19 min, SD=11.13). When using Pearson's correlation coefficient ($p \leq .05$) in all 51 cases, a modest positive, statistically significant correlation of $r=.30$ was found between time spent in the vocal loading task and symptoms of vocal fatigue as recorded online by the test leader (SW). Strong correlations were found in two subgroups: post vocal fold surgery ($r=.72$) and voice healthy controls ($r=1$). None of the correlations in the subgroups were statistically significant.

Discussion**:** Results are interpreted and discussed with caution, as some of the subgroups are small. The modest correlations shown in four of the six vocal subgroups, and in the clinical sample as a whole, indicates that vocal loading caused by the vocal loading task is not only owing to vocal fatigue, or symptoms thereof. E.g. in group 5the correlation was negative ($r=-.20$), perhaps indicating this group to be more resilient to vocal fatigue. Coping factors such as vocal resilience, experience of vocal loading and recovery, mental endurance, physical endurance and/or lack of kinesthetic feedback may have protected these individuals from experiencing or noticing symptoms of vocal fatigue.

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DO DIFFERENT SEMI-OCCLUDED VOICE EXERCISES AFFECT DIFFERENTLY VOCAL FOLD ADDUCTION IN SUBJECTS DIAGNOSED WITH FUNCTIONAL DYSPHONIA?

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The present study aimed to observe the possible effect of eight different semi-occluded vocal tract exercises on vocal fold adduction by using electroglottographic contact quotient. Eighty participants were divided into two groups: an experimental group of subjects diagnosed with functional dysphonia (n=40) and a control group of vocally healthy subjects (n=40). Inclusion criteria for experimental group included: 1) age range of 20-50 years, 2) laryngoscopic diagnosis of functional dysphonia. Inclusion criteria for control group included: 1) the same age range as the experimental group, 2) no current or past history of voice disorders. Prior to electroglottographic assessment, all participants were asked to undergo rigid videostroboscopy to confirm the diagnosis. Participants were required to randomly select and produce a series of three semi-occluded vocal tract exercises from a list of eight exercises: 1) straw phonation (5 mm of inner diameter and 25.8 cm in length), 2) straw submerged 3 cm below the water surface, 3) straw submerged 10 cm below the water surface, 4) lip trills, 5) tongue trills, 6) Y-buzz, 7) hand-overmouth, and 8) humming. All productions were asked to be produced for 5 minutes. Twenty minutes voice rest was taken between exercises for all subjects. A sustained vowel /a/ was produced before and after semi-occluded exercises. Each electroglottographic sample captured before, during and after exercise was analyzed to obtain the glottal contact quotient (CQ). Numerical variables were described by mean and standard deviation, while categorical variables were described in frequencies and percentages and compared using Wilcoxon test or Kruskal-Wallis test as appropriate. A generalized linear model to observe the joint influence of gender, country and presence or absence of dysphonia, in electroglottográphic assessment, according to each phonatory exercise was fitted. All exercises had a significant effect when pre, during and post conditions were compared. Regarding vocal exercises, contact quotient changed differently throughout the eight semi-occluded postures during exercise. Most exercises increased CQ (straw phonation, straw submerged 3 cm below the water surface, straw submerged 10 cm below the water surface, Y-buzz, hand-overmouth, and humming). Only lip trills and tongue trills decreased CQ during exercise compared to pre phonation. Results from the multivariate linear regression model including contact quotient as outcome; and semi-occluded exercise, voice status, and gender as predictive variables (and its interactions if they exist) showed that participants diagnosed with dysphonia evidenced a greater CQ compared to vocally healthy subjects. Males demonstrated higher values of CQ compared to females. Considering semi-occluded exercise, straw submerged 10 cm below the water demonstrated the highest value for CQ, while tongue trills obtained the lowest value. Different semi-occluded vocal tract exercises affect differently vocal fold adduction measured by electroglottographic contact quotient. Most clear patterns are demonstrated during exercising. After exercise results produced no clear patterns. Lip trills and tongue trills generated the lowest values on contact quotient, therefore they may be recommended to decrease glottal adduction. Straw submerged 10 cm below the water surface presented the greatest contact quotient. A shallower depth tends to lead to a lower CQ, while deeper submersion tends to produce a higher the CQ. Thus, for subjects with low glottal adduction e.g. patients with vocal fold paralysis or with presbyphonia, deeper immersion may help improve glottal function.

EFFICIENCY OF ELECTRIC NEURO-STIMULATION IN TREATMENT OF PRESBYPHONIA IN THE ANIMAL MODEL

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Introduction: Age related atrophy of the vocalis muscle and its adjacent structures affects the voice and may lead to presbyphonia, a condition affecting more and more people in aging western societies. So far therapy modalities comprised conservative speech therapy as well as phonosurgical approaches. Chronic electrical stimulation of the afferent nerve (recurrent laryngeal nerve) is a completely new therapeutic option that has not been tested before.

Methods: 18 male Wistar rats were implanted with a unilateral nerve stimulator. One week after implantation stimulation protocol was initiated over eight weeks, twice daily. Changes were observed on the muscular level histologically (cross section area, number of muscle fibers etc.) as well as on the cellular level (immuno-histochemically and qPCR).

Results: Compared to control group, chronical stimulation lead to changes in the parameters mentioned above.

Discussion: Chronic electrical stimulation can be a new treatment option for age related changes of the larynx. The findings need to be proven in bigger animals before going into human studies.

THE EFFECT OF OSTEOPATHIC MANIPULATIVE TREATMENT ON MUSCLE TENSION DYSPHONIA. A PILOT STUDY.

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INTRODUCTION. Voice disorders are considered multifactorial and require a multidisciplinary approach. Although speech therapists report a growing interest in a manual approach, the prevalence of patients with voice disorders in osteopathic daily practice is very low. From this increasing awareness, we hypothesize that changes in subjective and objective voice quality might occur as a result of osteopathic clinical reasoning and treatment. The objective of this study is to determine the effect of osteopathic manipulative treatment (OMT) on primary and secondary muscle tension dysphonia (MTD). METHODS. We performed a double blind randomized placebo controlled clinical trial about the effect of OMT on MTD in patients suffering from benign organic or non-organic voice pathology. Eighteen patients (5 men, 13 women) diagnosed by an ENT physician as suffering from MTD were randomized into two groups. The OMT group (n= 9, 33.8 ± 11.7 years) received three osteopathic treatments for three weeks, the placebo group (n= 9, 50.8 ± 18 years) received three times a placebo intervention. Voice Handicap Index (VHI), Grade Roughness Breathiness (GRB) scale and Dysphonia Severity Index (DSI), performed by a speech therapist blinded for group assignment, were recorded one week before and one week after the set of three interventions. RESULTS. Comparing baseline and final measurements, a significant improvement in VHI was found in the OMT group **(table 1)** in contrast to the placebo group **(table 2)**. DSI and GRB also improved after the osteopathic treatment albeit not statistically significant. A tendency towards significantly better results in all parameters has been shown in favor of OMT. However, comparing the OMT and placebo group did not demonstrate any statistically significant difference **(table 3)**. DISCUSSION. The present study, showing a statistically significant improvement of VHI and a larger positive trend for all parameters in the OMT group in contrast to the placebo group, suggests a beneficial effect of osteopathic treatment on voice quality in patients suffering from MTD. The fact that this study did not reveal a statistically significant difference between both groups can be explained by the small sample size and the large variability between groups. However, the positive tendency in the current study indicates that the osteopathic approach of voice disorders merits attention in future research.

Table 1: Summary comparing mean and p-values out of the Wilcoxon Signed-Rank test, comparing baseline and final measurements within OMT group

	At baseline	At final measurement	Δ values	*p*
VHI	35.22 ± 14.40	26 ± 17.57	-9.22 ± 10.16	*0.02*
DSI	-0.67 ± 2.27	0.05 ± 2.13	+0.722 ± 1.86	0.38
GRB	4.00 ± 2.06	3.44 ± 1.51	-0.56 ± 1.01	0.25

Table 2: Summary comparing mean and p-values out of the Wilcoxon Signed-Rank test, comparing baseline and final measurements within the placebo intervention group

	At baseline	At final measurement	Δ values	*p*
VHI (N=9)	61.11 ± 26.36	58.89 ± 28.17	-2.22 ± 9.04	0.45
DSI (N=8)	0.01 ± 2.46	-0.21 ± 3.09	-0.22 ± 1.27	0.55
GRB (N=9)	3.78 ± 1.56	3.89 ± 1.96	+0.11 ± 1.05	1.00

Table 3: Summary comparison between placebo group and OMT group, using the Wilcoxon Rank Sum test

	Placebo	OMT	*p*
VHI	- 2.22 ± 9.04	- 9.22 ± 10.16	0.23
DSI	- 0.22 ± 1.27	+ 0.72 ± 1.86	0.16
GRB	+ 0.11 ± 1.05	- 0.56 ± 1.01	0.27
G	+ 0.11 ± 0.33	- 0.22 ± .044	0.27
R	- 0.22 ± 0.67	- 0.33 ± 0.87	0.97
B	+ 0.22 ± 0.83	0.00 ± 0.50	0.76

UTILITY OF SMART PHONE MICROPHONE FOR MEASUREMENT OF ACOUSTIC VOICE PARAMETERSAND VOICE PATHOLOGY SCREENING

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Objective: To evaluate the reliability of acoustic voice parameters obtained using smart phone (SP) microphones and investigate utility of use of SP voice recordings for voice screening.

Methods: Voice samples of sustained vowel /a/ obtained from 118 subjects (34 normal and 84 pathological voices) were recorded simultaneously through two microphones: oral AKG Perception 220 microphone and SP Samsung Galaxy Note3 microphone. Acoustic voice signal data were measured for fundamental frequency, jitter and shimmer, normalized noise energy (NNE), signal to noise ratio and harmonic to noise ratio. Correct Classification Rate (CCR) and Equal Error Rate (EER) were used to evaluate the feasibility of acoustic voice parameters classifying normal and pathological voice classes. Glottal Function Index (GFI) questionnaire was utilized for self-assessment of the severity of voice disorder.

Results: The correlations of acoustic voice parameters were statistically significant and strong (r= 0.73-1.0) for the entire measurements. When classifying into normal/pathological voice classes, the Oral-NNE revealed the CCR of 73.7 % and the pair of SP-NNE and SP-shimmer parameters revealed CCR of 79.5 %. However, fusion of the results obtained from SP voice recordings and GFI data provided the CCR of 84.60 % and the EER of 7.9%, respectively.

Conclusions: Measurements of acoustic voice parameters using SP microphone showed to be reliable in clinical settings demonstrating high CCR and low EER when distinguishing normal and pathological voice classes, and validated the suitability of the SP microphone signal for the task of automatic voice analysis and screening.

Keywords: acoustic analysis, voice screening, smart phone

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VOICE PATHOLOGY DUE TO FOOD AND RESPIRATORIES ALLERGIES

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Introduction
Food and respiratory allergies due to different mucosa hyperreactivity produce voice pathology. An analysis of the most frequent allergies in a phoniatrical group of 567 patients is presented. The voice production can be affected and the symptoms are discussed. Statistical analysis is made to understand the relation of the food and respiratory allergies with vocal complaints.
The voice symptoms are dysphonia, phonastenia, lack of vocal flexibility, lack of brilliance, throat cleaning and neurovegetative disorders, nasal resonance, posterior nasal drip. The food allergies can produce also dysphonia , reflux signs without significant symptomatology.
Methods
Allergological tests with titration end point in skin or IgE dosification in Radioinmunofluorescent test were made in all 567 phoniatrical patients. Treatment with desensitization vaccine were done to the patients. Environment improvement was necessary in all the patients of this group to diminish the allergological overload. Prevention of these effects are discussed. The noxious effects of the environment (pollution, allergens, noise) can provoke mucosa dryness, if the patient has a right lubrication of the nose, pharynx and larynx helps to avoid more voice complaints.
Results

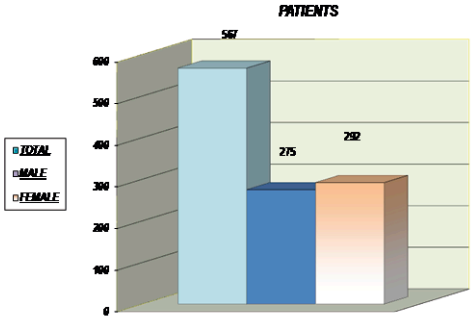

Figure 1. Gender in 567 patients with food and respiratory allergies

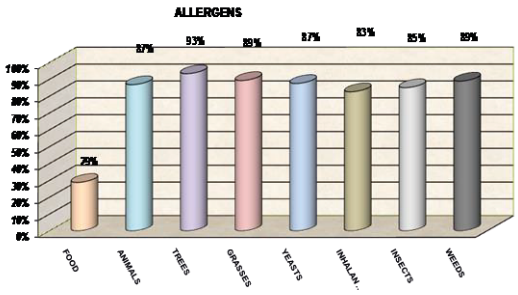

Figure 2. Distribution of allergens presence

The statistical analysis of the respiratory allergies is shown, the trees, dust, mites, pollens among others were higher in significance. The food allergies are to milk products,chocolate, tomato, chicken and tables are presented.
Discussion.
Food has changed in the last century. The environmental influences, industrial pollution and climate change have an influence in the hypersensitivity of the mucosa and change the voice production
Conclusions
Air pollution and respiratory allergies harm the mucosa of nose pharynx and larynx disturbing the voice. Our phoniatrical patients group show the results of the highest incidence of food and respiratory allergies. Diet information has to be examines in more details. The epigenetic studies have to be directed to the environmental influences on the voice.

FP-Singing 4 (Room4)

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VOCAL TRACT RESETS FOR PROFESSIONAL MUSICAL THEATRE SINGERS DURING PERFORMANCE; AN EXPERIENTIAL OVERVIEW

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Musical Theatre singers warm up before a performance, some cool down afterwards and those who have a role with a large vocal load may also undertake vocal tract resets during the performance.

In this experiential overview I will firstly set out the purpose of vocal tract resets during performance. Secondly I will outline what they they are and finally discuss how they work for the singer in relation to their own 'home-neutral' vocal tract setting.

Key words: warm up, cool down, reset, vocal tract, 'home neutral', performance

BYZANTINE ECCLESIASTIC CHANT: FROM PRACTICE TO THEORY USING MACHINE LEARNING TECHNIQUES

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Going from practice to theory, especially in the context of music, is the natural flow for obtaining and preserving musical knowledge. After all, theory is the observation of the practices followed by performers, organized in a way as to reflect a musical genre or even a larger group of music styles, but it is also considered a tool for a student to be able to study music efficiently. Byzantine Ecclesiastic Chant (BEC) is a religious type of monophonic vocal performance practiced mainly in churches. Its main purpose is to serve the religious needs of the Orthodox Christian worship, providing a musical accompaniment for the ecclesiastical poetry. BEC follows aesthetical rules formed over the course of centuries, traditionally transferred from master performers to apprentices. It is a microtonal music since it contains intervals smaller than the conventional contemporary Western theory semitone. Although continuity is one of the key characteristics of every musical tradition, BEC has undergone great changes related to its theory. Among these changes the one that happened in 1814 resulted in passing from a condensed type of writing to a more analytical one. As a consequence, several mappings between the old and new BEC writing style emerged, triggering many discussions, studies and even disputes on the way theory should be applied to BEC musical performance. In this study we try to approach BEC theory by analyzing the actual recordings of several chanters, trying to extract patterns and other information related to performance by using a series of machine learning and digital signal processing techniques. Our goal is to validate a selection of BEC theory elements by analyzing our findings, while trying to discover some of the mappings mentioned previously. Such elements include musical patterns, embellishments and other micromelodic elements. For this purpose, both supervised and unsupervised machine learning techniques are used. Our study goes even further by investigating issues related to different traditional styles of BEC and highlighting common characteristics or noticeable differences, using the same machine learning techniques. The recordings used in the present work are part the DAMASKINOS prototype acoustic corpus of Byzantine Ecclesiastic voice. DAMASKINOS corpus is a standard, tagged corpus of BEC, from a statistically representative sample of modern BEC performers.

EXPLORING THE VOCAL TIMBER NUANCES OF THE CRETAN RIZITIKA SINGING IDIOM

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Rizitika represent the folk singing style at the island of Crete : a living culture that is spread all over the island
It is noticeable that there is strong differentiation between the singers of different areas of Crete, due to the pronunciation of idiomatic diphone (consonant with a following vowel).
In this presentation, we explore first of all, the general characteristics of the Cretan singing style, in order to make a first cartography of the characteristic Cretan voices from 3 different areas (Hania, Rethymno-Anogeia, Heraklion)
Afterward, we create a performance guide for the performance differentiation of the same song due to the idiomatic use of language.

Methodology:
a) Studio recordings were made. These consist of two (2) Rizitika songs, sung by four (4) Cretan singers. The recorded Rizitika songs were the same for every singer who have different origin.
b)Identification of the VRP (Voice Range Profile) singer's formants and passagio's between certain phrases (using PRAAT software program).
c)Formant Tuning and electroglottographic signal to see the movement of the vocal folds.
d)Understanding the different intonation: as it is well known depends upon the emotions, the gender (male or female) and the linguistic parameters that a certain geographical region adopts.

Results:
The results of this investigation will give:
A) the general charasteristics of the Cretan singing style (vocal range, loudness, formant tuning and quality of the voice).
B) the Playfulness during the act of Cretan singing between two notes.
C) The acoustical differences at the interpretation of Rizitiko, by isolating certain phrases of idiomatic diphones and vowels used in passaggio and how the melody and rhythm “move” in different regions of Crete.
D) The vibrato rate and extend of Cretan singing style.
E) How the syllables fall and what is the impact that the origin of the singer can give to the act of Cretan singing, creating a unique Rizitiko singing style.
F) The non-tempered scales of the Cretan song are very close to those of the Byzantine and trational Greek music (oral tradition).

A DEMOGRAPHIC STUDY OF PROFESSIONAL BELTERS: WHO THEY ARE AND HOW THEY SING

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This study was an attempt to gather demographic and professional information about those who are self-designated as paid professional "belters". This vocal quality is found in Contemporary Commercial Music, or what has previously been referred to as "nonclassical", including music theater, jazz, rock, pop, country, gospel and other styles.
The questionnaire was available exclusively on-line and contained 40 questions about vocal training, vocal health, subjective experiences and other related topics. More than 300 responses were gathered of which 132 were considered valid. Available data was gathered on Perseus Survey Solutions/Express for statistical analysis and also categorized by the authors into related groupings of subjective written responses.
This study attempts to provide the first picture of the typical professional belter. It presents a broad base of subjects, from many styles and geographic locations, primarily in the USA, who provided their personal data as well as vocal behavioral patterns, concerns, and needs. The questionnaire also provided the opportunity for respondents to volunteer for future research on belters and belting.
This may allow for future researchers, regardless of their location, to have access to a pool of professional belters. The information provided in this questionnaire may allow existing research to be evaluated more effectively, and assist the acoustic, physiologic, pedagogic, clinical and medical research disciplines that deal with belters to be more precise in their inquiries and investigations.

LOOKING AT THE INTERFACE BETWEEN CLASSICAL SINGING AND CONTEMPORARY COMMERCIAL MUSIC: THE CURRENT SITUATION

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Currently, there is controversy regarding training singers to have a standard "classical" all-inclusive technique for any and all repertoire versus one that is specifically designed to meet the needs of those who sing Contemporary Commercial Music (CCM, formerly “non-classical”). The primary question addressed in this presentation will be: Does “one technique, different styles” really hold true in the 21st century? What progress has been made within singer and teacher training with regard to CCM and classical arenas? Where are we headed? What needs to be done? This oral presentation—written by two specialists, one in Contemporary Commercial Music and one in classical singing—will discuss the current relationship between the fields of CCM and classical voice pedagogy. Data will be presented regarding specific components of training for CCM and classical singers in the United States. Physiological aspects of technique will also be addressed with respect to each genre. The notion of resonance in traditional classical singing will be discussed as being somewhat irrelevant to most contemporary CCM styles due to the different aesthetics required in each. Recorded examples will provide a clear auditory picture of the differences between styles and the vocalists who sing them. Discussion will include cultural and aesthetic considerations as currently found in the music industry in the USA. The presentation will include suggestions about training for those teachers interested in learning to teach styles found in music theater as well as in jazz, rock, pop, blues, rap, and country music alongside—or separately from—classical repertoire. Both authors wrestled with these and other related concepts in their published work, *A Dictionary for the Modern Singer* (Rowman & Littlefield, 2014).

CONTEMPORARY COMMERCIAL MUSIC VOCAL PEDAGOGY – A CLASS OF ITS OWN

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ABSTRACT: The popularity of reality television talent shows, the social media phenomenon of music sharing and the changing culture of Musical Theatre productions from light classical (Legit) to Rock and Jukebox musicals, has fuelled a growing public demand for singing voice training in contemporary commercial music (CCM) styles. It is widely accepted there are many differences in the voice production of classical and CCM singers; that is, vocal tone, registration and sound qualities inherent in commercial singing styles differ greatly from accepted, classical vocal practice [1, 2, 3, 4, 5, 6, 7, 8]. This recognition poses two major problems for teachers and singer/students of CCM. The first, that the traditional classical training model will not equip singers with the necessary vocal production to be hired for CCM performances due to the inherent style-driven differences of classical and CCM vocal production. The second is that in any case, a cohesive, specific pedagogy for singers of CCM styles is lacking. To date, what does exist is a hybrid, fractured collection of anecdotal and non-researched methodologies and philosophies which all claim to hold 'the secret to success' for aspiring CCM singers, often with seemingly opposing and contradictory information on technique and little that supports healthy vocal functioning for the group.

This paper reports the preliminary findings from a research study focused on structured interviews with seven leading, international CCM pedagogues. The collected data indicate both commonalties and distinctions within the threads of collected information. All seven interviewees reported some classical training (either instrumental, voice or both) emphasizing that, in the past, western classical training was the only option for aspiring singers. They all came to teach CCM styles somewhat serendipitously, but typically in response to student demand. Commonly, all participants spoke to the inefficiencies of imposing a 'one-size-fits-all' classical pedagogical model on singers of CCM styles. Therefore, without recourse to a structured CCM model, this group of teachers was driven to develop an individual pedagogical approach guided by personal performance experience, observations of CCM performers and ongoing investigation of past and current voice science research. The pedagogues were unanimous in their discussions about the need for vocal authenticity across the broad range of CCM styles and, as with reports in the existing literature [9,10], they pointed to the specific demand for a uniqueness of sound, individual artistic expression and vocal freedom. Each pedagogue emphasised that the needs of the student *on that day*, *at that particular moment in time* are the driver for their teaching approach. Stressing that they did not follow a particular teaching methodology, they professed to have developed an eclectic teaching tool kit constructed from a variety of sources including a continuous review of the literature of voice science, conference and workshop attendance and most importantly, a consideration of individual students' needs. The emerging collective philosophy appears to be a nonjudgmental, non-aesthetic appraisal of style choice with a common aim to promote an efficient and healthy vocal production for singers of CCM.

Preliminary analysis of the data confirms a variety of approaches employed by the pedagogues in their interactions with students of CCM styles with apparent distinctions in emphasis, application and communication of technique and artistry training. Differences of emphasis in areas of physicality, alignment, breath-management and laryngeal function have been noted. However, there appears to be an underlying if unconscious agreement in consideration of specific style demands and the impact of emotional expression, text interpretation and storytelling on vocal production and sustainable vocal health. Through a focused discussion, the authors present these tenets in the belief that they could form the foundation of a structured and focused pedagogy for singers of CCM styles.

