WHAT VOICE CLINICIANS NEED FROM BIOENGINEERS

Presented by

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at:

Bioengineering Applications in Performing Arts and Entertainment Industry Conference (BAIPAEIC) & XIX Pacific Voice Conference (PVC): Safety, Efficiency & Health on Stage

Santa Clara University
Santa Clara
April 22-23, 2011

THE PRESENTER

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BACKGROUND

• Nanotechnologists, biotechnologists and bioengineers.are new supporting fields to th medical doctors

•Pharmacological aspects of diagnosis and treatment.must be understood by them

•Great need for bioengineers, e.g. in radiotherapy and cardiology.

•Problem in our area: evidence and transparency of formulas in software till now have not followed the rules of biological documentation (ref, Cochrane reviews)

•Methods used in pharmacology are necessay to document the technologies

The exact formulas have been difficult to get and so has the possibility to compare to other formulas

HIGH-SPEED FILMS

- In phonation: speed of the closing/opening of the vocal folds: 110 times per second in males and 220 times in females.

- Speed must be slowed down significantly: high-speed imaging

- Principle: photographs of vocal-fold vibrations with speeds exceeding the frequency of the vibration

- Images are presented to the viewer at slower rates.

- 1930s: The first high speed film machine made

- → conduction of many studies examining vocal-fold vibrations

- → crucial understanding of the laryngeal physiology

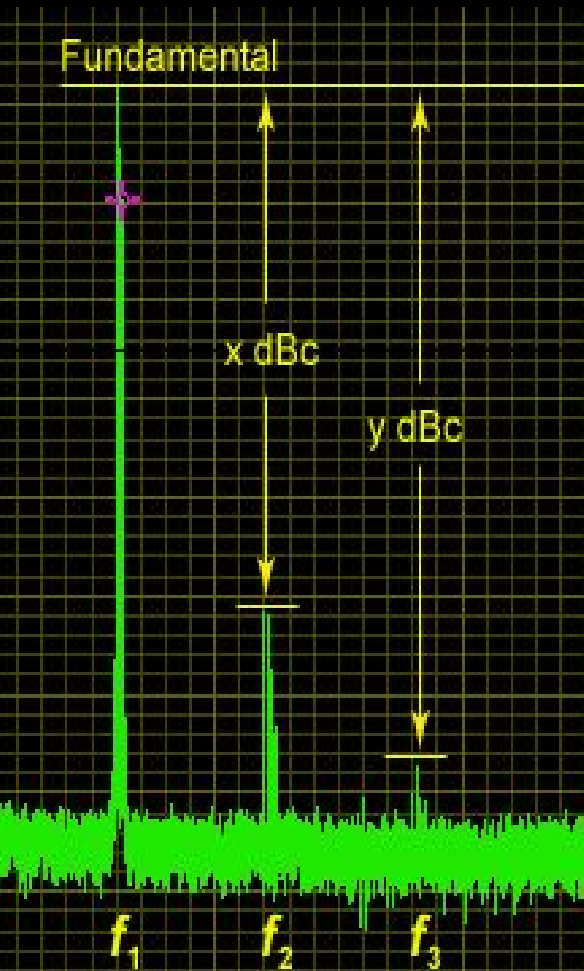- Today, the cameras are able to record up to 4000 (and higher) frames per second.In p

HIGH-SPEED FILMS

In the field of laryngology:

• Aid in evolving the diagnostic approach and investigations of different aspects of voice problems.

• Investigation of disorders where the less accurate video-stroboscopy measures cannot be used.

• Voice production of patients who have been through endoscopic phonosurgical treatment of early glottic cancer.

• Aid in developing methods for restoration of damaged biomechanical properties of the mucous membrane lining the vocal folds.

• In neurological voice disturbances focus has been on dystonia where spasms are clearly seen.

• Important that the biotechnology of the high speed cameras are further developed based on quantitative evidence in the voice clinics.
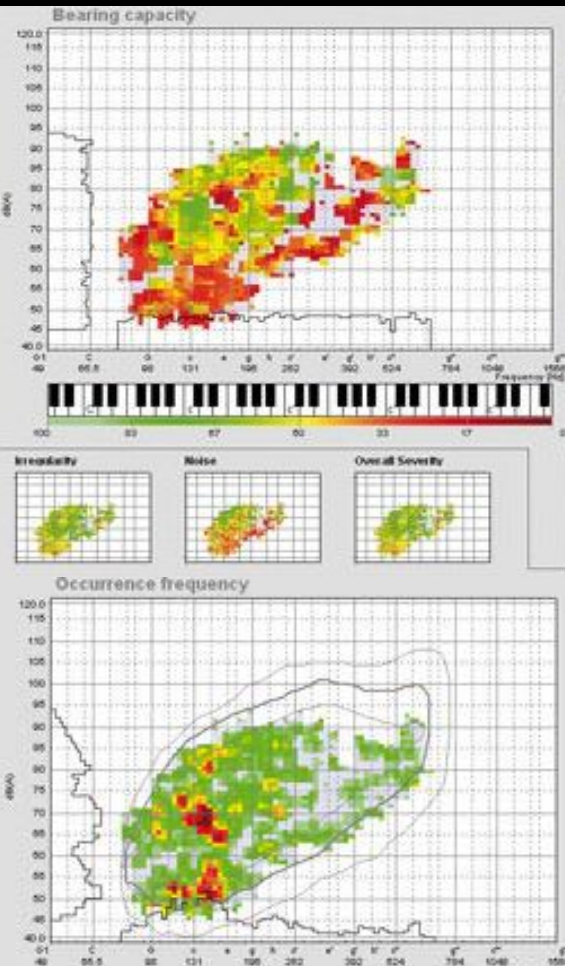
FUNDAMENTAL FREQUENCY AND INTENSITY