W21-Singing Voice 14 (Room1)

B-SINGING WITH BONES FOR LIFE®

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Voice is 'Body & Soul'! Singing involvesyour whole self and the voice is the link between your inner self and the environment. How to use and manage the different vocal demands, whether it is on stage or in daily life, is an essential need for everyone to be able to keep up the voice healthy, reliable and effective in function. Bones for Life® (BFL)isApplied Feldenkrais® created by Dr RuthyAlon, renowned and prominent Feldenkrais trainer. BFL consistsof a number of different processes based on anexcellent synthesis of The Feldenkrais Method´s two modes Awareness through Movement (ATM) and Functional Integration (FI) together with studies of African Water Carrier´s Walk. It is about how we use ourselves in daily life. Theoutcomes are on thecutting-edgehow we can deal with different functional challenges. The benefit, for people in common,using BFL is restored, improved andenhanced balance, posture, functional breathing and easy, flexible functional movement, which are characterized by stability, energy- efficiency and freedom. BFL is for the re-education of movement and thinking habits and is used to sensitively recreate, activate and create new neurological patterns in the brain. The approach, in BFL and FM as well, is to provideguidance in an exploring, safe and non-corrective manner. We usespecial designed processes, which contents differentiated movementperformed with awareness. These areobserved and perceivedin different configurations and finally integrated into the whole body.The small differentiated movements give unused, new and varied information to the brain and each movement-sequenceis integrated with rhythmical pulsations into an organized harmonious coordination.These pulsations are also believed to enable the blood, which carries nutrients and oxygen around the body, to penetrate the solid tissue of the bones, and in turn encourage bone hardening. Using the processesincreases the sensibility of movement and flexibility in the neck, lower back, ribcage, shoulder blades, hips and knees. BFL might also prevent osteoporosis and NASA supports the premises trying to create an exercise program that produces the same pressure on the bones as does BFL. The purpose of BFLis to help usfeel kinaesthetically what could be an appropriate movement pattern at hand and to know how to promote proportionality body work between the different bones. This expands our ability to achieve balance between flexibility and stability in a certain function and to discover how the force may go through the skeleton efficientlyand easy. BFL can also present tools to quickly address a function and will help yourself to move forward regardless of age and interest. The benefit of using BFLas a tool educating singers and speakers is considerableregarding the instrument voice and the art of performance as well. In myworkshops peoplecan learn how to cope with the different challenges their voices meet in their profession and daily life. I tailor the teaching to raise singing and speaking to a sensible and mindful level and for the prevention and restoration of functional disorders. This is essentialfor those who are dependent on their speaking and singing voice in their profession. It has an individual approach though learned in a cooperative style in a suitable environment. BFL is an unconventional way of learning since you are the bearer of your owninstrument and carrying out yourown journey of discovery as an inside view. You arethe only expert of what you perceive. Knowledge and understanding therefore come from the senses rather than through abstract theories. Enhanced sense and sensibilityencourage you to decide on your own solutions to the task at hand, which also increases self-confidence. Human cognitive ability is limited in giving its attention to one focus at a time but the subconscious is able to perceive a whole system of interrelations simultaneously. That is why sensory motor learning cangive us capacity to orchestrateall body parts proportionally in coordination. This will occur asasophisticated and fine-tunedinnergame of music between bones echoing through the whole body with no excessive compression in vulnerable joints. BFL helps us to recognize how to do itwith flexibility and management of power to create harmony!

W22-Singing Voice 15 (Room2)

UNIVERSAL VOICE: SPEECH FALSETTO CLASSICAL BELTING

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The Universal Voice Institute defines the sound of the human voices in the whole world in four qualities: a speaking quality called Speech, a voiced whispered quality called Falsetto, a warm vibrato sung quality called Classical and a shouting quality called Belting. Each quality or mode has specific sound characteristics like: pitch range, loudness, clearness or breathiness, vibrato or non-vibrato or its specific timbre, color.

We will present the four qualities/modes and identify them with the use of 8 clear sound parameters. We will explain their sound character and it's corresponding anatomy with the use of animated movies. These education movies are the result of several studies done with more than 50 professional singers. In our research we used High Speed Video, Stroboscopy and normal Video Laryngoscopy. Besides this we used Voce Vista with Electroglottography and Electromyography. The results of these studies are put in a matrix, the Universal Voice System, which makes the way the voice works simpler to analyze and understand. The sound modes/qualities will be easier to teach, develop or correct and for pupils/students simpler to learn, control and/or change.

We will demonstrate the four modes/qualities and invite our visitors to participate and experience how to speak and sing in these sounds. We will explain and teach: How to find the right posture, body-support. How to use your power, for the right amount of breath-pressure and breath-flow. How to setup your vocal folds, in their right position, for the correct sound source. How to shape the vocal tract, the filter, for the desired timbre. To make this workshop fun and effective we are using accompanied exercises, well known song-lines in the right style for the sound mode/quality we want to train and achieve. Our aim is to make this learning trip extremely effective, enjoyable and easier to learn.

This workshop is a small demonstration of our new book: The Universal Voice Guide.

W23-Medical 1 (Room3)

METABOLIC DEMANDS AND NUTRITIONAL REQUIREMENTS IN SINGERS

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While a lot of scientific studies and therapeutic approaches aim to control damages from reflux, gastro-esophageal or esophago-laryngeal, and put in evidence relations between reflux and organic or functional vocal impairment, very few scientific studies focus on singers' nutrional requirements, some with interesting results against "miths and urban legends", which instead are widespread "throughout the Web".
The workshop discuss last scientific acquirements, values of food intolerance – food allergy tests, new exams to assess genetic aspects of nutrition.
Then tries to plan with participants how start to evaluate dietary habits in relation to professional scheduling (reharsals, performances, tours, rest periods…) and professional appointments (cocktails, gala dinners, …) focusing related metabolic needs, non forgetting the "edonic" meaning of nutrition and differences in "traditional" foods.
The target is to educate singer, or better "vocal athlete" -as to LeBorgne and Rosenberg definition- in keeping themeselves healthy and fit, without needs for prolonged medicaments assumption, only to compensate bad dietary habits.

LeBorgne W D , Rosenberg M The Vocal Athlete, Plural Pub 2014
Artioli GG, Bertuzzi RC, Roschel H, Mendes, SH, Lancha Jr AH Franchini E Determining the Contribution of the Energy Systems during Exercise, http://www.jove.com/video/3413/
Huber JE, Darling M, Francis E Relationship between Syntactic Importance and Breath Pausing in Extemporaneous Speech, ASHA Convention, 2008
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W24-Singing Pedagogy 3 (Room4)

USING SINGING EXERCISES EFFECTIVELY

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Many singing teachers use vocal exercises to help students change their vocal production. Since there are a limited number of variations on standard exercises, why do some of them work well and others fail? How can exercises be applied to various vocal or musical issues effectively? What should the response of the vocalist be to an exercise? How do we know that the exercise is producing the desired result?

This workshop will address this topic. Participants will be drawn from the audience and will be asked to sing short musical patterns on various vocal exercises in order to discuss their result.

The instructor will use a mobile phone app for the pitches.

Round Table 5 (Room1)

CARE FOR THE PROFESSIONAL VOICE USER WITH AN INJURED VOICE

Moderator : John Rubin
Participants : Ruth Epstein, Ed Blake, Mary Hammond, Philippe H. DeJonckere

Professional Voice Users have vocal requirements that are integral to their career. As such, mishaps affecting their voice will likely have a substantially greater impact on them than on the general public. Diagnosis of the injury/ injuries must be precise and management for these injuries needs to be comprehensive, multidisciplinary and holistic.

This Round Table consists of professionals from a number of fields whose input will be essential, not only to the initial diagnosis but to the early and longer term management. It will review such diagnosis and care in a number of cases in an attempt to develop strategies and pathways of care.

Round Table 6 (Room2)

ROUND TABLE ON NASAL RESONANCE IN SINGING

Moderator: J Sundberg[1]
Participants: M Havel[2], BP Gill[3], FMB Lã[4], J Lee[3]

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CONTENT

Since long nasal resonance has been a topic of discussion among teachers of singing, some maintaining that the velopharyngeal port should always be closed for vowels, while others are of the opposite opinion. Birch and associates [1] inspected the velopharyngeal port in 18 professional opera singers and found a small opening for most vowels sung by a majority of the singers. Nasal resonance has been the object of three recent research projects, which will be presented and discussed in the present round table.

Havel and Sundberg [2] have measured frequency responses of the nasal tract in cadavers and models and showed that the nasal tract is heavily damped and that the paranasal cavities are absorbents, producing dips in the response curve, see Figure 1. In eight cadaver nasal tracts the Q-value of the first resonance varied between 4 and 18 (mean 9.1, SD 4.2). This is several times lower than for a corresponding cylindrical tube. The bandwidth of the first resonance of a compound system, which consisted of a metal vocal tract complemented by a metal nose model, was substantially increased, when the nose model was attenuated by means of a piece of cotton. These experiments indicate that the first formant of the vocal tract can be widened by opening the velopharyngeal port.

Gill and associates [3] had singers sing a vowel sequence with varied sizes of the velopharyngeal port, documented by analysis of the nasal and the oral flow, which were captured by means of a divided flow mask. The analyses showed that the first formant peak of a long-term-average spectrum was attenuated by a velopharyngeal opening to an extent that increased with the size of opening, see Figure 2. With a small opening the spectral balance changed in favor of the high frequency components in the region of the singer's formant cluster.

Titze and collaborators have shown, by theoretical as well as by experimental work, that instabilities are likely to occur when one of the lower spectrum partials coincides with the first formant [4,5], an effect generated by nonlinear source-filter interaction. Sundberg and associates [6] failed to observe this effect in professional singers. An experiment was recently carried out where the nonlinear source-filter interaction was increased by lengthening the vocal tract resonator by means of a 70 cm long tube. Under these conditions, strong instabilities occurred, making the production of certain pitches completely impossible in a male subject, see Figure 3. This effect could be eliminated under two conditions, (1) if the lowest resonance of the compound system was attenuated by inserting a piece of cotton in the open end of the tube and (2) if the velopharyngeal port was opened, i.e. during nasalized phonation. These observations strongly support the assumption that by an appropriately tuned velopharyngeal opening singers can eliminate or reduce the nonlinear source-filter interaction and thus avoid the risk of instabilities when the first formant coincides with a spectrum partial.

OBJECTIVES

To present these findings to voice clinicians, teachers of singing and voice scientists
To find out to what extent these results agree with these professionals' experience
To discuss the possibility that the nasal tract eliminates risk of instabilities
To discuss under what conditions a velopharyngeal opening causes a nasalized vowel quality

VOCAL FOLD FAT AUGMENTATION: FILLER EFFECT OR TISSUE REGENERATION?

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Fat has viscoelastic properties that are similar to those of the vocal folds; thus, it can be considered an ideal material for augmenting the vocal fold and for restoring its gliding tissue. Since the 90s, fat has been used for vocal fold augmentation; however it is still often considered as a temporary filler; consequently, implants are widely used. The graft resorption is one of the main concerns about the long-term validity of the procedure but, nowadays, the widespread use of fat grafting in reconstructive and cosmetic surgery has demonstrated that the outcomes of fat grafting are technique-dependent: the modality of fat refinement and handling and the placement in fat microdroplets according to the spaghetti-like technique are the crucial factors for the resorption rate reduction. The aim of this workshop is to describe the technique applied - and improved over the last 12 years - of fat harvesting, handling and placement, according to Coleman lipostructure principles, and to present the obtained long term results. Enhancing the contact between fat parcels and the host tissue and avoiding bolus injection are key factors to improve survival of the grafted tissue. Injecting in multiple tunnels also favors drainage of the liquid component of the lipoaspirate.
A further aim of the workshop is to discuss the biological properties of fat and the potential effects of its cellular components. The ongoing researches about adipose tissue have confirmed the high concentration of multipotent mesenchymal stem cells (ADMSC) in its stromal vascular fraction. These stem cells, capable of self-renewal and differentiation into multiple cellular lineages, are supposed to play an important role in regenerative processes after fat transplantation and, to date, a number of clinical trials up to phase III are active. Such an attractive potential lies in several properties: first, ADMSC can be retrieved in high number from either liposuction aspirates or subcutaneous adipose tissue fragments and can easily be expanded under clinical conditions; second, ADMSC are reported to be both immunoprivileged and immunosuppressive; third, the beneficial effects of ADMSC on injured tissues is not restricted to cell restoration alone, but also due to their transient paracrine actions. In this frame, a recent report in rats showed a high ADMSC treatment potential for vocal fold restoration associated with a significant recovery of hyaluronic acid together with an antifibrotic effect. For these reasons, we investigated the effect of different culture media on human ADMSC culturing and potential, starting from the isolation procedures, a crucial requisite to identify the most appropriate conditions in view of clinical applications. A future clinical use of isolated and expanded ADMSC to be injected into the vocal folds might be postulated for enhancing the results obtained so far, especially in cases of severe glottic incompetence.
The point of view of the laryngologist, of the plastic surgeon and of the biologist will be discussed.

W26-Singing Pedagogy 4 (Room4)

THE SCIENCE OF THE SINGING VOICE: HOW SUNDBERG'S ICONIC BOOK HAS CHANGED THE TEACHING OF SINGING IN THE LAST 25 YEARS

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This workshop led by EVTA, the European Voice Teachers Association, will examine how the work of Johann Sundberg and fellow voice scientists have changed attitudes, methods and outcomes in the Singing Teaching profession. Voice science has covered the disciplines of voice therapy, medical and health related problems. The teaching of singing is an artistic, creative and musical exploration of the voice but it has used much knowledge from voice science to great advantage.
It will begin with a brief summary of the main developments of voice science relevant to the teaching of singing followed by short personal accounts on the use of science in teaching, from members of EVTA e.g. digital technology, spectral analysis, formant tuning and will finish with an open discussion as to the future application of science to the study of singing.
This workshop will demonstrate with singers and teachers how the interaction of science and music can enhance the teaching process. It will be practical and cover classical, operatic and contemporary styles of music. EVTA President, Outi Kähkönen with other EVTA members will illustrate some of the teaching points raised in the workshop.

VIDEOKYMOGRAPHY IN PHONIATRIC CLINICAL PRACTICE

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Laryngostroboscopyis the commoninstrument for examination of the vocal fold mucosal wave in ENT and phoniatric practise. However, laryngostroboscopy is not a real-time registration and is therefore dependent of regularity of vocal frequency and intensity. This is, however, not the case in many dysphonic patients. A reliableassessment of the vocal fold mucosal wave cannot be obtained in these cases. In contrast to laryngostroboscopy, videokymography(VKG) is a real-time registration.This enables reliable registration of also irregular vocal fold vibration. The recent developments inVKG(Cymo™) make this instrument easy to handle in ENT and phoniatric practise. The VKG mounting consists of a rigid laryngoscope connected to the VKG camera. Via the camera controller, the pictures are fed into the archiving system. The obtained picture consists of wo parts. At the left side the overall view of the larynx with the selected line is shown. This line is sampled with a frequency of 7200/second. This written down at the right side of the picture. The line can be moved over the vocal folds in a scanning way and focus can be put on specific regions of interest (Fig. 2). The need of a real time registration in irregular vocal fold vibration is shown in fig. 3. This shows the irregular vibration in so called „grunt“ phonation. These characteristics make VKG the new „golden standard“ in examination of vocal fold vibration. The method and instrumentationare explained in the workshop and various clinical conditions are illustrated.

Fig. 1. VKG mounting. Left: total set up (including laryngostroboscopy).
Right: Detail ofv the endoscope and VKG camera.

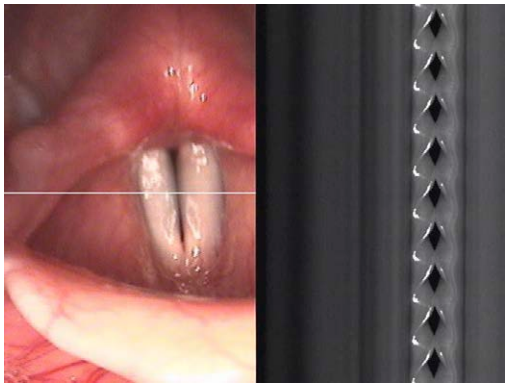

Fig. 2. VKG picture of normal phonation in a male.

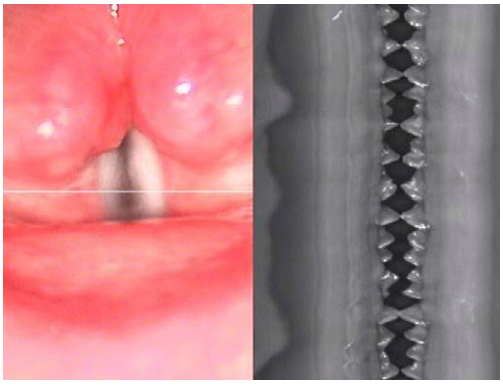

Fig. 3. VKG pictre of “grunting” voice.

W28-Singing Pedagogy 5 (Room4)

IMPOSTARE O LIBERARE? (TO PLACE OR TO LIBERATE?) THE METHOD OF VOICE RELEASE TROUGH THE MOVEMENT AT WORK WITH FUTURE ACTORS AND SINGERS

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The speech will be a presentation of my method of voice release through movement. Authorial method and exercises used in the method refer both to speech and singing. I will present my own research and work on a publication on the subject, which is produced in collaboration with a specialist - a physiotherapist.
As an introduction I will present examples of specific actions movement during performances and concerts, performed by established opera stars and young students of vocal art.
Then I'll will talk about relationship between practice and research, about the practical use of the mechanisms functioning in areas such as biomechanics, physiology, exercise physiology, anatomy and physical education in the process of releasing the voice.
I will show aspects from the borderline of physical culture and culture of the spoken and sung word. I'll talk about the work of the body in the process of voice training (emission and impostation).
Target of this demonstration are actors, singers, vocalists, teachers of singing and instructors and trainers who use the voice as an instrument of their work, or learn to use the voice.
I will try to answer the question, how do we know that the movement can influence the liberation of voice?
Triggering of voice with use of exercise treatment is a kind of voice therapy, creating, forming of habits and skills (proper speech or singing), prevention of voice problems in the employment of the body's reactivity to stimuli (in this case, the incentives in the form of physical exercise and changes in body position).
That is why this method was created in close cooperation with a physiotherapist. This will clarify the mechanisms of action and effectiveness of the exercise - of course, provided that the method will control specialist and will be implemented the methodology of conduct, so repeatable and systematic.

Every cycle of exercises should consist of three parts:

I. Adaptive (initial) part, popularly known as a "warm up".
II. Fundamental part
III. Relaxing part

One of the most important elements of work in my proprietary, authorial method of voice liberation by the movement, are accessories. Once I used in exercises only such accessories as: rubber expanders, ropes, fit-balls or gymnastic ladders, and now I introduced a novelty: hammocks for Aerial-Yoga.
I have observed that many positions of traditional yoga works excellent in teaching of voice impostation, but effects of antigravity yoga are even more spectacular. This applies especially inverted position, because gravity helps to the respiratory (*appoggio*) or to muscle relaxation.
I am a certified trainer of Aerial-Yoga and for over a year I use its exercises in working with students of acting. In my presentation I'll show pictures of exercises using hammocks.
This use of scarves (hammocks) is an absolute novelty in the work with the voice, and I hope that my method will be well accepted.
The author is a professor at the State Theatre Academy in Wroclaw, where she teaches subjects: vocal technique and impostation of the voice, while the method was established and based on many years of working with students of acting and observation of results achieved by students through physical exercise combined with work on the voice.

September 2

Claudia Manfredi (edited by), *Pan European Voice Conference : Pevoc 11 Abstract Book : August 31 – September 2, 2015*,
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W29- Singing Pedagogy6 (Room2)

THE ACOUSTIC LANDMARKS OF THE MALE PASSAGGIO: WHY AND HOW PEDAGOGIC STRATEGIES MUST VARY BY VOWEL

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The Acoustic Landmarks of the Male Passaggio: Why and How Pedagogic Strategies Must Vary by Vowel

Awareness of the acoustic registration events caused by changing interactions between the lower harmonics of the voice source and the first formant of the vocal tract can assist in working out a smooth, comfortable transition through the *zona di passaggio* into the upper range of the male voice. In order to establish a stable tube length and open throated *chiaroscuro* timbre, all harmonics other than H1 should be allowed to pass through F1 without formant tracking. Ten specific formant-harmonic intersections correlate with the historically identified *primo* and *secondo passaggi* of the male *zona di passaggio*, necessitating specific pedagogic strategies that differ by vowel. This workshop will demonstrate—via audience volunteers—how knowledge of the locations of these events, and of the passive vowel modifications that accompany them, can form an objective basis for a coherent acoustic approach to training male range.

At the end of the workshop, participants will:

1. Be familiar with all formant-harmonic interactions that occur within the male zona di passaggio
2. Understand why and how they differ by vowel
3. Learn pedagogic techniques used in implementing an acoustic approach to male passaggio training.

FP-Occupational 1 (Room1)

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OBJECTIVE AND SUBJECTIVE VOICE DATA LINKED TO BACKGROUND NOISE IN FEMALE PATIENTS WITH OCCUPATIONAL VOICE DISORDERS AND MATCHED CONTROLS

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INTRODUCTION: Speaking in high background noise levels is a well-known risk factor for vocal strain. To be heard in background noise the speaker typically increases the voice sound pressure level (SPL), which may result in increase in fundamental frequency (F0) and hyperfunction. Extensive voice use in background noise can cause voice symptoms such as vocal fatigue and hoarseness and eventually harm the vocal fold tissue due to the effect of accumulated vibration forces. Women with voice intensive occupations are at especially high risk of developing functional voice disorders. The most frequent diagnoses are phonastenia and vocal nodules. The aim was to examine the relationship between objective and subjective voice data linked to background noise in daily life in female patients with occupational voice disorders and vocally healthy controls. The research questions were whether objective and subjective voice data correlate and if there are any differences between (i) patients with phonastenia and vocal nodules and their controls; and (ii) during work and leisure time?
METHODS: Thirty-six women with voice intensive occupations participated in the study. Eighteen were patients with voice disorders (mean age 41 years, range 39 years), and 18 were controls (mean age 43 years, range 42 years). Ten of the patients were diagnosed with phonastenia and eight with vocal nodules. They were matched regarding age, profession and work place with vocally healthy colleagues. A voice accumulator (VoxLog, Sonvox, Sweden) was used register to register F0 (Hz), phonation time (seconds and percent) and SPL (dB) of the voice and background noise for a period of one week. During the week of the recording the participants also completed study specific self-reports concerning vocal fatigue, hoarseness, estimated speaking time and disturbing background noise on 100 mm visual analogue scales, four times per day (morning, 1st and 2nd half of working day, evening). The objective data from the voice accumulator was categorized into corresponding four time intervals and was analysed with the Software VoxLog Connect. The self-reported data was transferred to Microsoft Excel for calculations. Statistical analyses were made to compare objective and subjective data for the four time intervals per day during one week, for the two groups of patients and their controls.
RESULTS: Preliminary findings show that the patients reported voice symptoms to a larger extent than the controls. The patients also perceived background noise as more disturbing than the controls. The patients with vocal nodules spoke significantly louder and more in loud environments, >70 dBA, compared with the patients with phonastenia. The patients with vocal nodules also subjectively estimated that they were speaking significantly more and perceived background noise as significantly more disturbing than the patients with phonastenia. Furthermore, the patients with vocal nodules experienced vocal fatigue and hoarseness to a significantly higher extent compared with the patients with phonastenia. Phonation time was higher and vocal symptoms were reported to a larger extent during work than during leisure. Individual variations were large.
DISCUSSION: A better understanding of the interplay between objective and subjective voice data linked to background noise for individuals with voice intensive occupations, with and without voice problems, can be used to facilitate interpretation of data for clinical purposes and be used for voice ergonomics recommendations.

IMPACT OF A ONE-DAY PREVENTIVE VOICE PROGRAM FOR TEACHERS: A LONGITUDINAL STUDY

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PURPOSE: This study aims to evaluate the impact over a five-month period of a one-day prevention program for female teachers. This program includes both direct and indirect methods.
METHODS: Twenty-two female kindergarten and elementary schoolteachers with less than 5 years of experience participated in this study. Half of them (test group) took part in a one-day prevention program in October, while the other half (control group) received no counseling on the use of the voice.
For each participant, five sustained /a/ vowels and the reading of a text were recorded (1) at two times of the workday (morning and evening), and (2) at three times of the year: October (T0), December (T1) and February (T2).
For the sustained vowels, we measured maximum phonation time (MPT), mean fundamental frequency (F0), values of jitter, shimmer and harmonics-to-noise ratio (HNR). For the texts, we measured mean F0, standard deviation in F0 and intensity, and parameters related to speech rate (number of syllables per second, number of pauses and mean duration of pauses). For each parameter, a repeated-measures ANOVA (2 groups * 2 times of day * 3 times of year) was carried out.
Participants also completed a questionnaire on voice use and comfort at the three test sessions.
RESULTS:
Time of day effect
The main effect of time of day showed an increase in the mean F0 of the vowels and the text following a workday ($p<.01$). MPT and HNR also increased ($p<.01$), while jitter and shimmer decreased at the end of the day ($p<.05$). The speech rate measures showed that the teachers tended to pause less often while reading the text at the end of the day, and their pauses were shorter ($p<.05$).
Time of year effect
The main effect of time of year showed an increase in the mean F0 of the vowels and the text during the year ($p<.01$), with the highest values observed in December (T1). The speech rate measures also showed an increase in the number of syllables per second ($p<.01$) and a tendency for speakers to pause less often later in the year.
Group effect
Several acoustic parameters showed that voice changed during the day and during the year in significantly different ways in the two groups. Thus, the MPT increased more during the year for the control group than for the test group. The elevation of mean F0 during the day increased to a similar degree for both groups between T0 and T1, but continued to increase until T2 for the control group, while it decreased for the test group. Jitter and shimmer decreased significantly following a workday for both groups at T0, and this decrease was more marked for the test group at T1 and T2.
Finally, analysis of the questionnaires showed a very strong deterioration in teachers' self-evaluations of vocal comfort and control at T1; nevertheless there were significantly fewer complaints from the group that received the prevention program.
DISCUSSION AND CONCLUSION: For both groups, the changes in the observed parameters suggested an increase in vocal fatigue and hyperfunctional phonation during the day and during the year. The results showed greater vocal deterioration in December than at the other points in the school year (October and February).
For several acoustic parameters, the comparison of the two groups showed a less severe vocal deterioration for subjects who received the preventive program. Moreover, the questionnaires showed that the prevention program had a significantly positive impact on the changes in the teachers' perception during the year. These results encourage to offer such preventive interventions to teachers before or during their career, since they have a positive impact on teachers' perception and vocal comfort.

PERCEPTUAL RATING OF THE IMPACT OF VOICE DISORDERS ON OCCUPATION: IS THERE A CONSENSUS AMONGST VOICE PROFESSIONALS?

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The Royal National Throat Nose and Ear Hospital ENT Speech and Language Therapy Department has a consistently high and growing referral rate. It is, therefore, essential for us to use a robust and fair system for prioritisation to ensure we target those most severely affected in a timely manner. We have been using a prioritisation system devised in our department since 2004. This system takes the following parameters into consideration: Severity of dysphonia; Laryngeal lesion; Occupation; Voice Handicap Index score and Surgery.

Although our system has proven anecdotally effective, it has needed to evolve over time in order to accommodate occupations and lesions not originally included. In an attempt to make it more robust we have recognised the need to look at "occupation" more fully and to develop the evidence base of the impact of voice disorder on occupation. To this end, we have devised a questionnaire which aims to determine (a) whether there is a difference in ratings of the impact of voice disorders on occupation between ENT surgery professionals and SLTs working with voice, (b) what parameters professionals consider important when rating the impact of voice disorders on occupation and (c) whether the ratings of the impact of voice disorders on occupation are affected by the level of experience the professional has in working with a voice caseload.

For this study we have taken a sample of 590 referrals to our department, listed, and then grouped, the occupations typically referred. We have sent out a survey asking voice professionals to rate these occupations when considering the impact of a voice disorder.

Results showed no significant difference between ENT and SLT ratings for all occupations. ENTs and SLTs considered vocal load as their main decision-making factor. Level of experience did not indicate a statistical significance for rating impact of voice disorders on occupation.

VOICE PROBLEMS AMONG SOCCER COACHES – PREVALENCE AND RISK FACTORS

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The prevalence of voice problems has been investigated in various occupations. Voice problems have a negative impact on peoples' ability to work and affect their quality of life [1]. Research investigating sport coaches' voice problems seems to be limited even if coaches are an occupational group whose work requires heavy voice use [2]. Communication between the coach and the players is usually performed in group situations in which the coach has to speak loud or shout, often under unfavorable circumstances caused by loud background noise and long distance between the coach and the players. The aim of this study was to determine the prevalence of voice problems among soccer coaches and identify risk factors which can contribute to the problems in this particular occupation.

The data were collected with a web questionnaire that was sent to 500 soccer coaches. Overall, 109 males, who practiced soccer coaching to various extents, responded to the questionnaire. It included questions related to work and work environment. The presence of six voice symptoms was explored. The participants were asked to consider how often the symptoms occurred during the past year by indicating whether the symptoms occurred *daily, weekly, more seldom* or *not at all*. Health related factors and lifestyle habits that may have an influence on the occurrence of voice symptoms were also enquired.

Almost all of the participants had a coaching education. For about a fourth, soccer coaching was a paid full-time occupation, for the others it was a paid-part time occupation or an unpaid hobby which they carried out in their leisure time. The results showed that the prevalence of voice problems among soccer coaches was high. Almost 30 % of the participants reported two or more voice symptoms occurring weekly or more often The most common symptom was *throat clearing or coughing* followed by *the voice becomes low or hoarse*. There were significant associations between frequently occurring voice symptoms and the way the coaches exerted their coaching tasks. The coaches who had *voice demanding main occupations alongside their coaching tasks* showed an increased risk for voice problems. A significant relationship was found between *chronic rhinitis* and frequently occurring voice symptoms.

Given the extent of voice problems and the fact that soccer coaches have a vocally demanding occupation, it would be extremely important to increase the awareness of voice use among this group. Soccer coaches are in immense need of more information about voice ergonomics during their coaching education.

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PREVALENCE OF VOICE DISORDERS IN THE GENERAL POPULATION IN SWEDEN

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Several studies have explored the prevalence of voice disorders in specific occupations but only a small number of studies have investigated the prevalence of voice disorders in a general population. An opportunity to explore this was offered in a public health survey distributed to a random selection of adults.

Since only one question about voice was possible to include in the survey a procedure was undertaken to construct one single question prior to inclusion. In a pilot study, 183 consecutive patients completed two existing voice questionnaires. The final question selected for inclusion read: "*Does your voice tire, strain or get hoarse when you talk? Disregard symptoms that depend on current cold or upper-airway infection. The voice symptoms may vary but try to enter an average* (1= no, 2=yes, to a small extent, 3=yes, to a great extent). A group of voice healthy controls was recruited to try the question for its construct validity n=166 (M30/F136). The difference between the patients and the controls was significant at p>0.01 level. A self-administered questionnaire including one question on the occurrence of voice problems was sent out through a base-line survey to the Stockholm Public Health Cohort to randomly selected adults in the County of Stockholm.

A total of 103 265 questionnaires were sent out, 74 351 were returned (response rate 72%). The overall prevalence of voice disorders in the entire group was estimated to 16.9% where 15.5% rated 2=yes to a small extent and 1.5% rated 3=yes, to a great extent. The prevalence per age group is shown in table 1. There was a negative correlation between the prevalence of voice problems and socio-economic status.

Table 1: Prevalence of voice symptoms in men and women for different age groups:

	Men		Women	
Number:	32 170		40 976	
Voice symptoms:	Small extent (%)	Great extent (%)	Small extent (%)	Great extent (%)
Total:	14.4	1.1	16.3	1.7
18-24 years	7.5	0.4	11.4	1.0
25-44 years	9.3	0.5	12.8	1.2
45-64 years	13.4	1.2	16.4	1.7
65-84 years	20.2	1.5	19.7	2.0
85- years	31.5	3.6	31.0	4.7

The over-all prevalence (16.9%) was higher as compared to other studies. The main reason may be the age span of the investigated population. The highest percentage of voice disorders was found in the oldest groups, subjects aged 65-84 and 85 yrs and over. One more reason to the high prevalence might also be found in the phrasing of the question, it is broad and several symptoms are included. However, the question was tried for construct validity and the conclusion was that it significantly differed subjects with vocal disorders from the vocally healthy controls.

VOICE PROBLEMS IN PERSONEL WORKING ON A CRUISE SHIP AND SOME ENVIRONMENTAL FACTORS CONTRIBUTING TO THEM

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During more than two decades, the prevalence of voice problems have been explored in numerous occupational groups that have been considered to be traditional professional voice users such as teachers, singers, telephone operators, broadcasters and priests. Even if there seems to be a small genetic effect on the etiology of voice problems, environmental factors play a major role [1] and a large number of environmental and ergonomic factors that affect the voice have been defined [2]. Persons working on cruise ships represent a large variety of occupations sharing the same working environment. The purpose of this study was to explore the prevalence of voice problems and possible environmental factors contributing to them in personnel on a cruise ship.

Two hundred and six persons, 65 % women and 35 % men, all working on the same cruise ship, answered a questionnaire. The questionnaire was based on earlier studies on voice and working environment. The prevalence of vocal symptoms occurring weekly or more often during the past year was explored. Questions concerning working environment were enquired. Some health related questions were also included.

Of all participants, almost a fourth reported two or more frequently occurring vocal symptoms. There were no significant differences between women and men regarding the prevalence of the symptoms. Most of the participants experienced the work environment as onerous and almost all reported that they were exposed to noise and that the air quality was poor. In this population, the prevalence of asthma, allergies and chronic rhinitis was higher than in a normal population. Regarding smoking habits, almost a fourth reported that they smoked regularly and there was no significant difference between women and men. As to prevalence of frequently occurring vocal symptoms, there was no significant difference in smokers and non-smokers, neither in women nor in men.

In a normal population, the estimation of persons with voice problems is 6 – 9 % [3]. The results of this study indicate that voice problems are very common among those working on cruise ships. The results also showed that the work environment was noisy. One surprising result of this study was that there were no significant differences between women and men regarding prevalence of vocal symptoms. Another surprising result was that there were no significant differences in the prevalence of frequently occurring vocal symptoms in smokers and non-smokers, neither in women nor in men. This result differs much from the results of a recent study on smoking habits and vocal symptoms [4]. The frequent reports of allergy, asthma and chronic rhinitis might depend on poor air quality. The results of this study indicate that there are several environmental background factors affecting vocal- and general health on cruise ships.

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SMOOTHED CEPSTRAL PEAK PROMINENCE AND PERCEPTUAL EVALUATION OF VOICE IN TEACHERS

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Perceptual assessment of voice quality and type of phonation (on the axis from breathy to pressed) is essential to quantify and understand the vocal changes during voice training process. Acoustic measures are supposed to complement and objectify the evaluation, but many of them are found to be more or less unreliable [1]. Smoothed cepstral peak prominence (CPPS) has been shown to indicate dysphonic voice quality, especially breathiness, in voice clinic patients [2-8]. The present study applies the method on teachers who are vocally healthy enough to be able to work in their profession.

Text reading and sustained vowel [a:] were recorded from 195 female teachers. Other aspects of the data have considered in earlier studies [9-10]. Sustained vowel and continuous speech -samples were analyzed for smoothed cepstral peak prominence (CPPS) using Praat. Perceptual ratings of overall voice quality (10 points unipolar scale from poor = 0 to excellent = 10) and firmness of phonation (10 points bi-polar scale from breathiness = 0, adequate firmness =5, strainedness = 10) were performed for all samples by four experienced voice trainers. Relations between CPPS and perceptual voice quality and firmness of phonation were calculated with Spearman's rank-order correlation.

CPPS had statistically significant correlation with auditory-perceptual evaluations of voice quality and firmness of phonation in sustained vowel. The correlation coefficient for voice quality evaluations was r= .43 (p= .000) and for firmness of phonation r = .53 (p= .000). For continuous speech there were no significant correlations between CPPS and perceptual evaluations of voice.

Results show that CPPS from a sustained vowel correlated better with perceptual evaluation of voice than the same acoustic measure calculated from continuous speech.

Previous studies [2-8] have shown that CPPS is a promising tool in clinical practice. The results of this study suggest that it may be worth applying also in normal voiced subjects.

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FP-Acoustical/Mechanical Analysis 5 (Room2)

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DEMONSTRATING VOICE ACOUSTICS USING THE VOCAL TRACT ORGAN

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As part of on-going research into natural singing and speech synthesis, use is made of digital waveguides and vocal tract shapes are gained from magnetic resonance imaging. Having such images provides the possibility of making 3-D printed replicas of the oral cavity. The similarities between these and the pipes of a pipe organ were noted; hence the name: *Vocal Tract Organ*. These 3-D printed tracts are designed to sit on a loudspeaker that is driven with an appropriate signal that relates directly to the acoustic excitation provided by the vibrating vocal folds; at present this is the LF model [1]. Two versions of the Vocal Tract Organ have been realized: *instrument (1)* a 6-note polyphonic instrument playable from a MIDI keyboard and *instrument (2)* a one-voice version that is controlled via two joysticks that can be played by one person, offering the opportunity for a singer from a virtual 'choir' to be realised. The latter provides a basis for demonstrating the principles of singing and speech production in an interactive manner to students of music technology, singers, actors, clinic clients, and anyone attending public engagement events.

Taking the underlying explanation of the acoustics of voice production as a power source, sound source and sound modifiers [e.g. 2, 3], various possibilities exist for modelling voiced sounds. In the case of the vocal tract organ [4], the power source is electrical so there is nothing to model. The sound source is based on the LF model [1] and the source waveform can be controlled in terms of its fundamental frequency (f0), amplitude, vibrato rate and vibrato depth. Control of these is implemented by various means depending on the situation. The note played determines the f0 for *instrument (1)*; different tuning systems can be included as required. The amplitude may be controlled by MIDI key velocity, which gives it more of a piano-style control and/or only by a volume control such as a swell pedal or standard volume control. Vibrato is controlled by slider or rotary controls. For *instrument (2)*, the control can be from any suitable controller offering variable resistance and at present, a double joystick is preferred.

Implementation is based on Pure data or Pd for *instrument (1)*, and the LF model is implemented as a hand-drawn wavetable [5]. For *instrument (2)*, implementation is based on an Arduino MEGA [6] that is configured to create a wavetable synthesis of a pre-calculated LF model that can be controlled by two joysticks (joystick 1: F0/amplitude; joystick 2: vibrato rate/vibrato depth). The advantage of using an Arduino is that the resulting system is battery-powered, small, cheap and with an on-board buffer amplifier, it can drive the Adastra (952.210) loudspeaker, onto which the 3-D printed tract mates as a push-fit.

The vocal tract organ has been used to demonstrate the different vocal tract shapes involved in speech and singing both visually to point out the shape variation between vowels and acoustically to hear the differences. Changes in tongue settings are readily observed when comparing the 3-D tracts. *Instrument (1)* is a performance 'chamber organ style' instrument that provides a new way of realizing a vox humana (human voice) stop that is found on some large pipe organs [7]. *Instrument (2)* enables control of F0, amplitude and vibrato to be explored in the context of the sound of a single sound or as multiple voices working together in harmony, where control of F0 becomes very important.

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PERCIEVED NATURALNESS OF A 3D DYNAMIC DIGITAL WAVEGUIDE MESH MODEL OF THE VOCAL TRACT

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Physical modelling approaches to speech synthesis are often considered to provide the most potential for natural-sounding synthesized speech. In recent years, digital waveguide mesh (DWM) models [1] have been used for this purpose. Using an impedance-mapping approach [2], it is possible to make a two-dimensional (2D) mesh model dynamic, and so model the movements of the vocal tract made during speech. In [3], it was found that three-dimensional (3D) models offer a closer approximation to the acoustics of the real vocal tract than lower-dimensionality models. However, the 3D mesh model has not yet been made dynamic.

In this study, a simplified dynamic 3D DWM model is investigated in order to determine whether perceived naturalness is improved compared to existing 1D and 2D dynamic models. The impedance-mapping technique introduced in [2] is extended into three dimensions, with a 3D DWM model mapped according to a two-dimensional raised-cosine relationship at every point along the mesh. The maximum of each of these 'slices' is provided by the characteristic acoustic impedance of the vocal tract at that point, calculated from MRI scans of the vocal tract. This technique allows dynamic changes in the mesh in a manner consistent with articulatory changes during natural speech, without changing the overall mesh size.

The eight English diphthongs were synthesized using the above technique, as well as with one- and two-dimensional models using the same vocal tract data. Audio and laryngograph recordings were taken of the MRI subject, and the laryngograph recordings used to drive the models, preserving natural pitch fluctuations and reducing perceived unnaturalness associated with a synthesized source. The resulting audio files were presented to 34 participants as a listening test. Participants were told which diphthong to expect using context words, and provided with four audio clips for each diphthong – the one-, two- and three-dimensional simulations and the anechoic recording of the natural voice – presented in a random order. They were then asked to rate the naturalness of each clip on a continuous scale, from 0 ("not at all like a human") to 10 ("exactly like a human").

The results indicated that the simplified 3D dynamic simulations were considered to sound significantly more natural than 1D ($p < 0.00$) and 2D ($p < 0.02$) simulations. This suggests that three-dimensional simulations are worth investigating in the pursuit of natural-sounding synthesized voice. There were, however, several factors that require further study, particularly the fact that the median naturalness of the 3D simulation remains far below the maximum value of 10. Comments from several participants noted that there was more high-frequency energy present in the three-dimensional simulations, leading to a reduction in perceived naturalness. This may be attributed to frequency-independent losses at the boundaries, of which there are proportionally more in the three-dimensional model compared to the two-dimensional model, and therefore incorporating frequency-dependent boundaries is considered important for further study.

The purpose of this study was to determine whether an increase in dimensionality improves naturalness ratings, and as such many simplifications inherent in the two-dimensional model – such as channel symmetry and a straightened tract – have been retained in the three-dimensional model. Further work will investigate different methods of impedance mapping to account for the detailed three-dimensional geometry of the vocal tract, in order to further improve the naturalness of the model.

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EFFECTS OF VOCAL TRACT GEOMETRY SIMPLIFICATIONS ON THE NUMERICAL SIMULATION OF VOWELS

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Three-dimensional numerical approaches are currently being explored for the analysis of vocal tract (VT) acoustics [1] and for the generation of synthetic voice [2]. Typically, very detailed VT geometries obtained from Magnetic Resonance Imaging (MRI) are used for the numerical simulations [3]. Alternatively and for simplicity, VTs with circular cross-sections can be built [1,2,4] using standard area functions [5]. However, a large amount of options exist between the intricate MRI-based geometries and the very rough circular approximations, which may provide a better balance between voice quality and degree of geometry details. In this work, an MRI-VT geometry for vowel /a/ [6] is progressively simplified and analyzed by using the Finite Element Method (FEM) [4] and a multimodal (MM) approach [7]. Three configurations for the cross-sectional shape are considered, namely the realistic, elliptical and circular ones, which are combined in turn with bent and straight configurations for the vocal tract midline (see Fig. 1). The obtained results show that cross-sectional shape and bending variations have a strong impact in the high frequency range above 5 kHz, where high order modes can propagate. Below 5 kHz, plane waves dominate and the examined simplifications do not significantly influence the vocal tract acoustics, although some small formant deviations occur. Simplified vocal tracts turn out to be very useful because low cost computational methods, like the MM, can be applied to them with confidence. Whether the observed high frequency discrepancies will play a relevant role from a perceptual point of view will require further research.

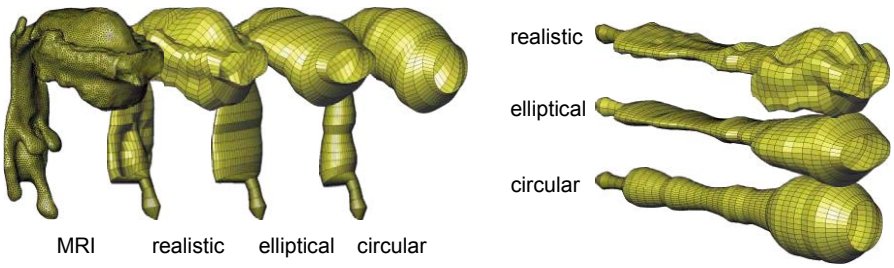

Fig. 1 – Vocal tract geometries. (a) Bent and (b) straight configurations.

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STUDY OF DIPHTHONG PRODUCTION USING A DYNAMIC VOCAL TRACT REPLICA

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INTRODUCTION

The experimental study of vocal tract acoustics is often performed with mechanical replicas having a static shape. This is convenient for the study of static vowels. However diphthongs are produced by rapidly changing (involving typical speeds of order of 200 mm/s) the vocal tract shape during phonation (voiced speech sound production). The wave propagation could be affected by the motion of the boundaries of the vocal tract. Thus, a vocal tract replica which can dynamically change its shape is of particular interest for the study of this kind of sounds. The aim of this work is to propose a dynamical vocal tract replica and to control precisely its shape variations.

METHODS

A. Dynamic vocal tract replica

A sound source connected at the entrance of the dynamical vocal tract replica allows to provide an excitation. The replica is constituted of a flexible cylindrical tube which can be compressed by four bars independently motioned by step motors. The position of the bars along the central axis and the constriction degree can be dynamically varied in order to generate different shapes having vowel like acoustical properties. Changing from the position corresponding to a vowel to another one allows to simulate a diphthong like sound. The generated sound is measured with a microphone and analyzed in terms of spectral properties.

B. Geometrical approximation

To be able to compare the measurements performed with the vocal tract replica, it is necessary to have an accurate description of its geometry at each time instant. To achieve this, a simple geometrical approximation of the cross-section of the compressed tube is proposed. It is described by a limited number of parameters. The evolution of these parameters along the axis of the compressed tube can be described with an analytical peak function such as a Gaussian or Lorentzian functions whose parameters can be fitted on the longitudinal profile of the compressed tube.

RESULTS AND CONCLUSION

Acoustic measurements have been performed near the exit of the dynamical replica while the motion of the bars simulating a diphthong like articulation is generated. In particular the potential influence of the speed of the motion is studied. Several excitation signals have been used:

- excitation signal 1: sinusoidal sounds with different frequencies,
- excitation signal 2: broadband noise,
- excitation signal 3: glottal pulse like signals.

The evolution of the amplitude of the sinusoidal sounds has been extracted as a function of time. The frequencies of the formants observed with the excitations signals 2 and 3 are extracted. Then, these data have been compared with static theoretical computation performed with a simple acoustic theory.

The following issues will be addressed:

- Is it possible to reproduce a diphthong like sound with this experimental setup ?
- What is the influence of the closure/opening speed on the acoustic properties ?
- Is there a difference due to the characteristics of sound source used ?

The presented dynamic vocal tract replica allows aero-acoustic study of the dynamic/articulartory aspect of human speech sound productions for vowels, but also for fricatives as well as plosives. Moreover, gathered experimental data enable model validation such as the simulated diphtonghs presented in [5].

RESONANCE TUBE PHONATION IN WATER – THE EFFECT OF TUBE DIAMETER AND WATER DEPTH ON THE BUBBLE FREQUENCY AND BUBBLE FORMATION MODES AT DIFFERENT AIRFLOWS

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I. INTRODUCTION

Resonance tube phonation in water is a type of semi-occluded vocal tract exercise, where the user phonates into a glass tube while the free end of the tube is submerged a few centimetres into a bowl of water [1]. The purpose of the present study is to study the bubble formation and back pressure caused by tube dimensions used in voice therapy.

II. METHODS AND RESULTS

The acoustic and aero-dynamic properties of two 26 cm resonance tubes with 8 and 9 mm inner diameters were examined. For the experiments, a flow-driven vocal tract simulator [2] was used to collect data on back pressure and flow for the different tubes. Three channels were recorded: audio, flow and pressure. Four experiments were performed.

Pressure/flow relationship. The tubes were assessed in air and at water depths 1-7 cm, in order to measure back pressure as a function of flow. When the tube ends were kept in air, the pressure increased slightly with increasing flow, but when the tube ends were kept in water, the starting pressure had to overcome the water depth before flow could start. Increasing the flow then resulted in a slightly increased back pressure. The results suggest that the back pressure has two origins; the water depth and the flow resistance of the tube itself. These findings corroborate the results of Amarante Andrade et al [2].

Bubble formation mode transitions. The tubes were submerged into water at depths 2, 4 and 6 cm and the flow was slowly increased. The points of shift from regular to bimodal, and from bimodal to chaotic pressure oscillations were identified by visual inspection of a spectrogram of the back pressure signal. The transitions occurred at significantly lower flows for the 8 mm diameter tube than for the 9 mm diameter tube.

Bubble formation modes, video recording. Close-up video recordings of the bubbles from the 26 cm length, 9 mm diameter tube at the depths of 2 and 4 cm were made. Sequences from the regular, bimodal and chaotic parts were selected for visual inspection.

Bubble frequency as a function of flow. The bubble frequency for the tubes at 2, 4 and 6 cm water depth was examined by keeping a steady flow within the flow range for periodic and bimodal bubble formation modes. For both diameter tubes, the bubble frequency increased when flow increased. However, the rate of increase of bubble frequency declined towards higher flows, indicating that bubble size also increase with flow.

III. DISCUSSION AND CONCLUSION

The thinner resonance tube behaves like a downscaled version of the wider tube. It produces a higher back pressure at a given flow, both in water and in air. The shifts between bubble formation modes occur at lower flows for the thinner tube. This results in a similar back pressure at a lower flow. In general, a small change in diameter seems to impact the acoustic and aero-dynamic properties of the tube to such an extent that it also might affect the therapeutic outcome of the exercise. This possible impact needs more attention in further research.