- The fundamental frequency (F0) is defined as the lowest frequency produced by any instrument (including the vocal folds).

- Male has a fundamental frequency of 85-180 Hz

- Female fundamental frequency of 165-255 Hz

- F0 plays an important role in vocal communication.

- The intensity variation measures how much one is able to control the voice

- A large variation in the intensity is widely seen during puberty

- Male teenagers where the phenomenon of their voices 'breaking' can be observed.
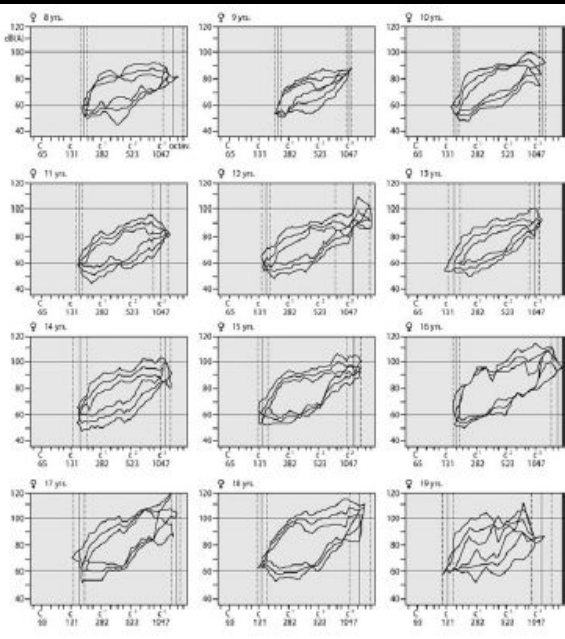
CEPSTRUM

- The spectrum analysis.

- The cepstral peak prominence measurements are useful parameters in voice research

- Correlate well with perceptions of breathiness

- Should predict roughness of voice

- A overview from 2009 found the cepstral metric to be the most promising and most robust acoustic measure of dysphonic severity.

- It should be developed further for clinical use.

FORMANT EXTRACTIONS

- Boosts of overtones-formants - in the vocal tract

- Generated at four to six different places in the vocal tract. Different resonances.

- In acoustics research: the spectral peaks of the sound spectrum $|P(f)|$'

- One of the most important features in speech signals

- Formant extracting methods:

1) spectral peak picking,
2) root extraction
3) analysis by synthesis

- Strengths and limitations

- Crucial that formant extraction methods are constantly revised based on evidence in the voice clinics.

PHONETOGRAMS

• Charts the clients' extent of voice.

• Measures how loud / soft a patient is able to reproduce the note and pitch.

• Shutte et al, 1983: standard setups, using an intensity-meter and a tone generator.

• Wendler and Seidner, 1987: developed some software with a singing formant analysis in the phonetogram.

• Pedersen et al, 1984: developed area calculations in semitones times decibel in a standard software.

• Pabon, 1988: developed the setup for online measure of phonetograms with formants.

• Lingwaves

PERSPECTIVES

- The biological situations in voice pathology are extremely varying

- Statistical evidence: meta-analysis comparing several randomised controlled trials (RCT) with well defined baselines of studies

- Has not been done in voice research on vocal cords and laryngopharyngeal reflux studies

- Discussion: is it possible to define a beautiful voice with classic, jazz and belting techniques. Yes, but only for technical perfection.

PERSPECTIVES

- Problem: voice is not "alone" in the larynx, the whole swallowing process and respiration are always involved in intonation.

- Nano-technology and biotechnology are new evidence based sciences preferred for research for the voice clinicians.

- Nano-diagnostics will be a help for diagnostics and to understand treatment effects of medication in the larynx.

- Transparency and evidence.

CONCLUSIONS

Clinical voice practise is renewed with understanding of the interaction between patient demands and advanced technology combined with evidence based statistics.

THANKS TO….

Julie Pedersen, Christian Larsen, Maria Dalby Pedersen, Anders Jønsson, Mike Ellingsen, Martin Eeg, Sarah Øst Jensen, Line Jönsson, Umbreen Yousaf, Shahzleen Rajan, Phillip Jensen, and Anna Beneni.