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VERTICAL LARYNGEAL POSITION DURING RESONANCE TUBE PHONATION WITH TUBE END IN WATER AND IN AIR

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INTRODUCTION: Resonance tube phonation with the tube end immersed in water (RTPW) is a commonly used voice therapy method. According to Sovijärvi [1], a main goal of this exercise is a lowering of the vertical laryngeal position (VLP), but this effect has not been thoroughly documented in previous investigations. In an earlier pilot study [2] a method for documenting the effect was tested in two subjects. Larynx position was measured by means of a Glottal Enterprises dual-channel electroglottograph. The method seemed to offer reliable data, provided that the electrodes were carefully placed on the subject's neck. The data further supported the assumption that RTPW could affect VLP.

METHODS: VLP in six vocally healthy male subjects was measured during RTPW with 6 cm, 2 cm and 0 cm immersion depths. VLP was calibrated by sliding the EEG electrodes up and down on the subject's neck while the subject sustained a vowel. The order of the immersion depths was randomized and all conditions were performed 4 times. VLP for the different conditions were compared to the values measured for normal phonation of the vowel /u/.

RESULTS AND DISCUSSION: In all subjects RTPW was found to be associated with a drop of VLP, compared to normal vowel phonation. The drop was greater for the greatest immersion depth. Figure 1 shows typical results observed for one of the subjects. Here the mean larynx lowering amounted to 14.5 mm and 16.5 mm for immersion depths of 2 cm and 6 cm. The order of the different immersion depths did not seem to affect the results.

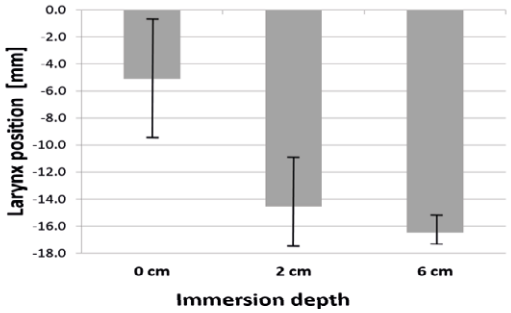

Figure 1. Mean difference in VLP observed in one of the subjects between normal vowel phonation and resonance tube phonation with the tube end at the indicated three immersion depths (RTPW). The bars represent one standard deviation.

DISCUSSION: The placement of the electrodes is crucial for the calibration of the dual-channel electroglottograph. This turned out to be difficult in some of the subjects, such that no data in mm could be obtained. On the other hand, qualitatively the RTPW was found to have the same effect in all subjects. In this sense the effect seemed rather robust, particularly taking into account that RTPW was a novel experience for all of them. A relevant question for future research is to what extent and under what conditions RTPW induces carry-over effects on larynx position during phonation.

CONCLUSION: The results show that the larynx is lowered during RTPW and that the lowering is greater for greater immersion depth.

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W30-Speech Pathology/Therapy 6 (Room3)

RESONANCE TUBE PHONATION IN WATER – A TUTORIAL WORKSHOP ON THE METHOD AND SOME OBSERVATIONS FROM HIGH-SPEED IMAGING, ELECTROGLOTTOGRAPHY AND ORAL PRESSURE REGISTRATION

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Voice training methods using a semi-occluded vocal tract are common. Phonation into glass tubes, keeping the free end of the tube in water, has been a frequently used voice therapy method in Finland since the 1960s [1, 2], and more recently also in other countries. The results of a study on the immediate effects of the resonance tube method on behavioral dysphonia showed that voice quality improved in the participants [3].

The results from our first experiments [4] including two participants show that changes in the backpressure during tube phonation into water alter the vocal fold vibratory patterns. As calculated from the glottal area variation by the high speed imaging, the open quotient increased with increasing water depth (from 2 cm to 6 cm). A modulation effect by the water bubbles on the vocal fold vibrations was seen both in the high-speed glottal area tracings and in the electroglottography signal. In another experiment, we found that the vertical laryngeal position was lowered during tube phonation in water, and that the magnitude of the movements increased with water depth [5]. In both of these experiments it was noted that the average oral pressure was largely determined by the water depth. Additionally, the back pressure of the bubbles modulates glottal vibrations with a possible 'massage' effect on the vocal folds. This effect and the well-defined average pressure increase due to the known water depth makes this method different from other methods using a semi-occluded vocal tract. The results of a recent experimental study by Amarante Andrade et al [6] also confirms that the flow-pressure relationship differs between tube phonation in water and in air, possibly making it easier for the clinician to control the amount of back pressure used by the patient if the tube end is kept in water. The intent of the workshop is to demonstrate the resonance tube method and to present some examples on how it can be used in various ways depending on the kind of voice disorder and the aims of the therapy. Some observations from high-speed imaging and electroglottographic registrations of vocal fold vibrations, vertical laryngeal position and oral pressure registrations will be presented. Ten participants can take active part using the resonance tubes and 30 persons can be passive participants.

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W31-Speech Pathology/Therapy 7 (Room3)

ERGONOMIC PROTOCOL FOR PROPER USE OF PROFESSIONAL VOICE

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Ergonomy is the science which deals with interaction between parts of a system and their functions, from a peculiar point of view, aiming to performances' optimization, with highest satisfaction, but avoiding damaging effects.
Even human beings or human vocal tract may be considered as "systems" or "part of a system", subject to ergonomic rules.
So, ergonomy controls that working conditions – both environmental and derived from working processes' organization - avoid physical and mental stress, enhancing performances.
But the voice student or professional can't apply on their own vocal ergonomy if they are not trained in.
The Authors present an ergonomic protocol to be applied in places where professional voice is studied or used.
Not only ambiental factors are evaluated, but also psychological (mental load, de-stressing working dynamics,…) and physical factors relating to "aptitude to vocal task" to be carried out as teacher, call centre operator, singer,…
The ergonomic protocol is a tool for prevention technicians dealing with "vocal risk", helps in planning knowledge and training meetings about vocal risk with observed populations, optimize job modalities and subject evaluations, from students to professionals, in order to limit as much as possible risks of vocal and professional damage.
Participants will be trained in vocal ergonomy following the protocol.

W32-Singing Voice 16 (Room1)

REAL-TIME SINGING VOICE SYNTHESIS WITH PHYSICAL MODELS

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I. INTRODUCTION

Most synthesized instrumental sounds that nowadays roll out of the computer are the result of physical modeling techniques. Physical modeling gained this dominant position due to its property to genuinely model the transient and nonlinear dynamic behavior of musical instruments, an aspect that is very important for our recognition of the instrumental sound and that is at the same time is very hard to model with deterministic, linear analysis-resynthesis techniques. The singing voice is beyond doubt the most complex and challenging instrument to physically model [1]. It is also the most studied musical instrument, but this is predominantly done with deterministic and linear models. Linear modeling means that an observed output is modeled as being linearly dependent on a specified input; a useful quality to define a cause and effect relationship. Consequentially, linear models prevail in explaining all aspects that characterize the voice. However, many aspects of the voice are better understood and also more naturally synthesized using physical modeling techniques and only by trying out these models we can get an impression how much.

Physical modeling is very different from source-filter modeling and uses its own terminology and abstractions. It takes time to learn the language, to understand what is actually modeled, how elements are physically linked together and how to interact and control such a model. This workshop aims at familiarizing researchers, clinicians, therapists, teachers or performers with physical modeling.

II. METHODS & TOOLS

Software environments to interactively experiment with real-time sound synthesis models have developed over the years and reached a form of standardization due to ever-growing user communities. These mature tools offer great opportunities for voice research and to share and communicate models. Recently, the “gen~” object became available for the MAX/MSP environment. With this development tool, complex models can be constructed by graphically connecting modular processing objects. The graphical scheme is directly translated to surprising efficient code, which-in processing speed approximates nerd-written assembly level, but which still is portable between platforms. Due to this efficiently, even the more complicated physical models that involve hundreds of elements and nonlinear links come into reach for a real-time implementation. This way of working brings with it a shift in thinking; no longer models are formulated in, and comprehended from structured code but from graphical abstractions only. An unanticipated advantage of this restraint is that the iterative and geometric setup of the physical system remains recognizable from the graphical layout of the model and can thus be directly interacted with. Moreover, the mathematical equations that define the system may look abstract on paper or in code, but these equations become transparent in the form of tangible links between the modeled units.

III. ITTERATIVE SCHEME

Underlying every physical model there is more or less the same iterative scheme. According to this scheme all spatially sampled information that describes the model’s state at one moment in time is evaluated as a whole to derive a new temporary sampled state description of the model. It will be explained how the graphical layout of the implementation also conveys this scheme. Understanding the where and when of the information flow and knowing the dimensions or physical units in which information is expressed is generally all that is needed to start editing and exploring the model.

We start from a relative simple vocal fold model where the physical behavior is captured into a limited set of elements only. Different versions of sub and supra glottal vocal tract models will next be coupled to this vocal fold model. A special focus will be on manipulating the amount of nonlinearity of specific interactions in order to demonstrate what makes physical modeling so special and different from linear source-filter modeling. Given the limited time span, extensions of the vocal fold and tract model are also presented but not discussed in detail. The topic of the physical modeling of the articulators is shortly treated. This workshop aims to complement other workshops that focus on more fundamental research topics.

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W33-Singing Pedagogy 7 (Room2)

THE SECRET KEY TO VOICE

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How it is possible that new born babies can use their voice for crying over many hours?
As yet only few studies have adressed this phenomenon. In many years of teaching singing and voice-therapy at universities, as well as daily treatment of numerous patients with voice disorders some experience has been accumulated for considering this question.
Physiological aspects and psycho-emotional factors are important for perceiving what exactly happens when voice power is produced (1).
The investigations from PEVOC 2013 about „Semi-occluded Phonation“ led me to undertake further practical studies with singers and voice patients with great success for their voices.
The connections between infant vocalization and „semi-occludedphonation“ reveals fascinating insights how to use the whole body for voice power.
My own question years ago was to consider what happens in the moments of birth before the first cry can be heard? The answer created the „Voice Function Circle“ (2) with six areas. My following question was „what happens exactly during babies crying with the body“ and led me to a new thinking about „semi-occluded phonation“ with measures of air-pressure and muscle tension in the laryngeal and articulation area, but also including body -movements like the „stretch-reflex“.
In this workshop not only theoretical information will be delivered, also some practical experiences should happen.

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W34-Speech Pathology/Therapy 8 (Room3)

SPEAKING IS HARDER THAN SINGING
TRANSITION OF VOCAL ABILITY TO SPEAKING ABILITY

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Workshop

In this workshop we work around the pedagogy of speech training for professional speakers.
Professional speakers include professionals whose work (mainly) consists of speaking (for example: politicians, actors, teachers) as well as experts in various fields of knowledge and skill, whose job it has become to speak about their work (for example: technicians, scientists). Both types of professional speakers will have to manage their vocal abilities whilst speaking in order to convey their content "in an inviting way".

A frequently encountered problem in vocal training is getting the most out of the cultivated sounds with regard to implementing those sounds in speech in a natural way. This workshop offers some practical steps that will provide a lot of effect to your work in a short period of time. The approach will strongly involve your client/patient in the voice work you do together: a work with independent individuals (and keeping it that way).

The work is based on 7 components:

1. "Experimenting and fun". Gathering voices, exploring the vocal system by moving the body, generating and imitating sounds.
2. "Listening and feeling". Defining what sound is, what voice is, independently of speech.
3. "self-consciousness and self esteem". Using listening for hearing and feedback, not for judging and correcting. Reinventing and mastering vocal use by discovering the connections between person, emotions, reactions, vocalizing and listening.
4. "Understanding and motivation". Speakers need to understand how the use of their voice can be influenced, and from where their vocal and speaking attitudes originate.
5. "Relating voice to speech and speech to content". Relating voice and speech sounds, general voice and speech, voice and meaning. How and in what way do vocal patterns influence the content of speech?
6. "Self-practice and self direction". Longer periods of work in daily practice between two sessions.
7. "Organizing feedback in a daily environment and work in progress". The client/patient appoints one or more persons as their evaluator. Evaluators are informed about goals and criteria of the work. Training starts in practice - from the first session onward.

All components are accompanied by their own games, exercises and assignments. However, this workshop is not about systems or methodology - it assumes that participants can use their own methods and skills as a starting point.

W35-Singing Voice 17 (Room1)

THE BODY INSTRUMENT: HOW THE BODY IS ESSENTIAL FOR VOICE QUALITY

Nana Fagerberg, Sophie Ziedoy
Anne Rosing Institute, Hellerup Denmark

In this workshop we will present the principles of the Singers ABC, and through practice based exercises demonstrate the direct impactThe Body Instrument has on breath support and the voice.

The body is as much the instrument as the larynx when it comes to singing.
When working with singers Anne Rosing hasdeveloped a progression that takes in consideration the three main principles for a healthy and sustainable voice: The Body Instrument, breath support, and vocal onset. We call this the singers ABC, which reflects the progress and specific order between the three.

In building The Body Instrument we strive for the muscles to be strong and flexible so the lumbar and neck curve straighten and the thoracic curve deepens, so the thorax reaches its maximal width and depth. When the thorax is expanded the diaphragm flattens, and therefore The Body Instrumentcontains a built-in inhalation.

The Body Instrument and the breath support create the optimal working conditions for the vocal folds and this is where a possible insufficient adduction of the vocal folds is (sometimes) revealed. If this is the case we work with detailed exercises to activate the adducting muscles (m. arytenoideus transversus & obliquus and m. cricoarytenoideus lateralis), so the vocal folds can vibrate freely in their full length. The tone produced here is egal, sonorous, rich in overtones and not least personal qua the individual physiognomy of the singer.

The workshop is practice based, soplease wear comfortable clothes and bring a yoga mat.

Short CV for Sophie Ziedoy and Nana Fagerberg:
Both CCM singers and Junior Partners in the Anne Rosing Institute (www.anne-rosing.org) where we teach singers, vocal pedagogy, voice rehabilitation, body instrument training, anatomy and physiology for singers and voice teachers.

Sophie Ziedoy:
Master in Music, Rhythmic Music Conservatory
2 yr. course in Voice Embodiment
1 yr. course in Voice Rehabilitation

Nana Fagerberg:
Master in Musicology, Cph. University
2 yr. course in Voice Embodiment
1 yr. course in Voice Rehabilitation

Together we have 20 years of experience in teaching singing and voice technique at: Copenhagen Music School, Rhythmic Music Conservatory, The Royal Academy of Music, Musicology at Copenhagen University etc.

W36-Singing Pedagogy 8 (Room2)

VOWELS IN COMPLETE VOCAL TECHNIQUE & VOWELS AS IT'S OWN METHOD

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Vowels and their pronunciation are an important part of vocal technique. Our aim is to give the participants science- based, concrete tools for working with vowels in singing.

In Complete Vocal Technique (CVT), vowels, as well as volume, laryngeal gestures etc., play a great role in defining 4 different vocal modes - each of which have certain limitations and offer various possibilities for vocal expression. In this workshop we introduce an overview of CVT, present the 4 vocal modes and the vowels attributed to them.
Theoretically, and through practical exercises, this part of the workshop will clarify why vowels are such an important part of CVT as a method.

We then present another angle, independent from CVT, to vowels as a tool in singing and in singing tuition. Different vowels produce unique sound characters and have different volume potential, and thus can result in different vocal modes. Making singers aware of text pronunciation and possible vowel modifications, enables effective and healthy voice production with extended freedom to artistic expression.
In this part we present common vowels and their tongue positions, volume ranges, and sound characteristics, and engage the participants in practical exercises individually and as a group.

About Annika Holmberg and Ville Laaksonen

Annika Holmberg, Authorized Complete Vocal Technique Teacher, Singer and Performance Coach at Vocal Soul, Sweden, was educated by Cathrine Sadolin, starting before the opening of Complete Vocal Institute, and is one of the most experienced CVT Teachers. She has taught singers within all styles of music and levels, coached musical theatre productions, professional artists, actors and voice teachers during more than a decade. In her work as a vocal coach, she also applies strategies based on other voice research, studies of Sports Psychology, Mindfulness etc., as well as from her experience as a touring and recording musician, composer and artist.
More information at www.vocalsoul.se and www.vocalsoul.com

Ville Laaksonen is a singer, voice teacher and coach based in Helsinki, Finland. He has studied voice and pedagogy at the Sibelius Academy and Complete Vocal Institute. He is one of the first and most experienced Authorized Complete Vocal Technique teachers in Finland. Nowadays he runs a popular voice studio in Helsinki and works with best-selling artists and beginners with same passion. As a singer, Laaksonen has worked in musical theatre, with bands such as Nightwish and performed in international shows on TV. He released his solo debut album Boy With Strings - Spaces Between Memories in May 2015.
More information at www.villelaaksonen.com.

W37-Speech Pathology/Therapy 9 (Room3)

A SPEECH THERAPIST'S APPROACH TO VOCAL CORD DYSFUNCTION (VCD)

Devold Jannicke
Department of Speech and Language Disorders, Norway

Team of voice disorders at the Department of Speech and Language Disorders in Norway, offers treatment to approximately 200 clients with different voice disorders each year.Anincreasing group of clients at our center is diagnosed withvocal cord dysfunction, VCD orParadoxical vocal fold movement, PVFM.VCD is a disorder where the vocal cords start to close when inhaling, instead of opening. This condition leads to difficulties in breathing with symptoms like feeling of being choked, stridor, wheezing, coughing and pain in the chest.

The last ten years we have treated about 170 personswith this diagnosis, referred to us by ENT-specialists. Most of the clients that we have met are young people, mostly girls, 14-18 years of age. Usually they are active in sports and some of them compete at a high national level. Their main symptoms are breathing difficulties during training and competition. Another group with VCD symptoms is those who do not do sports. The symptoms appear more accidentally, such as before going to sleep, before exams at schools and other situations regarded as stressful. In both groups we see that VCD symptoms can lead to different degrees of anxiety.

Due to our clinical work we experience that clients with VCD is a complex group who need a holistic, multidisciplinary approach. These clients are often clever with high ambitions and increased vulnerability of failing. They often have high muscular tension, reduced stability and restricted breathing patterns. We think that VCD is caused by a biological vulnerability, unconscious emotions and repeated patterns in the body.

This presentation will focus on aspeech therapist'sapproach to VCD. We want to share our experiences and ideas from a clinical point of view.

POSTER SESSION

Claudia Manfredi (edited by), *Pan European Voice Conference : Pevoc 11 Abstract Book : August 31 – September 2, 2015*,
ISBN 978-88-6655-794-4 (print) ISBN 978-88-6655-795-1 (online)

Acoustical/Mechanical Analysis

Claudia Manfredi (edited by), *Pan European Voice Conference : Pevoc 11 Abstract Book : August 31 – September 2, 2015*,
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HOW STRESSFUL IS 'DEEP BUBBLING'?

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Abstract not available at time of publication

DEVELOPMENT OF A CONPREHENSIVE CLINICALLY AVAILABLE PROGRAM FOR HIGH-SPEED DIGITAL IMAGING

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Introduction: In previous study, we had proposed a variety of analyzing method for high-speed digital imaging (HSDI), such as laryngotopography[1-6], multi-line kymography[7,8], and edge analysis. In this study, we tried to create a comprehensive clinically available analysis program for HSDI.
Methods: Subjects were representive data of vocally healthy subjects and various voice disorders (e.g., vocal fold atrophy, sulcus vocalis, vocal fold paralysis, vocal fold scar, vocal fold polyp, vocal fold nodule). High-speed digital images of a sustained phonation /i/ at a comfortable frequency and sound pressure level were recorded at 4500 fps. Data processing was performed with an automated analyzing program (Laryngo-Analysing System of the University of Tokyo; LAST) developed by the corresponding author (H.Y.) at our institution, using a custom MATLAB program (R2014a; The Mathworks, Inc., Natick, MA). Laryngotopography, kymography (single and muti-line), and edge analysis were implemented in this program.
Results:Mean of data analyzing time of each case was about 10 minutes.
Discussion: We are planning to distribute an available programs for MATLAB non-implementede PC using the MATLAB compiler.

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RESONANCE TUBE OR LAX VOX?

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Voice training and therapy utilize phonation into tubes, the outer end either in the air or immersed in water. Two types of tubes are typically used: glass *resonance tube* (26-28 cm in length, 8-9 mm in inner diameter) [1], and silicone *lax vox tube* (35 cm, 9-12 mm) [2]. Depth of immersion in water is 2-15 cm for the *resonance tube* and 1-7 cm for *lax vox tube*. This study compares (1) flow resistance of *resonance tube* and *lax vox tube* when submerged 2 cm and 10 cm in water, and (2) phonation into *resonance tube* and *lax vox tube* with the outer end immersed 2 cm and 10 cm in water.

The mean air pressure for steady flow rates of 60-600 ml/s was measured at the tube inlet, when the outer end of the tube was submerged 2 cm and 10 cm below water surface in an aquarium using immersion angles of 30, 45 and 90 degrees. Compressed air, reduced to max. 0.85 bar, was used as the flow source. Measurements were made with a floating flowmeter (EMKO DF3 09K5) and a digital manometer (GDH 07 AN).

Three males and three females phonated 3 times in habitual loudness and 3 times loudly into a *resonance tube* (27 cm) and a *lax vox tube*, with the outer end submerged 2 cm and 10 cm in water. Half of the subjects started with the *lax vox tube*. Recordings were made for oral pressure (MSIF, Glottal Enterprises), electroglottographic signal (dual-channel EGG, Glottal Enterprises), and acoustic signal (AKG C5441 at 6 cm from the lips). CSL 4500 (KayPentax) was used (44.1 kHz, 16 bits). Sensations during tube phonation were registered with an open questionnaire. Peak oral pressure P(oral) during [p] and shuttering of the tube was measured for an estimate of subglottic pressure P(sub). Mean P(oral) during vowel portions was measured to calculate P(trans) = P(sub)-P(oral). Analyses were made with SoundSwell Signal Workstation (Nyvalla DSP). Contact quotient (CQ =contact time / period time), derived from EGG, was calculated with VoceVista (35% threshold level).

Flow resistance was slightly lower with *lax vox tube* than with *resonance tube*, and slightly lower for smaller immersion angles. Flow resistance was higher for lower flow values (corresponds to soft phonation). The only significant difference was that CQ was somewhat lower for softer phonation into *lax vox tube* immersed 2 cm in water. Half of the subjects preferred *resonance tube* due to stronger sensation of vibration at the lips and sensation of less air consumption. The other half preferred *lax vox tube* since it felt more pleasant between the lips and they felt sensation of vibrations also on the cheeks and forehead.

The differences in length, material and inner diameter of *resonance tube* and *lax vox tube* seem to have rather little effect on phonation. Only in softer phonation the somewhat lower resistance offered by *lax vox tube* may lead to less adduction of the vocal folds (smaller CQ). Due to the small number of subjects the results are preliminary.

Acknowledgements:
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A VIDEOKYMOGRAPHIC STUDY OF FLAGEOLET ACCORDING TO COMPLETE VOCAL TECHNIQUE

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I INTRODUCTION

Complete Vocal Technique (CVT) is a style-independent singing technique and teaching method, developed by Cathrine Sadolin (DK). The description of flageolet is mainly based on auditory perception and endoscopy (laryngostroboscopy & high speed registration). CVT defines singing in flageolet by two characteristics: vibration and closure of the vocal folds. CVT assumes that in flageolet, the vocal folds vibrate at the anterior part but not posteriorly. CVT states about closure of the vocal folds: 'They may or may not close completely posteriorly'. This might be a referral to the dorsal glottal insufficiency that is common in women. Flageolet is mostly used from C5 (women) / C4 (men) on and higher. Flageolet is mainly a way of singing at low intensity, but from C6 (women) / C5 (men) on and higher, it is also possible to sing louder in flageolet. Below C5 (women) / C4 (men), extra caution must be applied when singing in flageolet, as it is a very delicate way of singing that easily strains the voice and might cause technical confusion when being used without adequate knowledge and skills. One may state that being able to shift easily between flageolet and 'normal' use of the voice (with complete vocal fold closure) is a technique for advanced singers.

The aim of this study was to investigate if it possible for vibration to occur over the entire length of the vocal folds during and whether there are different possible contact areas of the vocal folds when singing in flageolet (ventral, medial & dorsal).

II METHODS

In order to assess the vibratory pattern during singing in flageolet Videokymography (VKG) of CYMO™ was used. As opposed to laryngostroboscopy, VKG is a real time measurement, independent of periodicity of frequency and intensity. Therefore, VKG examination of the vibratory pattern is much more reliable than laryngostroboscopy. The vibration and closure of the vocal folds was assessed anteriorly, posteriorly and in the middle. The singers were instructed to sing a sustained note in several kinds of flageolet, from the lowest possible, until the highest possible.

III RESULTS

It was observed that in flageolet vocal fold vibration can possibly occur over the entire length of the vocal folds. Six different patterns of glottal closure were observed in flageolet:

Closure	Anteriorly	Middle	Posteriorly
1. Entire length	x	x	x
2. Middle and anteriorly	x	x	0
3. Anteriorly	x	0	0
4 No closure of the vocal folds at all	0	0	0
5 Middle	0	x	0
6 Posteriorly and anteriorly	x	0	x

IV DISCUSSION

The results of this study indicate that in the various conditions of flageolet vocal fold vibration is possible over the entire length. This was not observed by the researchers at the Complete Vocal Institute. The different findings may be explained by the use of a real time registration measurement (VKG) versus a not-real time measurement (laryngostroboscopy).

CVT describes an incomplete dorsal glottal closure in flageolet. In our study we observed six types of glottal closure.

The results of this study offer new insights on the mechanism of flageolet, as described in Complete Vocal Technique.

INVERSE PROBLEM IN HIGH-SPEED RECORDINGS OF THE VOCAL FOLDS

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High-speed recordings of the vocal fold dynamics during phonation have been shown to be a powerful tool for clinical assessment of speech disorders. Although visual inspection may be sufficient for voice clinicians to diagnose certain pathologies, quantitative image analysis provides additional useful information, in particular for functional voice disorders. Image segmentation algorithms have been used for tracking quantitative features, such as the projected glottal area, amplitudes or phase ratios (e.g., see [1]). Given a biomechanical model of the vocal folds, it is possible to infer material parameters by inverse problem solution, when image features are taken as input data [2]. Previous studies have shown satisfactory results for lumped-element model of the vocal folds [2-3]. Even though lumped-element models may be convenient with regard to the computational cost, crucial vocal fold characteristics for medical research, such as geometry and layered structure of the tissue, are not described in detail.

The present work is a prelimenary investigation on the inverse problem for parameter estimation of a three-dimensional continuum model of the vocal folds. The discussion mainly focusses on inversion methods and image processing procedures. The initial vocal fold model to be used in the inversion procedure involves flow-solid coupling and additional position-based constraints at collision [4]. Due to the complexity of the equilibrium equations, special attention must be paid to the choice of the inverse formulation, as deterministic inverse schemes may show limitations regarding the convexity of the objective function and statistical inverse schemes may require averaging process.. Furthermore, the suitability of different image segmentation techniques for input data extraction from high-speed recordings is analyzed.

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RELIABILITY OF OPERAVOX™ AS A VOICE ANALYSIS TOOL

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Introduction: OperaVOX (On Person Rapid Voice examiner) is a voice analysis software running on an iPod, iPhone or iPad. It is developed to let patients collect their own voice outcome data in a quick and easy way. Investigators found that the quality of iPhone microphones is sufficient to perform acoustic measures of voice. A recent study showed good reliability results compared to MDVP (Kay Pentx, NJ, USA) for the parameters F0, jitter and shimmer on a sustained vowel and good to excellent intrasoftwarereliability. In the current study the agreement with PRAAT will be investigated for all parameters of the OperaVOX™ app running on an iPad.

Methods: participants were 24 persons without a voice problem and 8 dysphonic patients. All subjects were native Dutch speakers.
The instructions of the OperaVOX app were translated into Dutch and given to all participants during the recordings. A standard text in Dutch was provided to replace the English text in the app.
Voice recordings were made simultaneously 1)following the instructions of the OperaVOX app running on an iPad and 2) with a digital Samson CU1 microphone connected to a laptop. The distance from the mouth to the iPad microphone and the digital microphone was 30 centimeters.
Voice analysis was done in three conditions: 1) automatically by OperaVOX 2) The voice samples recorded with OperaVOX were analysed using PRAAT 3) The samples recorded with the digital microphone and laptop were analysed in PRAAT.
Parameters analysed are f0(aa), jitter, shimmer and HNR. To evaluate user friendliness of the OperaVOX app the subjects filled in a short questionnaire.
The agreement between the software analysis and between the recording conditions was investigated using the Spearman correlation coefficient. A comparison of the acoustic parameters between normal and disordered voices was made using the Mann-Whitney test.

Results: Correlations between conditions 1 and 2 and were excellent ($r = .93$ to $.99$; $p < .01$) for the parameters f0 and HNR, both for healthy and disordered voices. Also good correlations ($r = .71$ to $.99$; $p < .01$) were found between condition 1 and 3 for the same parameters. For the parameters jitter and shimmer, less good correlations were found ($r = .29$ to $r = .74$). The subjects have evaluated the app as user friendly but they needed oral instructions before starting and the opportunity to ask questions during the first use.

Discussion: OperaVOX and PRAAT show the best agreement in fundamental frequency, which is the parameter that is least affected by different algorithms. This is in accordance to previous findings. Also HNR did correlate strongly between the different conditions, in contrast to shimmer and jitter. In a previous study in which MDVP and OperaVOX were compared, the opposite was found. This is possibly due to the different algorithms used. There was a tendency to somewhat better correlations between the app-analysis and the Praat analysis of the samples recorded with the app, than between the app- analysis and the Praat analysis of the external microphone recordings.

Conclusion: OperaVOX is a user friendly voice analysis tool for routine clinical data collection. In this study OperaVOX showed to be comparable with PRAAT for f0 and HNR.

Children

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INDOOR AIR PROBLEMS AND HOARSENESS IN CHILDREN

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A well-functioning voice is becoming increasingly important since voice demanding professions are increasing [1]. The largest proportion of voice disorders are caused by factors in the environment [1, 2]. Moisture damage is common [3, 4, 5] and can initiate microbial growth [6] and/or diffusion of chemicals from building materials [7]. Indoor air problems due to moisture damage is associated with a number of health symptoms, e.g. rhinitis [3], cough [3, 8] and asthma symptoms [9]. The purpose of this study was to investigate if children attending a day care center, preschool or school with indoor air problems due to moisture damage were hoarse more often than a control group.

The participants were 1857 children aged 6–9 years that attended 57 different day-care centers, preschools or schools with indoor air problems due to severe or minor moisture damage or without indoor air problems due to moisture damage. Information was collected through electronic and paper questionnaires filled in by the parents of the children. The questions chosen for the statistical analysis in this study were questions regarding respiratory and laryngeal symptoms, nasal symptoms and general information such as age, gender, number of siblings and which day care center, preschool or school they attended.

The results showed a significant association between indoor air problems due to moisture damage and being hoarse every week or more often. The association between having had laryngitis and having been exposed to indoor problems due to moisture damage was also significant. Dry cough, phlegm cough, and nasal congestion were significant predictors for being hoarse every week or more often. No significant age or gender differences were found.

The results of this study indicate that indoor air problems due to moisture damage are a part of the multifactorial background for hoarseness and should be included in a voice anamnesis. Indoor air problems due to moisture damage contribute to a number of known health symptoms and should be taken seriously and attended to.

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LENGTH AND FREQUENCY OF SPEECH THERAPY ON CHILDHOOD DYSPHONIA

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Introduction: Childhood dysphonia is one of the fields on the scope of speech therapists with little research on standardize methods and its applicability over time. The variables influencing the prognosis are not just the amount of sessions, even though an higher number of sessions is usually associated to efficacy.

The aim of this paper is to characterize the mean length of therapy in a group of children with bilateral vocal fold nodules. It also intends to describe other important variables that authors believe to influence the number of appointments to achieve voice normalization.

Methods: The sample is composed by 41 pediatric patients (until 13 years) with bilateral vocal fold nodules. A retrospective analysis of patient charts was done and the data regarding beginning and ending of therapy was collected as well as the season of the year with more appointments. The age distribution was between 4 and 13 years old (9,61±2,53), where boys were more frequent (56,1%). The significance level was established as p=0,05. Descriptive statistics as well as inferential were used according variables. The authors used the tests: Kendall-Tau-C and Mann-Whitney correlation.

Results: Among this group, 67% normalized their larynx configuration, 7% maintained the initial diagnose and 22% showed little improvement (after therapy it was concluded that one subject – 4% – had a vocal cyst and a contralateral lesion, instead of bilateral vocal fold nodules). Regarding the number of direct speech therapy sessions, in average these patients got 7,4±4,0, thus most of them got 7 appointments.

There was a low correlation between age and number of sessions (W=0,215, p=0,043).

A statistical significant difference was found on the amount of appointments according to the gender (U=97,5, p=0,017). The average number of appointments for male was 6 and 9 for female.

A statistical significant difference was also found comparing the number of appointments and the laryngeal condition after therapy (W=0,340, p=0,014). The absence of laryngeal disorder was attained with 7 appointments for 18 subjects and 6 subjects improved to bilateral nodular tendency after 10,7 appointments (mean values for both).

Based on frequencies analyses, results show the patients underwent therapy mostly on holiday months (mode is July).

Discussion: It is possible to conclude that with a higher age, more speech therapy sessions are required to achieve results, even though more studies are needed to confirm this assumption. To achieve efficacy the female group needed a higher number of appointments. The number of appointments does not predict the success of therapy, although 7 sessions were enough for most of the subjects. Most of the patients began voice therapy during holiday months, probably due to their preferences and not to collide with their academic schedule.

A PILOT STUDY OF TEACHING CHILDREN AGED 8 TO 12 TO SING 2010-2013

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There is a great deal of research about children´s voice and teaching children to sing. Compared to adult vocal pedagogy, teaching children to sing emphasizes more delicate approach both from the point of view of the physiology of vocal organs as well as the mental aspects of voice production.
The aim of this pilot study is 1) to delve into the characteristics of child vocal pedagogy using balance board to support voice production and 2) finding out, do emotions effect and support child´s voice. Can effective and emotional bodywork using individual keywords (”happy potter”, angry bird etc.) and balance board help the singing child release physical tension and sing more freely – increase sound making/singing as an emotional and a physical process?

18 months and 14 children
In addition to weekly half an hour individual singing lesson children had a group lesson once a month. Private lessons were focused on working with voice technique using emotional warm ups and balance board to find naturally better connection to body. Song material were chosen individually from pop to jazz.
In group situation children practiced music styles, scales (for example Locrian and Phrygian) and voice improviation.

Results:There is always an option
Using balance board and finding individual and emotional exercises for children helped and developed them as a singer. Singing became easier and felt stronger and every child´s voice range expanded. Very important observation was meaningful feedback for children. Using voice analyzer software (VoceVista and Praat) as a mirror helped children increase attention during singing lesson and understanding of voice. “Circle singing” – method in the same age peer group inspired and supported children for vocal improvisation. In group situation a sense of togetherness and safe environment supported and inspired all children .

pVHI: SUITABILITY IN AN EUROPEAN PORTUGUESE CLUSTER

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Introduction: Dysphonia is present in a wider number of children, with a negative impact on social interaction and academic proficiency. The importance of measurement instruments that reflect the magnitude of voice problems and the efficacy of Speech Therapy is enhanced. The main goal of this manuscript is to present the pilot-study results of a translated to European Portuguese and adapted version of the Pediatric Voice Handicap Index (pVHI).

Methods: This study reflects the results of the translation, retranslation and peer-review of the pVHI for speakers of European Portuguese. The pVHI is a parent proxy and self-administered questionnaire. It is subdivided in three parts: functional (7 questions), physical (9 questions) and emotional (7 questions). Furthermore, it begins with a question to describe the child conversational ability and ends enquiring about the perception of voice disorder.

A pre-test was conducted and the new version was applied to a group of 43 parents: 37 of children with no voice complaints and 6 of children diagnosed with organic voice disorders (age range 6-10 years old). The data was collected between a school and a central hospital in 2014. Statistical analysis was conducted using Shapiro-Wilk test and Mann-Whitney test, with a 95% of confidence level. The authorization from the original authors was obtained as well as the informed consent of participants and ethical committee approval.

Results: According socio-demographic data, 18 girls and 25 boys compose the sample. There is no girl in the voice disorder group – regarding boys, 6 of them present a laryngeal diagnose against 19 who do not. Age distribution in the pathological group has an average of 8,5 years old and in the non-pathological voices it is 7,7 years old.

Regarding the first question, most of the parents (55,6%) considered their children between the option 4 (average talker) and 7 (extremely talkative).

The average values of subsets and total score of pVHI were always higher in the pathological group, with statistical significant differences (except for the functional subset). For the last question, the mean value was higher (increased perception of voice disorder) in the pathological group, also with statistical significant difference.

Discussion: The mean age of the pathological group (8,5 years old) matches with other literature references. There is a higher prevalence of dysphonia between age 6 and 10.

All of the cases are boys, also supported by other researches, and it is justified due to personality characteristics and the higher prevalence of vocal abuse behaviors in this gender. The results of the first question also confirm their talkative profile.

The questionnaire sub-scores and total score reveal the sensitivity of the instrument to differentiate in a statistical significant way the group with pathology and the group without voice complaints (except the functional score). The higher average values were always in the physical sub-score because it refers to the organic changes of voice, which are highlighted in voice disorders. On the other hand, functional score didn't have statistical significant differences because, as expected, the social impact of dysphonia at this age range is not so perceived.

Against the results of other authors, the parents of pathological group classified their children voices as more severely impaired. This difference can be imputed to the place where this group was allocated. The data was collected in the ENT service of a central hospital, which means that those parents already identified the voice as problematic.

The final version of the questionnaire was considered appropriated to be used in the European Portuguese dysphonic children.

pVR-QOL: OUTCOMES OF THE PRE TEST APPLICATION IN AN EUROPEAN PORTUGUESE SAMPLE

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Introduction: The number of children with dysphonia has been increasing as well as the professional interest on it. It is broadly known that there is a male tendency until ten years old, mainly due to their social and behavioral vocal profile. The assessment of childhood dysphonia needs to be performed by different professionals, using distinctive approaches. Among those approaches, the impact of dysphonia on quality of life must be always addressed. The childrens' and parents' standpoint are useful to infer about their motivation to therapy.
This paper aims to present the process of translation, retroversion and cultural adaption of a vocal quality self-perception questionnaire – Pediatric Voice Related Quality of Life (pVR-QOL) – for European Portuguese speakers, as well as the completion of a pre-test.

Methods: This questionnaire was translated and adapted into Portuguese by specialists in English and Portuguese Language. Peer-review was done by three experts. Final version of the questionnaire entitled "Questionário de Qualidade de Vida Relacionada com a Voz Pediátrica (QVRVp)" is a parent proxy and self-administered questionnaire. It was applied to 44 parents. Two groups were formed: 37 parents of children without voice complaints and 7 parents of children with organic voice disorders (age range 6-10 years old). It is subdivided in two parts: social-emotional (questions no. 4, 5, 7, 8, 10) and physical-functional (questions no. 1, 2, 3, 6, 9). All the questions were compared as well as the sub levels. The data was collected between a school and a central hospital in 2014. Statistical analysis was conducted using Mann-Whitney test, with a 90% of confidence level. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS), version 22. The authorization from the original authors was obtained as well as the informed consent of participants and ethical committee approval.

Results: As main results we can point out the average age of 7.64 years and that 50% of the sample was female and 50% male. In terms of disease group, 4 children are female and 3 are males, while in the group with no complaints 18 children are female and 19 are male. There were statistically significant differences between the two groups. In a discriminative manner, 3 out of 10 questions identify the disease group compared with the group without pathology.

Discussion: With this research we conclude that the questionnaire used in this study can be a tool in the assessment and speech therapy intervention, with application in European Portuguese paediatric voice disorders.
The results of the pre-test show statistically significant differences between the two studied groups. In Portugal there is a deficiency of formal and reliable assessments that characterize the impact of voice disorders in quality of life. Larger sample studies should be considered for the future validation of this instrument, since it allows greater awareness of voice problems, which are increasing in younger ages.

Linguistics/Emotional

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PHONETIC CONSIDERATIONS IN VOCAL EFFORT ASSESSMENT

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Vocal effort is commonly assessed through the pronunciation of vowels because they are voiced phonemes, i.e., phonemes produced with vocal folds vibration [4]. However, some consonants are also voiced. Voice production requires adduction of vocal folds and build-up of transglottal pressure, i.e., difference between subglottal and supraglottal pressure [1]. In consonants, unlike in vowels, there is an oral airway constriction, which increases the supraglottal pressure [2]. Voiced consonants thereby require larger vocal folds adduction and greater amounts of subglottal pressure, i.e., greater vocal effort, than that produced for vowels; hence, they could be more informative during vocal effort assessments. Consonants also require a greater articulatory effort than vowels, and this effort varies according to the voicing contrast: Voiceless consonants are referred as "tense" and supposed to require a greater articulatory effort than voiced consonants, referred as "lax" [5]. The proportion of effort, vocal or articulatory, in the different phonemes is not known. In this study, we set up an experiment of self-perception in normal subjects, questioning the proportion of self-perceived effort during the production of items with 1 or 2 vowels pronounced with either voiceless or voiced consonants.

The phonetic material consisted of 12 French consonants (6 stops; 6 fricatives) with a voicing contrast [3]. They were set in 2 contexts with the French open vowel /a/: monosyllabic, i.e., with 1 vowel, and disyllabic, i.e., with 2 vowels. The items were opposed in pairs, according to the voicing contrast (18 pairs) or the vocalic context (24 pairs). These 42 pairs of items were set in 2 orders resulting in 84 studied pairs. They were mixed with 152 filers and presented in a randomized order through 4 pages. Ninety-six subjects (48 female; 48 male), aged from 16 to 54 years, participated in this study. The subjects were asked individually to read each pair aloud with marking a silent pause between the 2 items and to circle the one they found either more difficult or easier to produce, according to the given instruction (2 equal groups of subjects).

There was a significant effect of the vocalic context on the self-perception of effort during French consonants production ($F(1,4607) = 303$; $p < 0.0001$; $R^2 = 6.2\%$): 38% of the disyllabic items were perceived as requiring more effort than the monosyllabic items. This effect was modulated by the voicing contrast ($F(1,4606) = 26$; $p < 0.0001$; $R^2 = 0.6\%$) with a smaller effort for disyllabic items with voiced consonants (34%) than with voiceless consonants (41%). There was a significant effect of voicing contrast on the self-perception of effort during French consonants production ($F(1,3455) = 135$; $p < 0.0001$; $R^2 = 3.8\%$): 60% of the voiced consonants were perceived as requiring more effort than the voiceless consonants. This effect was modulated by the vocalic context ($F(1,3454) = 19$; $p < 0.0001$; $R^2 = 0.5\%$) with a larger effort for voiced consonants on a monosyllabic item (62%) than on a disyllabic item (55%).

Results showed that normal subjects perceived less effort during the production of items with 2 vowels than of items with 1 vowel. Adding a vowel did not increase the self-perceived vocal effort. Adding a phoneme could have increased the articulatory effort but the consonant duration is smaller for intervocalic consonants than for prevocalic or postvocalic consonants [6]. Thus, adding a vowel reduces the articulatory effort; the items are more speech-like. Results showed that normal subjects perceive more effort during the production of voiced consonants than of voiceless consonants. Voicing a consonant increases the self-perceived vocal effort. In addition, the vocal effort predominates over the articulatory effort, at least in French consonants. Thus, voiced consonants seem to be more informative than vowels in vocal effort assessment for French subjects. Further experiments could be conducted in another language with a voicing contrast occurring not only on the vocal folds vibration but also on the glottal aspiration. This experiment demonstrates that we should consider phonetic parameters in vocal effort assessment, especially when conceiving the speech material we use.

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RELATION BETWEEN HEARING AND SPEECH PERCEPTION OF THE ACTRESS AND THE ACTOR: PRAXIS UNDER CONSTRUCTION

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I. Introduction: According to Sanches and Alvarez [2] the hearing perceptual process, also entitled auditory processing, is a set of specific abilities of which the individual depends on to understand what is heard. It is a mental activity, a brain function, and must be studied as a multi-dimensional phenomenon to the received stimuli by the ear. The hearing perception involves processes such as: [2] attention; discrimination; integration and prosody. According to Pereira, Navas, Santos [4] the ability to produce intelligible speech depends mostly on the abilities to process acoustic spectrum paradigms and prosody of the sender speech. We may also say that is possible to relate the speech perception with the sender voice quality. According to Gimenez, Medrano, Sanches, Camargo [5] hearing feedback has an important role in the emission physic parameters control, as frequency, duration, and intensity. According to Coelho, Bevilacqua, Oliveira, Behlau [6] it is necessary to use motor adjustments that also rely on hearing in order to determined voice quality to be produced. There is a correlation between voice production and hearing function, therefore the hearing training reveals its importance to vocal development [5]. However, the opportunity to colligate the hearing processing and actor pedagogy research is verified , developing a praxis that stimulates the hearing and speech inter-relation during the actor learning process, as the artistic creation monitoring.

II. Methods: The method consisted in performing the exercise called "Sound Landscape", influenced by music education premises by Schafer [7]. The exercise proposes a sound landscape of an environment to be appreciated, identified and recognized by the students. Before initiating the exercise the teacher guided the group in a hearing warm up which was the students' exposure – who should have their eyes closed – to diverse sound stimuli in the presentation location, frequency, stimuli duration, and intensity. At the end of sound landscape presentations, the teacher guided the students to a debate about their experiences during the exercise.The general students impressions were collected; the recognition or not of the sound landscape throughout proposed stimuli and possible reasons to the reached results; change propositions in the sound landscape score whether necessary; the relation between the hearing perception caused by the landscape with the actor oral expressivity perception; the relation with the actor learning.

III. Results: The results pointed out by the students, as creators sound technicians or listeners, valued the experience by the opportunity to recognize the complexity of hearing act, including their relation with the sound production. That is, they recognized a strong correlation among the auditory perception, the sound expressions perception, the oral expression perception, and the verbal and non verbal sound production. The sound technicians creators realized how the sound stimuli choice and execution is determinant in terms of the sensorial, linguistic and cognitive building by the listener of the sound landscape chosen. This causes the reflection about the importance of perceiving oral expressivity own characteristics, contributing to the autonomy in their own oral expressivity.

IV. Discussion: In conclusion, the "Sound Landscape" exercise excited reflection in the acting students, not to mention meta-reflections about the narrow relation between audibility and oral expression of the actor, as well as a reflection about their occupation. According to Matteo Bonfitto [8] talks about the composer actor high lightening, among other things, the importance to the actor establishing dialog among making, thinking and performing. The experiencing selected sounds exercises during the landscape construction contributed to the recognition of the students about the impact of their choices through their own hearing perception, and in this case also by the listeners hearing perception. Therefore, the hearing perception is closely related to hearing feedback, which contributes to the oral expressivity feedback, essential to the actor expression composition. When Art and Sciences are put together, they account for a very promising epistemological field construction.

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PERCEPTIONS OF THE CREAKY VOICE QUALITY: CAN YOUR VOICE REVEAL WHO YOU ARE?

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In our studies and everyday work with voices we have found that a voice isn't just a mean of producing sounds and words to communicate but also a mean of expressing personality. A voice can be used to construct a persona (a social role) intentionally or subconsciously.

Working with voices on a daily basis we have observed an increase in the number of Danish young women talking with a creaky voice quality. A quality that until recently has been associated with male voices. American research suggests that more and more women use this creaky quality and that it might be motivated by a number of positive personality traits associated with it [1].

In 2010 Ikuko Patricia Yuasa, associate professor of Japanese sociolinguistics teaching at University of Iowa, published her results on the occurrence and perception of creaky voices among young women in the US [2]. She compared the creaky female voices with non-creaky female voices by having an audience rating the voices on six pairs of opposite attributes, for example educated/uneducated. She found that the women with the creaky voice quality were perceived as being more hesitant, nonaggressive, and informal as well as educated, urban-oriented and upwardly mobile than the modal voice counterpart. Yuasa concludes that creaky voice seems to be "a new feminine voice quality" for "educated urban upwardly mobile women with a hint of traditional femininity" [2].

In 2014 we published our hypothesis and observations of the creaky voice quality among young Danish women as well as our own analysis of what kind of persona a creaky voice supports based om the American publications. The interest from the media and the academic world was far bigger than expected. So we decided to conduct a more thorough research on how the creaky voice quality contributes to the construction of a certain persona.

The study was conducted in March 2015 and consisted of four readings of the same text by four students from University of Copenhagen age 20-25. These were played to an audience consisting of 50 students from Copenhagen Business School age 19-24. Three of the voices were chosen based on their degree of creaky voice quality and the lack of any other significant voice qualities. The fourth was a modal voice. The voices were played to the audience in the following order: mildly creaky female voice, creaky male voice, non-creaky female voice and creaky female voice. The audience were asked to listen to one voice at the time and evaluate it by writing their initial perception of the person behind the voice first and then evaluate it on nine parameters of personality traits. On the nine parameters the audience were asked to place the readers on continuums from 1-7. The nine parameters were as follows: extroversion, attitude, temper, intelligence, stress level, creativity, attractiveness, confidence and sincerity. The students were not allowed to talk to each other during the evaluation. Immediately after the first voice was assessed the second one was played and so forth.

We expected to find similar results and conclusions as Yuasa did in her studies but from the initial analysis of the results in this small scale study the creaky female voice was rated lowest on all nine parameters. Most significantly on the confidence parameter. The non-creaky female voice was perceived as the most intelligent, confident and outgoing. The female voice with a mild degree of creak was perceived as having a very mild temper and being fairly attractive among both female and male respondents. One conclusion could therefore be that the creaky voice quality is only positively perceived if it stays within the normality norm, meaning the voices that we regularly meet.

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EMOTION IDENTIFICATION BY HEARING IMPAIRED PEOPLE AND PEOPLE WITH NORMAL HEARING

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Introduction. Recognizing another person's emotions may sometimes be challenging, and even more so if hearing is impaired. Inability to understand emotional messages may have a negative impact upon social life, interaction and communicational conditions. Therefore, it is of essential importance to seek a better knowledge of vocal attributes and facial expressions and, a more holistic understanding of the nonverbal communication of emotions and how that is interpreted within people with impaired hearing.

Methods. Emotional nonsense sentences, sentences in Finnish language and prolonged vowels [a:], [i:] and [u:] (N = 80) were produced by professional actors of both genders (N = 4). Four emotions were expressed: anger, contented, excitement and fear. The recordings were made in a soundproof studio, using Logic Pro X workstation and Brüel & Kjær 4006 microphone. The samples produced were studied for the acoustic parameters by Praat software, and the statistics were analyzed by SPSS22. Perception tests for emotion identification were conducted for randomly chosen volunteers, 25 hearing impaired (HI) participants (20 females and 5 males) and 25 females with normal hearing (NH). The participants were native speakers of Finnish language. The HI participants used different hearing aid devices. The forced choice tests were conducted one by one with the participants in a soundproof studio. One loudspeaker and a screen were replaced in front of a participant. One half of the samples (N = 40) were replayed without video, thus, voice only was available. The other half (N = 40) was replayed without voice, thus, picture only was available.

Results. F0, F3, SPL, number and degree of voice breaks correlated significantly with the emotions identified in HI participants. One-way ANOVA showed significance between voice parameters and emotions identified: F0 $p < 0.01$, SPL $p < 0.001$, duration $p = 0.014$, number of voice breaks $p = 0.024$, and degree of voice breaks $p < 0.001$. In NH participants shimmer and harmonics to noise correlated significantly with emotion identification ($p < 0.01$). A statistically significant difference was found in emotion identification between hearing impaired participants and those with normal hearing ($p < 0.001$). Anger was best identified of the four emotions. Visual stimuli seemed to be easier to recognize than auditive stimuli by both groups: In NH participants 71% of the non-identified stimuli were auditive samples, and in HI participants 68% respectively.

Discussion. Voice quality seemed to be the key element in choosing the emotion for an answer in HI participants. Especially the arousal level (reflected in F0 and SPL) affected the decision. In regard to emotion identification from visual stimuli, poorer results were observed in HI participants than in NH participants. It may be concluded that impaired hearing does not give as strong support to other senses as normal hearing does. One explanation for the poor identification in HI participants might be that hearing aids have been designed to distinguish more between the words than the colouring of the voice. Moreover, processing may take a longer time in HI participants, starting from the reaction time of the hearing aid. Hence, processing may be slower and more volitional and therefore also more prone to flawed perception than processing among people with NH. Having two ears enables to segregate sound sources and to direct attention to one source. Targeted training programs are needed for HI people to ease their social interaction and everyday life.

Medical

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BODY COMPOSITION, PHYSICAL CONDITION AND PULMONARY FUNCTION IN PATIENT WITH VOICE DISORDERS

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INTRODUCTION: All disorders of the voice have large impact both on daily work and social activities of many people [1; 3]. A number of articles have illuminated the way in which posture, particularly of the cervical spine, is directly related to vocal resonance [2].
The purpose of this study is to explain whether the physical activity, body composition and pulmonary function affects the production of voice in patient with voice disorders with the indicators of healthy people.
SUBJECTS: The tests were conducted with functional voice disorders patients aged 19-52, (n=12; F =7 M=5). The control group consisted of healthy people of same age (n=12; F =9 M=3).
METHODS: Lung volumes were assessed the spirometry. Additionally Maximum Phonation Test was used. Their balance was tested by Stork test. Weight and body mass index was calculated. The patient's trunk muscle strength was tested by Lafayette Instrument. Functional voice disorders were identified by using laryngoscopy. Both groups filled the Voice Handicap Index 10 (VHI-10) questionnaires and indicated on the visual along scale the severity of their problem and a physical activity questionnaire.
RESULTS: According to the Body Mass Index voice disorders patients were overweight (mean 25, 97 ± 9.06 vs 24, 26 ± 4, 54) and their thoracic mobility was lower (mean 5 ± 3,5 cm vs 6,92 ± 4 cm). The control group maximum phonation was longer (mean 15, 35 ±7 sec vs 21, 80 ± 11, 68 sec) and their results in spirometry were better. Patients who were physically active had positive correlation between spirometry and trunk muscle ($p<0,05$) and Stork test too. Patients who regularly take part in sport rated their physical form higher ($p<0,005$). There was a positive correlation between regular physical activity, thoracic mobility ($p<0,01$) and spirometry PEF ($p< 0,05$).
CONCLUSION: The research indicated clear correlation between voice disorders, physical activity, maximum phonation time and spirometry. Physical activity affects the production of voice through the lung volume and improvement in respiratory function. Prospective studies and qualitative approaches may be useful to further understand this relation between voice disorders and physical activity and create more effective intervention programs.

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THE USE OF TWANG TECHNIQUE IN VOCAL TREMOR

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Vocal tremor is a common symptom of several neurological disorders. Tremors are defined as rhythmic involuntary oscillating movements, which, when the muscles of phonation are involved, have a disabling effect because of fluctuations in the amplitude and fundamental frequency of the voice (Monika I Sidor, 2010). In Norway, prevalence of vocal tremor is about 0.5%, i.e. approximately 5 individuals per 1000. The literature indicates there is little evidence that vocal treatment has any effect, but medication such as betablockers is sometimes used. Several research papers have been produced to show that botox can alleviate, but not eliminate vocal tremor.

Case description: Moderate laryngeal tremor in a 40 year-old male, teamleader. When speaking, he became embarrassed and concerned that his colleagues might interpret the tremor in his voice as a sign that he was about to cry. He wanted help but had no idea what kind of help might be beneficial in improving the flow of his speech.

Aim: The aim of this case was to evaluate the effect of Twang technique combined with resonance using the /m/ sound. Evaluation was carried out through client self-evaluation of tremor and fluency.

Method: The treatment was based on work with reflexive breathing and Twang technique combined with resonance exercises using the /m/ sound. Projecting the voice in words, short sentences and conversational speech was also a focus. Voice recordings were made during conversational speech in both the client's first language and in English, and using sustained phonation /A/.

Results: Analyses of the recordings demonstrate that the client can project his voice. When using the mask resonance in conversational speech, he achieves greater projection and more fluency, but the tremor persists if he does not use the method. He has become more conscious of the way in which he uses his voice and is able to project his voice when he wishes to. The knowledge that he has techniques to manage the tremor, has made him more relaxed and led to improved speech fluency and improved dissemination of spoken information to his colleagues.

VOCAL AND PSYCHOSOCIAL CHARACTERISTICS OF PATIENTS WITH PSYCHOGENIC VOICE DISORDERS

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I. INTRODUCTION

The diagnosis of psychogenic voice disorder is often a matter of discussion. Besides the absence of observable/structural abnormalities, there should be evidence of a stress event playing a role in the origin of the disorder. Besides that, a number of patient characteristics may be helpful in diagnosing this kind of patients. The purpose of this retrospective study is to create a profile of patients with a psychogenic voice disorder.

II. METHODS

Data were collected from 69 patients (59 women and 10 men) with a psychogenic voice disorder, including age, gender, perceptual voice assessment (GRBAS-scale), aerodynamic and acoustic measurements and psychosocial aspects as collected by means of the Voice Handicap Index.

III. RESULTS

Results show that a patient with a psychogenic voice disorder in 85% of the cases is a woman with an average age of 41 years, a moderately impaired score for G, a slightly impaired score for B, A, I and a nearly normal score for R and S on the GRBASI-scale. The average DSI is -1.6 and the average VHI is 56/120. The score on the physical subscale is significant higher than on the emotional and functional subscale, which is a surprising finding

IV. DISCUSSION

Gender, age and voice characteristics are quite obvious and in agreement with our clinical experience. The expectation that the VHI and the E-subscale more specifically would reveal some indication for the diagnosis of psychogenic voice disorders seems to be not valid.

A PRELIMINARY STUDY OF THE ACOUSTIC VOICE QUALITY INDEX IN FINNISH SPEAKING POPULATION

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INTRODUCTION: The Acoustic Voice Quality Index (AVQI) is an acoustic model, which has been developed to measure overall voice quality in both sustained vowel and continuous speech. The AVQI equation is based on six acoustic parameters (i.e. smoothed cepstral peak prominence, harmonics-to-noise ratio, shimmer local, shimmer local dB, general slope of the spectrum, tilt of the regression line through the spectrum). It has been reported as a reliable, and valid method to distinguish dysphonic and healthy voices. Furthermore, AVQI has proven to be highly sensitive to voice changes through voice therapy. Although AVQI was originally developed for Dutch speakers, this model has been validated and found reliable in different Germanic languages. The present preliminary study applied AVQI to the Finnish speaking population and investigated it's validly in Finnish-Ugric language group.

METHODS: The present study applied AVQI to 50 native Finnish participants. Nine of the participants were male and 41 were female ranging in age from 21 to 76 years (mean: 44 years, SD: 15.4 years). The recordings were made in the Tampere University Hospital and the University of Tampere. Twenty-two of the participants were patients in the Department of Phoniatrics and 28 of the participants were asked to join as healthy controls. All voice samples were recorded with an AKG C544L head-mounted condenser microphone and digitized at 44100 samples per second using the Focusrite iTrack Solo soundcard. Participants read aloud a text (i.e., "The nord wind and the sun" in Finnish "Pohjatuuli ja aurinko") and sustained the vowel [a:] at comfortable pitch and loudness. All voice samples were analyzed using the AVQI-script version 02.02 in the program Praat. Three medial seconds of [a:] and the first 23 syllables of the text were used for the analyses. The analysis automatically merged the voiced segments of the text with the sustained vowel can determined a single AVQI-score (scale from 0 to 10) per participant. In addition, five experts evaluated voice quality perceptually from the samples by means of the ordinal four-point equal-appearing interval scale of GIRBAS-scale. The inter-rater reliability among the five judges was considered substantial (Fleiss's Kappa = 0.62). In the present study the mean of the overall severity of dysphonia (Grade, G) was used to validate the AVQI in Finnish speech.

RESULTS: The mean for the AVQI scores was 1.48 (SD 0.67) for healthy voices and 3.95 (SD 1.88) for dysphonic ones. A strong correlation (Spearman's rho = 0.81) was found between the results of the AVQI and overall voice quality rating. Further, the results showed that the diagnostic accuracy of the AVQI was excellent. First, the area under ROC = 0.898, revealed high discrimination between healthy and dysphonic voices. Second, a preliminary threshold of AVQI = 2.35 in the Finnish language showed reasonable sensitivity = 0.821 and excellent specificity = 0.955. Lastly, the likelihood ratio (LR) confirmed the good results in diagnostic accuracy with the threshold of AVQI = 2.35. The higher the positive LR, the more confident the clinician can be that a person with a higher AVQI-score is dysphonic. A positive LR $\geq$ 10 indicates that a positive AVQI-score is very likely to have come from a dysphonic person. It was found a positive LR of 18.07 and it implies that elevated AVQI scores highly correspond with abnormal overall voice quality. The lower the negative LR, the more confident the clinician can be that a person with a low AVQI score is normophonic. A negative LR $\leq$ 0.10 indicates that a low AVQI score is very likely to have come from a person without dysphonia. Consequently, the negative LR = 0.19 in this study indicates that the lower AVQI scores nearly sufficiently correspond with normophonia.

DISCUSSION: The results of this preliminary study indicate that AVQI is a valid tool in the evaluation of voice quality also in Finnish speaking population. In future it would be worth controlling AVQI's assessment performance in a larger study group (especially with intermediate dysphonia levels), and examining AVQI's outcome in healthy voices before and after vocal loading and intensive vocal training.

SPEECH CHANGES AFTER PARTIAL TUCKER'S LARYNGECTOMY: THE REDUCTION OF REGRESSIVE VOICING ASSIMILATION

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INTRODUCTION: We use the reconstructive anterior frontal laryngectomy (LFAR) described by Tucker [1] to achieve complete excision of a laryngeal tumor while preserving the main functions of the larynx (phonation, breathing, swallowing). Partial laryngectomy generate a moderate to severe dysphonia, which was the subject of many studies. Crevier [2] demonstrated a modification of the vocal tract and of the formants induced by surgery. However, speech after laryngectomy, particularly in French, was not thoroughly studied. The aim of our study was an acoustic analysis of the regressive voicing assimilation phenomenon after partial laryngectomy of Tucker.

MATERIALS AND METHODS: 11 partial laryngectomy (PL) patients were recorded and compared to 10 healthy subjects matched for sex and age. We measured the regressive assimilation voicing with three indices: the voicing rate, the duration of the consonant treated and duration of the pre-consonant vowel. Patients were recorded for spontaneous and accelerated speech rate.

RESULTS: Statistical analysis showed a significant change in the rate of the consonant voicing assimilated in healthy subjects ($p < 0.05$) and in patients accelerated speech rate ($p < 0.05$) . The duration of the pre-consonant vowel is significantly altered in healthy subjects only in context of assimilation ($p < 0.05$). The duration of the consonant has not changed significantly for both healthy subjects and patients.

DISCUSSION: The corpus enables the detection of ARV phenomenon in healthy subjects. For patient only accelerated speech rate allows the identification of ARVs.

CONCLUSION: The ARV seems decreased in patients after partial laryngectomy of Tucker. The acceleration of the rate of speech allows its re-emergence. The partial laryngectomy causes a slowdown of the speech rate and a stuttering resulting in the disappearance of ARVs.

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PRELIMINARY STUDY ON CREATING A VOICE SCREENING QUESTIONNAIRE FOR ADULT COCHLEAR IMPLANT RECIPIENTS

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Auditory feedback plays an important role in voice use and laryngeal control is highly dependent on the ability to self-monitor auditorily [1, 2]. There is evidence that even short periods of auditory deprivation can affect speech and voice production [2, 3, 4]. Studies show that the voice of individuals who are deaf has a higher fundamental frequency and a lack of control regarding voice intensity and frequency. A procedure for restoring hearing is a cochlear implant. After gaining audio-feedback by a cochlear implant it is expected that there will be a gradually beneficial effect on both speech perception and speech production skills – including voice use. A systematic analysis by Coelho et al. [5] concludes that there are a limited number of studies with high-level evidence showing effects of the cochlear implant on the quality of voice of recipients. Like hearing through a cochlear implant takes time to learn or relearn, achieving a better voice does not happen spontaneously but needs guiding from a speech and language pathologist. Most CI recipients have had their hearing loss for a decade. The voice problem did not suddenly appear and therefore most of the individuals with cochlear implants are unlikely to seek professional help.
The aim of this study was to initate the development of a voice screening questionnaire for adult cochlear implant recipients.
A literature search was conducted and 4 domains that seem to be relevant when creating a voice screening tool for cochlear implant recipients were found. These are 1) Excessive adduction of the vocal folds and increased tension and strain, 2) Breathing pattern abnormalities 3) Inappropriate pitch level and lack of pitch variation and 4) Inappropriate loudness level and lack of loudness variation.
In this work no distinctions are drawn between pre- or postlingually deafened adults even though the impact on voice might differ due to the fact that postlingually deafened adults have had, at one stage, normal access to the sound of their own voice. Nevertheless it has previously been found that postlingual adults can develop voice abnormalities similar to those developed in prelingual deaf adults [4,8]. The reported voice abnormalitites are explained by limited auditory feedback in both populations.

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INVESTIGATING STRESS AND SELF-REPORTED VOCAL SYMPTOMS THROUGH LEVELS OF SALIVARY CORTISOL

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Objective: The objective in the present study was to investigate whether participants who reported more often occurring vocal symptoms showed higher salivary cortisol levels. Of interest was also to investigate if such possible associations were different for men and women. Psychological stress and elevated cortisol levels due to life stress influences well-being and has a connection to a variety of health issues [1, 2]. It has been shown that stress may be one of the risk factors for vocal symptoms [3-7]. A functioning voice is an essential part of well-being and a dysphonic voice influences quality of life [8]. Based on research results regarding stress and voice we hypothesized that the occurrence of vocal symptoms and cortisol levels would have a positive association.
Methods: The participants (*N*= 170; men *n*=49, women *n*=121) consisted of a population based sample of Finnish twins born between 1965 and 1989. The participants submitted saliva samples for genotyping and completed a web-questionnaire including questions regarding the occurrence of six vocal symptoms during the past 12 months. These vocal symptoms were; *Voice becomes strained or tired*, *Voice becomes hoarse or low in pitch*, *Voice breaks while talking*, *Difficulty in being heard*, *Throat clearing or coughing while talking* and *Sensation of muscle tension or a lump in the throat*. The participants reported how often these vocal symptoms had occurred by (*daily*, *weekly*, *less frequent* or *never*). The association between level of cortisol and occurrence of vocal symptoms was analyzed using the Generalized Estimated Equations (GEE) method, which takes into account the dependent structure of family data. The vocal symptoms were analyzed separately as well as a composite variable.
Result: The composite variable of the vocal symptoms showed a significant association with salivary cortisol levels. Three of the vocal symptoms had a significant association to the level of cortisol when analyzed separately. Participants who reported more often occurring vocal symptoms showed higher cortisol levels. The results indicated that there was a tendency to a gender difference regarding the association between the occurrence of vocal symptoms and the level cortisol. When analyzed separately, significant associations were found for women but not for men.
Discussion: The main hypothesis of the study was confirmed. There was a positive correlation and a significant results from the GEE analysis indicating that participant who reported more often occurring vocal symptoms showed significantly higher salivary cortisol levels. All vocal symptoms included in the study were not equally strongly associated with the level of cortisol. The results of this study provide hormonal insight to the investigation of how stress influences vocal symptoms.

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ROLE OF THE VOICE CLINIC IN THE VOCAL PEDAGOGY OF CCOM

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The author used to be an ENT doctor who received her higher education at Harbin Medical College and the Central Conservatory of Music. It has been 28 years since she started her career as a unique Phoniatrician at CCOM. This presentation will be concerned about her work.

She is convinced that the voice clinic can contribute to the vocal pedagogy in the following aspects:
1 Vocal Student Admission Selection(see her paper, Reference 1)
2 Voice Identification and Classification(see her paper, Reference 2)
3 Assessment and Therapy of the Speaking and Singing Behavior
4 Prevention, Care and Cure of the Singing Voice Disorders (see her paper, Reference 3)
5 Offering the Vocal Student Course: Singing Mechanism and Voice Care.
6 Co-Cultivate Postgraduate students

She holds that a voice doctor is an asset to a singing teacher and acts as the guardian angel of vocal students. What a voice doctor sees can make a voice teacher aware of what is happening in the vocal organ, which can cast light on such issues as why some tenor student needs to take great pains to sing high C or why some student often has some vocal problem and what the cause is.

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THE ANATOMY OF THE THYROID CARTILAGE AND THE CRICOTHYROID MEMBRANE

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Introduction

The thyroid cartilage (TC) and the cricothyroid membrane (CTM) are important anatomical and surgical landmarks in both, laryngeal 'in-office' procedures and laryngeal and neck surgeries. The laryngeal prominence is more prominent in adult males than females thanks to a more obtuse inter-lamina angle (ILA) among females. Anatomy textbooks classically state that the ILA is 90° in males and 120° in females. Few studies measured the laryngeal cartilages on cadavers revealing different results, ranging from 65° to 90° in males and 80° to 120° in females.

Our impression, based on thyroplasty type IV and chondroplasty operations, of much narrower angles led the current investigation.

Materials and Methods

The images of adult patients, who underwent computed tomography angiography (CTA) imaging of the neck with 0.9 millimeter slices, were revised. Multi-planar reconstructions of the larynx were used to realign the axial and sagittal planes. The ILA was measured at the level of the vocal processes (VP) and 5mm above. The anterior projection of the thyroid cartilage and the vertical dimension of the CTM were measured as well.

Results

The study included 126 patients (75 males and 51 females). The average ILA angle was 63.5±20.6 degrees and 93.3±16.6 degrees for males and females, respectively ($P<0.001$) and was significantly narrower at the upper level in comparison with the VP level ($P<0.001$). The anterior projection of the TC reached 18.4 degrees among males and was significantly correlated to the ILA ($P<0.05$).

The vertical dimension of the CTM membrane was 11.1±2.3 mm and 10.3±1.7 mm for males and females, respectively ($P<0.05$).

Conclusions

The ILA is narrower than reported in the classic anatomy textbooks. The upper part of the thyroid cartilage gets narrower and project anteriorly like a 'beak' or a 'jug's spout'.

The emergency airway access through the CTM during coniotomy procedure is limited by its vertical dimension, between 10-11 mm.

A COMPUTATIONAL UPDATE OF AGENT-BASED COMPUTER MODELS OF VOCAL FOLD INFLAMMATION AND REPAIR

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INTRODUCTION: Vocal fold injuries, surgical or phonotraumatic, trigger complex inflammation and healing processes. The reaction involves the recruitment of immune and repair cells to remove cellular debris and produce extracellular matrix (ECM) substances to repair the tissue. Agent-based models (ABMs) have been developed to simulate the cellular response of vocal fold tissue to injuries [1], [2], [3], with the ultimate goal of predicting individual patient's vocal injury and repair outcomes. The current ABM has been partially calibrated and validated against cytokine and ECM data reported in literature. However, as the ABM increases in complexity and fidelity to improve its prediction accuracy, significantly larger computing resources will be required. To address this need, efforts are made to implement the ABM on a parallel computer platform based on the currently dominant multi-core Central Processing Units (CPUs). Exploiting parallelisms in the simulations would reduce the computation time of large scale biological simulations from days to minutes, an important factor in maintaining its relevance in clinical settings. Such a platform will be valuable in both improving our understanding of vocal fold healing and in enabling patient-specific clinical therapy.
METHODS: The ABM world is discretized into a grid of patches that are occupied by autonomous entities called agents. Agents interact with one another and execute certain functions as governed by a set of empirically derived rules. In the vocal fold ABM, chemical, cellular and biological factors influencing cellular activity and ECM remodeling in the lamina propria are modelled as agents. Agents include: 1) platelets, 2) cells, 3) growth factors, 4) cytokines, 5) collagenase, 6) ECM substances and 7) high mobility group box 1 protein [1],[2],[3]. In this study, we re-implemented the previous NetLogo ABM platform using the programing language, C++. To achieve better accuracy, we increased the model from a 200 cells on a 120x240 world (in patches) to a biologically representative scale of about 200,000 cells on an 1160x1600 world (in patches). Since the scale of the problem being simulated is large, parallelization is required to achieve real-time simulation. For that, Open Multi-Processing platform (OpenMP) was chosen for its portability, ease of programming, and performance. OpenMP is an Application Program Interface (API), which supports multi-threaded shared-memory programming in C, C++ and Fortran. Visualization was implemented using Open Graphics Library (OpenGL). OpenGL is widely supported by most platforms and works on CPUs as well as GPUs, enabling smooth transition if an accelerator is desired for further model improvement. The performance data are collected from executing the model on a dual chip Intel(R) Xeon(R) CPU E5-2690 system. Each Xeon E5 chip contains 8 physical CPU cores, thus total of 16 physical cores are available on the system. Each core operates at typical clock speed of 2.90 GHz and turbo frequency of 3.30 GHz. Each of them also has private L1 (instruction/data) and L2 cache of size 32KB/32KB and 256KB respectively. A 20MB L3 cache is shared across all cores on each chip. A 128 Gigabyte RAM is available on this system.
RESULTS: A computation-only medium-scale 5-day simulation with over one million initial agents and patches, while taking 3 hours in NetLogo, took only 14 seconds using our multi-core CPU-ABM software. A large-scale 5-day simulation with over 2 million initial agents and patches, which was not feasible to run on NetLogo due to memory constraints, took only 30 seconds to run on the new CPU-ABM. The current parallelization of the CPU-ABM achieves a desirable speedup of roughly 5.5 times on a 16-core machine. Visualization is also implemented for the CPU-ABM. The speed of visualization is improved for seamless real-time visualization.
DISCUSSION: Our current CPU-ABM model has shown promising performance and computational speed ups of large-scale simulation of vocal fold injury and repair. Currently, speedups following parallelization are limited largely by resource contention (i.e., memory bandwidth) as well as by low number of arithmetic operations to number of memory accesses ratio. Modifications to data structures for increased data and task parallelism for further speed ups are being explored. Future work includes automated model training with empirical data.

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THE USE OF Dx-pH MEASUREMENT SYSTEM IN THE DIFFERENTIAL DIAGNOSIS OF VOICE DISORDERS

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Introduction: There is a large group of patients with chronic dysphonia in which we observe in videolaryngoscopy changes in the larynx mucosa corresponding extraesophageal manifestations of gastroesophageal reflux.

Objectives: The aim of this study was to determine the etiologic factor associated with the occurrence of gastroesophageal reflux disease in patients with voice disorders/chronic dysphonia .

Methods: We performed 24- hour oropharyngeal pH monitoring in 40 patients with chronic dysphonia. Laryngeal lesions were evaluated with videolaryngostroboscopy using Reflux Finding Score (RFS). Voice quality was assessed using GRBAS scale, sonograms and multidimensial voice program (MDVP). Patients filled the Reflux Symptoms Index (RSI) questionnaire.

Results: The probe was well tolerated in all patients. All subjects were found to have vocal abnormatities both in subjective and objective voice analysis. Most of patients showed nocturnal pharyngeal reflux only, the rest of them showed combination upright daytime reflux events and nocturnal reflux. We observed correlation between RSI scores and number of pH events registered during the pH monitoring.

Conclusion: Dx – pH Measurement System is an effective tool in diagnostic proces of chronic dysphonia.

VOCAL FOLD PARALYSIS – SPEECH THERAPY EFFECTIVENESS USING AUDIOPERCEPTUAL ASSESSMENT

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Introduction: Voice assessment is considered the first step in therapeutic approach and includes procedures in order to describe voice quality. The audio-perceptual assessment is one of the tools that Speech Therapists use in clinical practice. The chosen scale was RASAT, which assesses hoarseness, harshness, breathiness, asthenia and strain. It results from a translation and adaptation of GRBAS to Portuguese.

The role of Speech Therapy facing this type of voice disorder is, usually, to achieve a better glottal closure using intrinsic and extrinsic laryngeal muscles to improve or normalize voice quality.

This study aims to compare audio-perceptual results before and after speech therapy in a group of patients with vocal fold paralysis.

Methods: A retrospective analysis was performed based on the clinical records of 75 patients with vocal fold paralysis. All of them were followed by the same speech therapist at the *Centro Hospitalar do Porto - Hospital Geral de Santo António*.

The initial sample was 171 people diagnosed with vocal fold paralysis between October 2000 and June 2014. The follow exclusion criteria were applied: discharge from hospital due to lack of attendance at speech therapy; inpatient status; transfer to another hospital; missing values.

RASAT parameters were compared using median and the nonparametric Wilcoxon test, with a 99% confidence interval. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS), version 22.

Results: Among 75 patients, 22 were male (29,3%) and 53 female (70,7%). The mean age was 58,36 years old, ranging between 7 and 87 years old. The median intervention time was 59,50 days. The median time between the onset of dysphonia and beginning therapy was 53,00 days – which corresponds to less than two months.

The most representative type of paralysis was unilateral left vocal fold, in paramedian position. Regarding etiology, 44% was associated to total thyroidectomy and 18,7% due to unknown causes.

All RASAT mean values, except for *Strain*, were closer to 0 after speech therapy – which means a better voice quality.

Along the therapeutic process, *Breathiness* was the parameter with higher values in opposite to *Strain*, with the lowest ones. It should be noticed that *Breathiness* and *Asthenia* were the parameters that showed highest improvements. All the differences were statistically significant except the *Strain* parameter.

Discussion: Strain didn't face statistical significant changes because it is one of the strategies and the base of some therapy exercises, e.g. pushing. In opposite, the significant improvement of breathiness, asthenia and hoarseness can be justified due to a near-complete glottal closure, higher sub glottal pressure and higher stability in vocal fold vibration.

Patients who underwent Speech Therapy have a good chance to increase mobility of the vocal fold or compensate glottal incompetence, improving their voice quality and, therefore, their quality of life. Results show the effectiveness of Speech Therapy in this type of laryngeal conditions. Eventually, it can avoid more invasive interventions, such as surgeries. It also suggests a more cost-effectiveness approach to vocal fold paralysis.

HIGH SENSITIVITY FEES WITH NBI-ILLUMINATION

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Flexible endoscopic examination of swallowing (FEES) is a routine procedure to assess swallowing function and ascertain laryngeal penetration and aspiration. The most common way is to let the patient swallow coloured fluids or thickened material. Sometimes during endoscopy it is not easy to decide whether there is a laryngeal penetration or aspiration because the coloured material cannot be seen with enough contrast.

We describe a technique how to visualize even smallest amounts of penetrated or aspirated bolus parts. By colouring the material with green food colorant (pistachio green, E 104 + E 123) and using NBI-Illumination the bolus will be coloured bright red with an enormous contrast enhancement that can be seen very well, even with very thin secretion layers containing food colorant. Endoscopic images of the striking effect will be shown.

LONG TERM VOICE OUTCOMES OF PATIENTS TREATED WITH RADIOTHERAPY VERSUS LASER EXCISION FOR EARLY GLOTTIC TUMOURS

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INTRODUCTION: Voice outcomes following intervention for early glottic tumours have been reported but in small cohorts with short term follow-up. We present our long term voice outcome data comparing radiotherapy and transoral laser surgery for early glottic tumours in one of the largest patient cohorts in published literature.

METHODS: A retrospective review of patients treated for T1 to T3 glottic lesions was carried out. All patients attending a tertiary referral voice clinic for post treatment follow-up with Voice Health Index (VHI) 10 scores were included. Follow-up was over the standard head and neck cancer follow-up period of up to 5 years. Results were analysed using a general linear regression model and multiple imputations.

RESULTS: 67 patients were identified with VHI data available. Of these 31 had undergone laser resection and 36 had been treated with radiotherapy. The mean follow-up period was 2.38 years (0.25-5 years). Overall an improvement in mean VHI-10 scores was seen in both groups over the follow-up period. Radiotherapy patients had statistically higher VHI-10 scores in the first year of follow-up, with a peak deterioration at 9 months post treatment. Laser patients recovered better in the first 2 years than radiotherapy patients, although long term recovery to normal was slightly faster following radiotherapy.

CONCLUSION: Long term voice outcomes for both radiotherapy and laser treatment are comparable, although early voice disability is significantly higher with radiotherapy. The single treatment event and fewer side effects of laser excision make it the best choice for patients undergoing treatment for early glottic tumours. This research shows that voice should no longer be a reason to prefer radiotherapy for these patients.

ANALYSIS OF THE ETIOLOGY CHANGE OF VOCAL FOLD UNILATERAL PARALYSIS OVER 20 YEARS

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Background: Unilateral vocal fold paralysis (UVFP) is a common and relevant cause of dysphonia and voice fatigue. The analysis of its causes may allow for treatment and prevention strategies.
Aim of the study: To analyze the etiology of UVFP in patients treated by the voice therapy service in our hospital in recent years (2012-2015) and to compare this recent cohort with that treated in the years 1990-1992
Patients and methods: The medical records of all consecutive patients affected by UVFP examined and treated in the phoniatrics and voice therapy service of our hospital over the years 2012-2015 were reviewed and compared to data gathered in the years 1990-1992. The 1990-1992 cohort included 113 patients (44 males, 69 females, age range 10-69 years); UVFP was due to thyroidectomy (61), other neck surgery (10), neck trauma (3), carotid endarterectomy (5), thoracic surgery (12), stroke (1), idiopathic causes (21). In contrast, etiology of UVFP in the 2010-2015 cohort of 243 patients (94 males, 149 females, age range 15-94 years) was: thyroidectomy (86), other neck surgery (24), neck trauma (5), carotid endarterectomy (22), thoracic surgery (31), stroke (3), idiopathic causes (69), compressive causes (3). Statistical analysis allowed to compare the two cohorts and to analyze gender and age group differences.
Results: A significant difference in etiology was found comparing female and male patients in both the prior and the most recent cohort of patients. Comparing the two global cohorts a significant difference in etiology was found; idiopathic etiology and thoracic surgery injury increased in the recent cohort while post-thyroidectomy UVFP decreased. Thyroidectomy was the most prevalent cause of UVFP in female patients while idiopathic UVFP was the most common finding in males in both groups. The side of paralysis was not analyzed in the older cohort due to missing data; in the recent cohort the side was not different among age groups, and between the two genders; the left side was globally more affected (left UVFP 68% vs right UVFP 32%). Thyroidectomy was the most prevalent cause of UVFP in the 35-64 years age subgroup while idiopathic paralysis was the most common finding in the 15-34 years subgroup.
Conclusions: The present study demonstrates a changing pattern over the last 20 years in UVFP etiology as idiopathic UVFP and post thoracic surgery UVFP showed an evident increase while post-thyroidectomy UVFP decreased. These findings might be the result of more accurate and conservative techniques during thyroid surgery with a decreasing number of recurrent nerve lesions and/or an increase in idiopathic unknown causes of UVFP. The increase in post- thoracic surgery UVFP might be the consequence of more advanced and aggressive thoracic surgical procedures in recent years.

Occupational

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SUBJECTIVE STRESS AND ENERGY LEVELS IN FEMALE PATIENTS WITH OCCUPATIONAL VOICE DISORDER AND MATCHED CONTROLS

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INTRODUCTION: It is well-known that stress, defined as "an imbalance between demands placed on us and our ability to manage them", has a negative impact on health. Stress can also affect the voice in a negative or harmful way and has been identified as an important risk factor for occupational voice disorders. Common diagnoses amongst individuals with voice intensive occupations are phonastenia and vocal nodules. Moderate noise exposure seems to increase people's rated stress levels and annoyance. Excessive background noise levels are common in many vocally demanding work places making it hard to make oneself heard. Therefore, background noise is a factor that needs to be taken into account when identifying causes of stress during work and leisure from a vocal perspective. The aim of this study was to investigate patterns of self-reported stress and energy, estimated amount of speaking time, and perceived disturbance with background noise in female patients diagnosed with occupational voice disorders. Questions were if stress and energy differ between patients and vocally healthy controls, between two patient groups, and between work and leisure time.

METHODS: Thirty eight women with voice intensive occupations participated in the study. Nineteen were patients diagnosed with occupational voice disorders (mean age 41 years, range 37 years) and nineteen were vocally healthy colleagues (mean age 45 years, range 42 years) matched regarding age, profession and work place. The patients had been diagnosed with either phonastenia (n=11) or vocal nodules (n=8). Four times a day (morning, 1st and 2nd half of working day, evening) the participants completed the Stress-Energy Questionnaire (SEQ), including 12 items rated using 6 answer categories. The SEQ gives two total scores, one for the stress dimension and one for the energy dimension. The participants also rated estimated amount of speaking time and disturbing background noise on 100 mm visual analogue scales at the same time as the SEQ was filled out. They did this during 7 days (5 working and 2 leisure days). The self-reported data was transmitted to Microsoft Excel for calculations and to IBM SPSS Statistics for statistical analyses. Additionally, the 28 measuring points (4 x 7) from the SEQ were plotted to a line chart for each individual and week. Based on those charts, three categories of stress-energy patterns, could be identified.

RESULTS: The stress-energy categorizations showed that the patients diagnosed with vocal nodules were overrepresented in a category in which increased stress levels were not synchronized by increased energy levels, a pattern interpreted as negative for the individual. No significant difference in rated stress on the SEQ were found between the patient group as a whole and the controls during work or leisure time. However, the patients with vocal nodules reported significantly higher stress on the SEQ compared to the patients with phonastenia during work. The energy levels were rated significantly lower by the patients than the controls during leisure time. The patients perceived background noise to be significantly more disturbing than the controls. Moreover, the patients with vocal nodules subjectively estimated that they were speaking significantly more and they perceived background noise as more disturbing than the patients with phonastenia.

DISCUSSION: Whether stress is a contributing factor for developing vocal nodules or whether the voice problems lead to increased levels of stress is not possible to conclude from the results in the present study. Further research is needed to examine the role of psychological factors such as stress and personality on the development of functional occupational voice disorders, and the stress energy questionnaire used in the present study seems promising for that purpose.

LIMITATION IN VOCAL ACTIVITIES AND PARTICIPATION RESTRICTION IN TEACHERS WITH FREQUENT SYMPTOMS OF VOCAL FATIGUE

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INTRODUCTION: High prevalence of symptoms of vocal fatigue found in teachers may contribute to reduced productivity and limitations on working performance or even prevent teachers from doing all teaching tasks. When voice is the primary tool of instruction in the classroom, it is essential that the pupils can hear and understand the teacher without difficulty. Pupils have shown to learn poorer when listening to a teacher with dysfunctional voice, as impaired vocal quality adds listeners' processing load and processing time. This may have a negative effect on pupils' equal opportunities for learning. Two or more very frequently (weekly or more often) occurring vocal symptoms are considered to be a borderline of functional voice disorder. This study investigated different amounts of frequent symptoms to find out how they effect to teachers' voice related activity limitation (AL) or participation restriction (PR).

METHODS: AL and PR were measured with Voice Activity and Participation Profile (VAPP) in 206 female teachers in relation to their vocal symptoms. The AL consider e.g. a voice user's difficulties to become understood in conversations or heard in noisy situations due to voice problems and PR e.g. avoidance of speaking or unwillingness to take part in communication situations because of one's voice problems. Laryngeal changes were found by the phoniatricians in 45 % of the teachers (11 % substantial, 34 % mild). Statistical analyses were carried out using IBM SPSS Statistics 21.0 software. Odds ratios were used to determine how the prevalence of vocal symptoms are associated for AL or PR.

RESULTS: AL between groups with or without laryngeal organic changes showed OR 1,3 (95% CI 0,82-1,5 ns.) and PR OR 1,1 (95 % CI 0,78-1,4 ns.). Combination of the two evaluation methods, organic changes evaluated by the phoniatricians and self-reported weekly symptoms were also calculated to a functional-organic variable; this showed OR 1,6 (95 % CI 0,9-2,9, p= .068 ns.) for both AL and PR. In addition the functional-organic variable was significantly associated to teachers' worse overall quality of life (OR 2.1 95 % CI 1.2- 3.7 p= 0.010). Teachers with higher symptom scores (over average) showed 3,7 times more likely the AL (OR 3,7 95 % CI 2,0–6,8 $p < .0001$) and 2,6 times more likely the PR (OR 2,6 95 % CI 1,5–4,7 p = .0012) than teachers with lower symptom scores (under average). Of the 206 teachers 35 % reported one or more (1+) weekly symptoms, 24 % two or more (2+),17 % three or more (3+) and 12 % four or more (4+) weekly symptoms. 65 % of the teachers did not suffer from weekly symptoms.

The odds for AL, i.e. teachers not to be able to do all activities at their work or other life, was 3,5 times higher (OR 3,5 CI 95 % 1,9 -6,5 p = 0.0001) in teachers with 1+ weekly symptoms compared to those without weekly symptoms. With 2+ weekly symptoms the odds ratio increased to 4,6 times higher (OR 4,6 CI 95 % 2,2 -9,6 $p < 0.0001$), with 3+ weekly symptoms to 5,2 times higher (OR 5,2 CI 95 % 2,1 -12,7 p = 0.0003) and with 4+ weekly symptoms to 8,5 times higher (OR 8,5 CI 95 % 2,4 -29,8 p = 0.0008). AL relations between groups with or without certain amount of weekly symptoms were all statistically significant.

The odds for PR, i.e. the teachers not to be able to full participation to all vocal situations at their work or other life, increased also : 1+ weekly symptoms OR 2,8 (CI 95 % 1,5 -5,1 P = 0.001), 2+ weekly symptoms OR 4,5 (CI 95 % 2,2-9,3 p = 0.0001) , 3+ weekly symptoms OR 5,1 (CI 95 % 2,1 – 12,5 p = 0.0003) and 4+ weekly symptoms OR 6,0 (CI 95 % 2.0-18,2 p = 0.002). All PR odds were also statistically significant.

DISCUSSION: High odds for frequent vocal symptoms to increase vocal AL and PR were found. AL and PR are 2,8-8,5 times more likely in teachers with frequently occurring symptoms of vocal fatigue. This may mean decreased working ability and thereby possibly unequal and lower quality learning to the pupils of a dysphonic teacher. Vocal symptoms, AL and PR were self-reported, and more studies are needed to find out how these actually effect to teachers performance in classroom situations. In previous studies poorer learning when listening to the teacher with dysfunctional voice has been found. More studies and effective educational and ergonomic interventions for teachers with vocal symptoms are warranted.

MENTAL MAPS IN LEADING VOICE-INSTRUMENT-VOICECOACHING FUTURE TEACHERS

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This presentation aims to present useful tools used in voice education in teacher training focusing the importance of mental maps in leading voice-instrument in order to support future teacher's voice- wellbeing. Mental maps are formed by the individuals ´attitudes of inner or outer surroundings which dictate together the way of action [1] like in leading one`s voice-instrument. As a music lecturer I `ve been modeling mental maps in leading voice instrument from 1990`s while developing voice coaching lessons, especially in speech.

One useful tool has been NLP Neuro-Linguistic Programming, which refers to purported systemic links to between a persons´ internal experience (neuro), their language (linguistic) and their patterns of behavior (programming) [2]. NLP has many different technics and methods to examine thinking and action, to model mental maps and if needed to make suitable changes in a short time. Useful tools have been like Reframing, Logical levels [3] and NLP`s "Meta- Model". Voice education teacher can help students to reflect and change non-ecological beliefs by using questions. Another method which I`ve been used in voice coaching has been to present the Masters model, which the students have compared to their own mental maps. I have modelled the Master model from my mentor Vilho Kekkonen who passed away last year 2014 aged 105 years and was after Guinness record book the worlds´ oldest still concertizing tenor singer in the world.

Using these techniques has been effective according to the feedback of the students. One student commented after experience of voice coaching lesson in spring 2013:"It was really useful. Though it was a short time I learned a lot how I can practice my voice. I can practice my voice and my ability to use my voice will not be so full of problems like it is now. You can do something to it."

In the future it would be useful to develop voice education methods in teacher training institutes and consider the usefulness of NLP and its` fast results in voice-wellbeing to increase awareness of own voice resources and skill to model own mental maps in leading voice-instrument towards more ecological way .

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THE STATE OF MEDICAL STUDENTS' VOICE

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INTRODUCTION: Doctor's profession involves a conversation between a doctor and patients or their legal representatives a lot of hours every day. Therefore a voice is an important component of doctor's routine work. We didn't find information about the prevalence of voice disorders among representatives of this profession. The aim of our work became an assessment voice quality of future's doctors which are medical students now.

METHODS: We prepared a special questionary that was filled by students of different Moscow medical universities. People who has complaints about the voice or are discontented with voice quality were invited for the complex examination that includes:
- electroglottography
- acoustic analysis of voice
- endolaryngoscopy

RESULTS: There were 170 (31.9%) from 532 medical students who had complaints or were discontented with the quality of voice. At the present 30 people who were examined had next pathology.
- functional dysphonia (52.9%)
- chronic laryngitis (23.5%)
- acute catarrhal laryngitis (17.6%)
- paresis of the right half of the larynx(2.9%)
- laryngeal papillomatosis (2.9%)

DISCUSSION: The main reason of the medical student's voice disorders was the functional dysphonia (52.9%) , laryngeal inflammatory diseases that were diagnosed among 41.1 % (23.5 % - chronic laryngitis). It is advisable to make series of exercises which aim is to train the diaphragmatic breathing and make the proper voice.

EVALUATION OF VOICE TRAINING EFFECTIVENESS IN PREVENTION OF VOICE DISORDERS IN TEACHERS

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Problems associated with vocal strain affect 25 per cent of professionals and the largest group of professional voice users affected comprises teachers. In the teaching profession, in addition to voice quality, it is the vocal endurance, i.e. good tolerance of vocal strain, which is the most desired quality.
The aim of this study was to obtain complex evaluation of the effectiveness of prevention and rehabilitation program for professionally active teachers in terms of improved voice quality and increased tolerance of the vocal organ to effort.
The material of this study consisted of 133 females who participated in a 7-week-long, extensive prevention and rehabilitation program on voice production technique.
Methods of the study included laryngological and phoniatric examinations, perceptual evaluation in the GRBAS scale and self-evaluation test in the VHI-III scale. Videolaryngostroboscopy, measurement of vocal intensity in whisper, speaking and shouting, and acoustic analysis of the voice were all performed prior to and after 30 min vocal loading test. All these examinations were repeated 7 weeks after completion of the voice training.
Statistically significant improvement in the way of breathing, increasing of the maximum phonation time and the voice range, perceptual voice estimation and self-assessment were obtained. Acoustic analysis of voice revealed statistically significant improvement only in group with pre-training worst values of the parameters.
The results of this study performed in the group of professionally active teachers who participated in a voice emission course allow us to conclude that voice emission training in working teachers is advisable independently of work employment period and condition of organ of speech. Such training also provides a sufficient basis for further conscious care of the voice as a working tool.

Singing

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EFFECTS OF DIFFERENT WARMING-UP SESSIONS ON THE SINGING VOICE

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Introduction: The function of the cavities of the vocal tract in forming the singing voice has two generally accepted models. According to the "voice source – filter" conception [Vurma 2002, Sundberg[2] 2007], cavities with their size and configuration work as resonators for enhancing the different harmonics of the primer voice. The "voice source-vocal tract impedance" in addition emphasise [Lee 2005, Sundberg[1] 2007, Andrade 2013, Guzman 2013, Have 2013, Chen 2014] the beneficial influence of the air volume inertia of the cavities on the function of the larynx and on the vibrato of the voice. The beneficial effect of short warming-up sessions on voice quality and singing function is already clear according to the scientific literature [Elliot 1995, McHenry 2009, Van Lierde 2010, Siupshinskiene 2011, Gish 2012, Enflo 2013, Moorcroft 2013]. The aim of this investigation was to detect and compare the effects of two different warm-up sessions on the singing voice. The principle of the *first session* was to exploit the enhanced impedance of the vocal tract, and the aim of the *second session* was to enable the easy, unbound flow of the voice.

Methods: We organised two different warming-up sessions on two different days with 28 participants (21 females and 7 males). The participants belong to the "full-time voice student" (7.1) category according to the Bunch-Chapman taxonomy [2000]. They arrived to the session without any previous warming-up. We recorded on both occasions - before and after the singing tasks - the vowels [i, a, u], sustaining them for more than 2 seconds on the same pitch. Comfortable voice pitches were chosen for the genders and different voice categories as well. From the records we cut out more than a one second long – in volume and vibrato - well-balanced part. Then with the help of SIEGVIEW 2.4 program we formed the Fast Fourier Transformation of the records and analysed three parameters of the diagrams of the overtones. The *mean* of voice volume, the *integral* of the FFT diagram, and the *number* of separated overtones. Data analysis was performed by using descriptive statistics, paired sampled-t test and correlation with SPSS 20 program.

Results: Descriptive statistics clearly indicated the advantage of the *first* - enhancing the impedance of the vocal tract - *session*. The values of every parameter grow in absolute value and in ratio more after this then the *second* - enable the easy flow of the voice – *session*. There are two exceptions only. The *number* of overtones at vowels [i] and [u] proved to be higher after the *second* session. According to the paired sample t-test, for the whole group the *first* session had a strongly significant effect at every parameter and at every vowel. The p values in the case of the *second* session proved to be smaller, but yet significant at every occasion, beside at vowel [a] on parameter "*number* of overtones". For females the *first session* on every parameter at every vowel stayed significantly effective, but the *second session* at vowel [a] had no significant effect at every parameter, and also had no significant effect at parameter "*number* of overtones" at vowel [u]. For males the advantage of the *first session* is also clear. It hasn't got significant effect only at parameter "*number* of overtones" at every vowel. The *second session* has one significant effect on the same parameter at only vowel [u]. The *first session* keeps its benefit at the voice groups – mezzo, bass – as well. For sopranos however at vowel [i] and [u] on two parameters – *mean* and *integral* – the *second session* proved a little bit more effective impact. In correlation at both of the sessions the changing of the parameters - *mean* and *integral* – are coherence, while the fluctuation of the "*number* of overtones" seems rather independent, mostly at session *first*, less at session *second*.

Discussion: In the educational practice we use both types of the warming-up tasks day by day, in different compounds and order. Our results proved that this practice is useful, but it is worth to adopt the session strategies for genders and voice groups as well. The choice of the proportion and order is not irrelevant. In our previous investigation [Altorjay 2014, 2015] we proved that the best order of tasks in session is to begin with "enhancing the impedance of the vocal tract", and continue then finish with "enable the easy flow of the voice". For accommodating the vowels - what is an important aim at classical singing education – the *first session* seems useful for wide- and the *second* for narrow vowels. Our further aim is to elaborate singing task supply for warming-up to facilitate teachers and singers practice.

OPERA STAGING, A METHOD FOR IMPROVING EXPRESSIONS OF EMOTION IN CLASSICAL SINGING?

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Introduction:From pedagogic experience we have noticed that opera staging may influence ecidently on young singers`voice quality and expression. To use own emotional expression to interpret a role character in opera seems demanding to many young singers. Both shyness and insecurity of own emotionality may hinder students in reckognizing various role characters. Theatre improvisation(T.I.) as a method has occasionally been used in opera, and has proved to be efficient for performers to change their focus from voice tchnique to the role character and the storytelling.To try out T.I. in voice teaching we tested how 10 voice students
performed a secco recitative from operas by W.A. Mozart before and after an hour with opera staging according to T.I. 6 sopranos, 2 mezzos and 2 baritones voluntered, mean age 25.
Protocol:
A)Singing the recitative, standing upright and a capella; sound recording by Roland Mp3 Recorder with external mic(type:ECM-MS907); Simultaneously respitrace registration was run to map respiration movement in the diaphragm area(device: NEXUS 10, run on bluetooth). B) Opera staging of the recitative, using T.I. C.) Repeating recording, as in A). D) Registration of each test person`s ability to reckognize and express both negative and positive emotions. The standardized Affect interview was run for the purpose. Typical negative emotions: hatred, envy, fright, guilt, shame. Typical positive emotions: tolerance, devotion, pleasure, interest.
Analysis: Sound recordings were digitalized and analysed on MAC,OSX, version 10.95, by PRAAT, version 5408. Sound analyses were concentrated on two spots in the recitative: namely where typical negative and positive emotions were exposed in the composition. Locations of F 3 and F 4 in the pre-and post tests were mapped , as well as sound power level. Total duration of the recitative in pre- and post tests were mapped.
Perception analysis were run using an expert group of three young professional singers. Based on arbitrary succession of the sound recordings from the pre- and post tests the perception group voice decided which performance they found to be most expressive, using a score scale from 1- to 10 points.
Results:

I. Variations in duration of the performance pre- and post tests:
   Increased duration: 5 test persons
   Decreased duration: 3 test persons
   No change in duration: 2 test persons
II. Preceived emotional expression throughout the recitative:
   Estimated improved expression from pre –to post-test:
   mean result for the whole group: 15 %
III. Acitvity in the diaphragm area during the recitative:
   Mean result for the whole group: Increased activity: 11.97 %
IV. Locations of 3 . and 4.formants pre- and post tests for a. postive and b.negative emotions:
   a. Positive emotions: F-3 shows increased values in 6 test persons
   F-4 shows decreased values in 4 test persons
   b. Negative emotions: F-3 shows increased value in 3 test persons
   F-4 shows decreased value in 7 test persons

Summary:
Test persons that reckognize and express both negative and positive emotions well, seem to change little or not in voice expression after the opera staging session. Test persons that vaguely express negative emotions, like fright, improve significantly on emotional expression after the opera staging session.
Perception analysis assesses that emotional expression over all improves evidently from pre- to post test.

VOCAL TRACT BEHAVIOUR IN WIND PLAYERS

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Introduction: The importance of vocal tract and glottal healthy function in wind instruments players is discussed in many theoretical approaches to these techniques . Advent of videoendoscopy let “look inside” and observe differences, if any, in vocal tract behaviour between normal speech, instruments playing or singing.
Methods: Some professional wind players are registered through flexible videoendoscopy while speaking and playing, and soometimes singing. They’re as free to move as possible, in recordings conditions, while they play. In the same time they wear VoxLog vocal dosimeter.
Results: Video recordings selection is presented to show analogies and peculiarities.
Discussion: Wind players are often taught to “widen larynx” “keep vocal folds open” “keep throat open” and similar metaphoric images. In this way students and professional players do not care about their vocal health as a measure of professional and tecnica guarantee of “playing health”. Studies in last years prove more and more evidence of the importance of the vocal tract correct function in these players. Knowledge of this , caring about vocal hygiene and preventive periodic monitoring of vocal tract healthy function may avoid unexpected tops in professional career.

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SINGING VOICE THERAPY REVISITED

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The elite vocal performers may be defined as olympic vocal athletes who have a special place among professional voice users. Pedagogical vocology is a discipline which supports training elite vocal performers as well as performing professionals for developing a safe and sustainable vocal performance throughout the professional life. Singing voice therapy is the main field of application of pedagogical vocology. Vocological applications for elite vocal performers will be reinterpreted and reviewed as below:

1. Consulting and elevating conscious awareness through explaining
2. Vocal hygiene program (mechanical and chemical trauma)
3. Applications for core elements (Primal sound, posture, breathing and support)
4. Applications for voice source (glottal attack, vocal muscle building techniques, focusing and registration)
5. Vocal tract applications (tuning the vertical larynx position, semi obstructive vocal tract exercises, formant tuning and using the vowels and consonants)
6. Relaxation and musical performance anxiety
7. Environmental factors; coping strategies

Applications for primal sound, posture and breathing/support which are defined as core elements of singing voice are crucial for sustainable professional vocal performance. Singing exercises ought to be explained in terms of physics and medicine for better understanding of vocal peformers. Not only source and filter problems but also environmental factors implicate the vocal health. By counseling through explaining, teaching and instructing, as well as performing indirect and direct voice therapy methods, pedagogical vocology aims for a sustainable professional voice and overcoming the voice problems in a reasonable period.

THE NEED FOR A 21ST CENTURY SINGING DICTIONARY: WHY, WHAT & HOW

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As vocal music continues to broaden and diversify and sub-styles continue to be created, and as the profession is more influenced by terms taken from voice science, vocal hygiene and medicine, the publishers Rowman & Littlefield (formerly Scarecrow) determined that a new music dictionary was needed. This presentation will present an overview of the book, *A Dictionary for the Modern Singer* (2014). It will discuss the editor's choices of what to include and exclude, genres and styles addressed, length of definitions, and how multiple sides of complicated issues were addressed. For instance, muscle physiology and more complex scientific concepts were distilled through pedagogical application and diagrams. Biographical sketches of particularly revolutionary and influential singers were also included, constructing a timeline of some of the history of singing's most important innovators. Twelve appendices—on topics such as IPA, the *Fach* system, *bel canto*, and medications and their effects on the voice—address items not easily adapted into definitions. There are also essays on important subjects including practicing, stage fright, repertoire selection, audio technology and Contemporary Commercial Music (CCM). The guest contributor of the CCM essay will address the importance of both the term and the styles it represents as being a key ingredient in 21st century lexicology. Feedback about the dictionary received since its publication, both pro and con, will be presented, as will suggestions for using the book as a bridge between pedagogy and voice science.

SEEKING AUTHENTICITY IN THE PERFORMANCE OF THE BEL CANTO TENOR REPERTOIRE

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The objective of this research has been to excavate and to reconstruct the historical singing concept of the *voce faringea* which was used by the high tenors who sang approximately between 1770 and 1850. Essentially, it is an extinct historical singing practice used to extend the upper range of the voice whereby the *falsetto* register, essentially a weak and often feminine sound, is modified by the singer into a vocal quality that is a more powerful yet tenor sound. This resulting sound is homogenous with that of the lower registers and is no longer related in vocal quality to the *falsetto* voice. Many tenor roles in the operas of the *primo ottocento* have exceptionally high tessituras, often with pitches well above high c" or d". Typically such high passages are beyond the normal vocal compass of modern tenors, so roles like these raise the question of how tenors in the early nineteenth century would have coped with the wide ranges and elevated tessituras without resorting to the *falsetto* voice. They also raise questions regarding historically informed performance practice, the aesthetics of western classical music, and how singers today should perform them in an effective and healthy way. The voce faringea helps to answer these questions.

Analysis of historical sources, such as vocal pedagogy literature, physiological and anatomical treatises, as well as periodicals of the time has yielded important evidence regarding the *voce faringea*. By comparing how these observers discussed performances of the great bel canto tenors and what characteristics were attributed to the noteworthy voices, an informed discussion of the technique has been developed. Historically relevant testimony describing the characteristics of different vocal register mechanisms, as well as various historical theories about the background, physiology of the chest voice and the *falsetto* register support the research concerning the timbre and technique of the *voce faringea*. Part of the research objective is to explore in depth the techniques used by the *bel canto* tenors as dictated by repertoire; it is not intended to be an in-depth performance history of the repertoire or of individual tenors, but rather an investigation of the implications of technique as demonstrated in the specific repertoire. While it is difficult to pinpoint the definitive origins of the technique itself, through a critical investigation of the repertoire one can determine the requirements for each role, particular skill sets of each singer and *fach* subdivisions. Therefore, a cogent discussion of its development through repertoire can take shape.

Today, through the training of the *voce faringea*, research into historical register strategies represents an important aspect in the search for authenticity in the informed interpretation of the *bel canto* tenor repertoire. By using the *voce faringea* concept tenors are enabled to navigate the highest tessituras with absolute assurance, ease, and brilliance. At the same time, like the tenors of the *bel canto* era, they are able to sing with increased artistry, preserve their vocal longevity, and lose any fear of high notes. To this end, training methods have been developed in order provide teachers with the ability to understand and develop the *voce faringea* in their own studios.

Subsequent to the current development of the *voce faringea* in tenor voices, we are able to discuss how the use of acoustic analysis, including first and second formant tuning, using VoceVista can be effective tools in understanding how the *voce faringea* functions, and how it may be taught. The research demonstrates the possibility of reconstructing this technique, and is composed of both audio and video materials of teaching that draw on the *voce faringea* concept for singers today. It is focused toward offering a suggestion concerning what might have been, but mainly to inspire contemporary and historical informed performance practice. Some of the results here may be considered heretical from a contemporary vocal pedagogical point of view and could disturb some strongly held views about the exact nature of *bel canto*, but what is the point of research if not to question?

CAN ANYTHING BE DONE PEDAGOGICALLY TO ENABLE THE MATURE FEMALE SINGER TO SUSTAIN VOCAL COMPETENCY AND HEALTH?

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This doctoral research is a study of vocal function and efficiency in the mature female singer and whether effective pedagogy can promote sustained healthy vocal production and competence. All the participants in this research are western classical, amateur choral singers. This investigation was inspired by the researcher's former work as a professional classical singer and current work as a voice teacher with extensive experience of working with this age and gender group.

The initial research literature review included an overview, organological study of voice anatomy, function and aging. This set the context for a review of related sources on the subject of possible problems that might occur to the female voice as it ages and the possible negative impact on singer identity and participation.

Like all instruments, the voice is subject to wear and tear; it can become dysfunctional, the vocal folds may swell due to infection, they may bleed due to misuse and they may change structurally and asymmetrically due to variations in the hormonal system. In addition, the respiratory system—the power source for the voice— could become clogged with mucus and its function severely reduced, such that the pharynx can become sore and constricted. Across the lifespan the human voice is subject to environmental threats such as chemical pollution, smoke and any air-born irritants. It is also subject to emotional stress as the target organ for the experience and communication of emotion at a primal level. Moreover, the aging process can mean that the older voice may become less resilient and less able to resist such threats, because of (for example) a decline in respiratory system function, atrophy or bowing of the vocal folds, decline of the musculoskeletal system, ossification and calcification of the laryngeal cartilages, and/or loss of stamina.

The aims of the doctoral research and to investigate the potential benefits of pedagogical intervention on any negative features of female vocal aging in older singers. Accordingly, part of the research and review of the literature has led the researcher to devise a series of targeted exercises to assess the function of key components of the voice: respiratory function, agility, onset, stamina and resonance and also to act as a tool to measure the impact of pedagogical intervention over time. Comparison data is being drawn from a matched control group without the experience of the pedagogical intervention.

In the pilot study (reported here) participants were asked to complete a questionnaire and to keep a notes of any reflections about their singing over the duration of the study. These data were set alongside the voice assessment data from the specially designed vocal tasks.

The pilot study has indicated, (a) that the research methodology appears to be working appropriately in capturing the desired data and (b) that singers who are proactive with overtly targeting the healthy coordination of their vocal muscles appear to be more able of maintaining the desired functionality of their singing voices. Detailed data syntheses are ongoing and the outcome will be reported in more detail at the conference, as well as the implications and impact for the main fieldwork phase which has begun.

The formal study of effective pedagogy of the aging female voice is relatively absent in the research literature. This current research seeks to address this need and also to provide guidance for all those who work with older female singers on how to sustain competency and vocal health, notwithstanding the challenges of vocal aging.

ASSESSMENT IN VOCAL POPULAR MUSIC PERFORMANCE IN HIGHER EDUCATION

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Assessment in musical performance is a common part of music education practice in both lower and higher education. Assessing musical performance is a delicate, complex and important process in music education. There are several studies on assessment (McPherson & Schubert, 2004; Vinge, 2014; Papageorgi and Welch, 2014; Lebler, Carey and Harrison, 2014), but not much investigation is conducted on *vocal popular music performance in higher education*.
In the present pilot study, assessment of vocal performance in higher music education is investigated, further explained, the utilisation of the vocabulary describing the assessed qualities in popular vocal music.

Research question: *What assessment criteria are salient in an examination of a vocal performance in popular music?* The vocal students´ views on assessment versus the assessors are chosen, and the students are divided in two groups according to where they study (group A and group U), to observe any difference between them.

Aim: To reveal the participant students´ awareness of what they actually assume, or know, is assessed in a vocal performance, and if and how it correlates with the teachers and sensors who assess the students.

Theoretical framework: Within a broader pedagogical framework of constructivism (Colwell & Webster 2011), McPherson & Schubert (2004) have made a broad introduction to performance assessment issues. I will draw upon their theories, and Martin Fautleys theories on the same topic (2010).

Methods: Twentysix vocal students from two higher music education institutions in Southern Norway answered the following question in April 2015: Which assessment criteria do you believe you are assessed by in your exam performance in vocal popular music? Four assessors answered this question: Which assessment criteria do you consider in an exam performance in vocal popular music? Participants were told to use keywords instead of long sentences, and four assessing areas within performance as a starting point were mentioned: technique, interpretation, expression and communication.

Analysis: To analyze the answers, I grouped similar words and used TagCrowd.com as a tool to get a visual impression of the words and terms that emerged to be highlighted. The group U students have all been through an audition, and are technically and theoretically on a higher level than the group A students.

Results: Preliminary results from the analysis shows that group A students highlight vocal technique, expression and communication with the audience and within the band. The group U students´ vocabulary highlight communication with the audience and communication within the band, but also the distinctiveness and confidence that the singer perform.
The assessors words emphazises the overall situation, musical and artistic understanding, and variety in the vocal expression.

Conclusion: A preliminary conclusion is that the technical aspects and communication are some of the criteria the students believe is most salient for the assessors. The group A students are overall shallower in their answers than the group U students and the assessors, who have deeper explanations and more detailed criteria descriptions.
The assessors emphazise a broader and more holistic view of the performance.

CoMeT Symposium

September 2

Claudia Manfredi (edited by), *Pan European Voice Conference : Pevoc 11 Abstract Book : August 31 – September 2, 2015*,
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Round Table

INSTRUMENTAL FEEDBACK IN SINGING PEDAGOGY

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Background :

In the last decades, a large amount of research work has been conducted in the field of voice assessment, dealing with vocal fold imaging as well as with physiological and acoustical analysis. The most important part of this literature deals with the assessment of dysphonia for clinical purposes, but attention has also been paid to specific properties of the (professional) artistic singing (and acting) voice.

Within the latter, artistic expression relies to some extent upon technical skills, normally taught in a progressive way during the education of a singer. Such skills result from specific motor and/or postural behaviours, that are some way under voluntary control. With modern technology, several of the vocal outcomes of these skills (or related parameters) can be objectively quantified and visualized in a non- or minimally invasive way. It may be expected that this should allow the teacher as well as the trainee to gain a better understanding of the processes involved and better overall control of the vocal outcome, and, particularly if the information can be provided in (quasi-)real time, it can be used as feedback for a didactic purpose.

Some examples are : air flow rate, glottal resistance, presence and extent of singers formant cluster, loudness control, characteristics of vibrato, noise to harmonics ratio, voice range profile (dynamics of intensity and fundamental frequency), voice loading etc.

However, up till now, most of these techniques have been primarily used for research purposes in singing science and are not normally available in the singing studio or in the classroom or during rehearsals. This also implies that they are not (or to limited extent) very 'user friendly'.

Aims and questions :

The purpose of this round table, organized by the Collegium Medicorum Theatri, is to confront (1) voice scientists active in the field, including designers of software and monitoring devices (short/long term), (2) potential users like teachers of singing and singers and (3) specialists in voice care.

Outlines of the Round Table :

(1) To make a short - but as complete as possible - inventory of the relevant available techniques, from the very basic to the more sophisticated ones, with emphasis on current possibilities and limitations, as well as on possible short-term developments and advantage that can be taken of modern portable computing technology.

(2) To hear the point of view of the potential users: Which are e.g. for a singing teacher, the parameters she/he frequently struggles with in vocal education (vibrato, timbre and singer's formant cluster, messa di voce, tessitura…) ? For which aspects is linguistic imagery and vocal/postural modeling by the teacher frequently unsatisfactory/misunderstood ? Do singing teachers have the feeling that possibilities presented in (1) could be of any help ? Which are, c.q. general or specific conditions : e.g. simplification, miniaturization, real time display, long-term averaging, etc.?

(3) To discuss, among the panelists and with the audience, which seem to be the priorities from a practical point of view, and in what manner it seems meaningful to direct future research or implementation. Costs and marketing aspects can also be taken in account.

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ARE VIBRATO FEATURES SPECIFIC FOR EACH SINGER?

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Objective:
To establish differences in vibrato rate and extent between classical singers and between registers in each singer.

Study Design and Methods:
Prospective case review.

Methods and Materials:
Recordings of 28 professional singers, 15 females and 13 males (15 sopranos, 2 mezzosopranos, 7 tenors, 4 baritons and 2 counter-tenors) were performed in order to collect a long sustained vowel sample in different registers: low, medium and high at a medium loudness.
The vibrato rate and extent were calculated for each register and comparisons were conducted relating to F0 in low, medium and high register for each voice type.

Results:
Vibrato rate tends to be higher in females and in higher pitches. The greater variation among singers was found in the higher pitch.
Vibrato extent was correlated with F0, with an increasing of the extent associated with higher pitches.

Key Words: Singing voice, vibrato.

EVALUATION OF VOICE MUTATION IN BOYS OF CHILDREN`S CHOIR

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Introduction: Voice change in children implies a gradual and significant change in the vocal characteristics of children. (1) (2) The evaluation of the voice change process is one of the challenges faced by infant choirs to allow children to sing during this period while carrying through a healthy vocal pace. (3) The progressive manifestation of mechanism 1, which will end up coexisting with the "falsetto" or mechanism 2 (4), is produced gradually, we count with little information on the biomechanical and functional changes produced. (5)
The following paper starts with the systematic evaluation of the voice change in two infant choirs with a highly demanding voice and artistic level: the "Escolania de Montserrat" and the infant choirs of "Palau de la Música Catalana" in Barcelona. It is expected that a voice change evaluation will allow the children to continue singing by adapting their place in the choir and repertoire.

Methods: A simple vocal evaluation protocol was considered for each child in voice changing age, to which the choir directors and the child himself had observed any change indications. The protocol consisted in:

- Assessment of the average fundamental frequency in the spoken voice, reading a common text, and analyzing the average frequency with the MDVP program – Kay Elemetrics.
- Manual Voice range profile perceptively assessing the existence of 1y of mechanism 2 (falsetto).

Results: 3 voice change stages were confirmed, each one presenting different characteristics and possibilities in singing voice:
STAGE 1. The beginning of mechanism 1, with persistence practice of the entire infant voice. The average fundamental frequency stays in the infant voice zone.
STAGE 2. The presence of mechanism 1, which coexists with mec2 (infant voice/falsetto) not very effective in terms of the intensity range. During this stage, the octave 3 is cleary difficult: Intensity range reduction and instability on both mechanisms.
STAGE 3 . Both mechanisms improve , regarding intensity range and extension.

Discussion: The evaluation of voice change allows children to be relocated in the choir according to the voice phase.
STAGE 2 reveals itself as the most disabling.
The perceptive assessment as well as the lack of bibliography on laryngeal mechanisms in children does not allow us to confirm to which laryngeal mechanism belongs what we have called infant voice, and as the voice changes, falsetto.
The EGG would be useful to assess these aspects.

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DOSIMETRIC ANALISYS OF DIFFERENT VOCAL STYLES

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Introduction: Teaching modern singing means also educate students to the difference between learn a style and "simply imitating famous singers' performances" . Vocal dosimetry is a tool to monitor vocal behaviour in different voice-uses. Many studies analyzed both vocal parameters and vocal tract shapes in different singing styles. This work studies differencies in dosimetric results of different modern singing styles.
Methods: A modern singer – who is also a coach – wears VoxLog dosimeter while singing a same song in different modern singing styles, visualized by flexible laryngoscope. Then the dosimetry is repeated without videolaryngoscopy. Finally the singer, always wearing VoxLog, sings a song for each different singing style, choosing among songs typical for each style.
Results: Phonation percentages, mean intensity levels , voicing profiles and other data are compared to results of similar analysis in literature – see references
Discussion: Dosimetry may help singing teachers and coaches in explain "graphically" to singing students the acoustical and gestual differences between modern singing styles. Dosimetry might act as another tool for students, to help them understand better their own way , and express singing styles in a personal way.

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THE RULE OF SILENT REFLUX IN THE TREATMENT OF PROFESSIONAL VOICE USERS: MYTH OR REALITY?

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INTRODUCTION
Patient with symptoms of LPR typically do not exhibit classic symptoms of gastroesophageal reflux disease (GERD) Therefore it is sometimes difficult to provide counselling regarding reflux guidelines for the patient. Professional singers perform singing tasks that require rapid changes of subglottal pressure and consistent use of the diaphragm, with activating the diaphragm when there is a need for a rapid decrease in subglottal pressure, which causes an abrupt and prolonged increase in intra-abdominal pressure, deep inspiration and straining. These mechanisms, repeated several times per day and over many years of professional activity, could, in theory, increase the occurrence of reflux symptoms by disabling the diaphragmatic sphincter. Therfore the silent reflux is one of the most important factors in the pathophysiologie of voice disorders in professional singers and voice users. Treatment options for LPR may include medical and behavioural management and surgical treatment in special cases. Proton pump inhibitors (PPI)plays a great role in the therapy of LPR but should be taken in an optimal manner and the counselling to optimize dietary and lifestyle modification should be started immediately. There are many Lifestyleproblemes at the vocal Artists, like: inadequate sleep, increased body weight in adulthood , dinner just before bedtime , the habit of midnight snack, lack of breakfast,lack of physical exercise, antihyperglycemic agents non-users, the habit of quick eating and dinner just before bedtime.

METHODS
In these retrospective Study 25 professional and nonprofessional Voice Users were analyzed by:
Refluxsymptomindex (RSI)
Voicehandicapindex (VHI)
Dietary Anamnesis
Videostroboskopie
PH-Measurement by the single Probe Restech System

According to the the cochrane ENT group specialised register lifestyle advice was found to be the most important factor in order to reduce the subjective complaints of laryngopharyngeal reflux. The Authors will speak about individual changes of lifestyle and bad dietary habits and the rule of Restech PH-Metrie and dietary advices in professional and nonprofessional voice users.

Literature:
Nobutake Yamamichi et al, “Lifestyle factors affecting gastroesophageal reflux disease symptoms: a cross-sectional study of healthy 19864 adults using FSSG scores”, BMC Med. 2012; 10: 45., Published online 2012 May 3. doi: 10.1186/1741-7015-10-45

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