University of Pittsburgh

Hot Topics: Voice therapy in Adults

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MSHA, March 2013

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School of Health and Rehabilitation Sciences
University of Pittsburgh

Context

- Historical
  - *Voice therapy using a series of "facilitating techniques" (e.g., Boone)*
  - *Distinctive advance at time of introduction; first systematic assembly of wide range of voice therapy techniques, rationale, and case examples*

internet-d.com

Context

- Concern
  - *Voice therapy approaches based on trial and error*
  - *Not addressed: How to get from "here" to "there"*
  - *Approaches lacked cohesive theoretical framework*
  - *Approaches lacked empirical data (difficult to research due to idiosyncratic nature of combining "techniques")*

bananabelt.org

Next generation

- <u>"Packaged" therapies</u>
  - *Lee Silverman Voice Treatment (Ramig)*
  - *Vocal Function Exercises (Stemple)*
  - *Laryngeal massage (Roy)*
  - *Lessac-Madsen Resonant Voice Therapy (Verdolini)*
  - *Accent Method (Smith et al.)*

amassblog.com

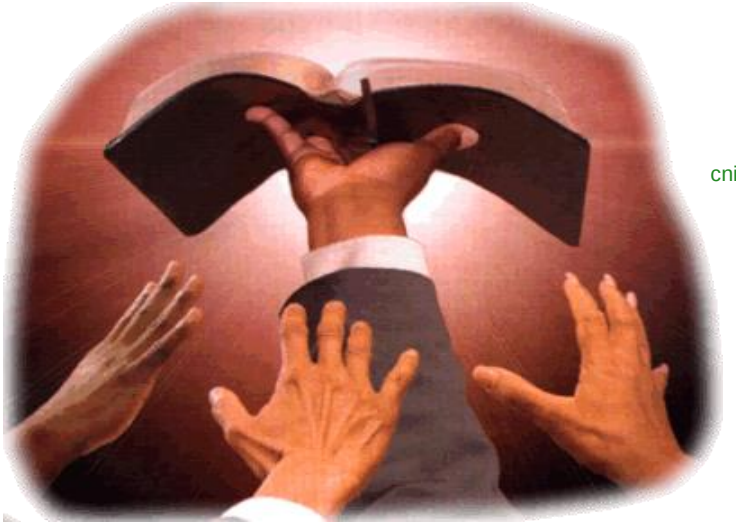
Next generation

- <u>Advantages</u>
  - *Cohesive frameworks*
  - *Systematic programs allowing for (a) formal clinician training; (b) scrutiny by evidence-based medicine*

shebamuturi.wordpress.com

Next generation

- Concerns
  - Nearly evangelical enthusiasm for some programs



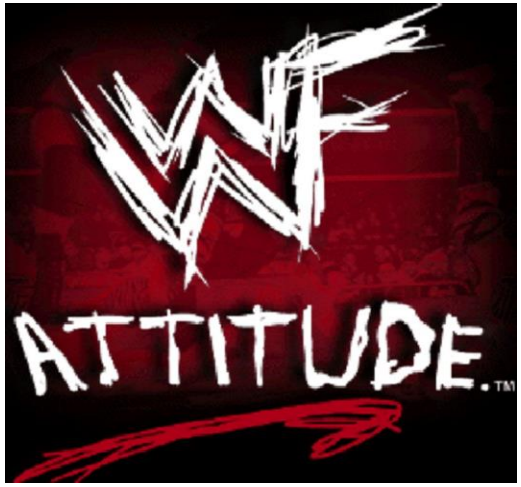
cnimf.org

Next generation

- Concerns
  - Tendency towards "cookbook" orientation

Next generation

- Concerns
  - Questions about “evidence-based medicine” (warning: next slides, minor tirade)



broadstreetbuzz.com

- Qualifier
  - EBM is a generally a good thing, overall
  - I make a living doing EBM
  - I know how to do EBM
  - I simply voice some cautionary concerns meant to “temporize”

Stated differently

- <u>New type of authority</u>
  - Many clinicians seemed as robotic about the new master (EBM) as we did about the old one (“expert opinion”).
  - We need to evaluate the concept and practice of “EBM” judiciously.

Evidence-based medicine

- *“The dark side”*
- (Term coined by Eva van Leer)

alum.wpi.edu

What's the problem???

- The issue seems innocent enough.

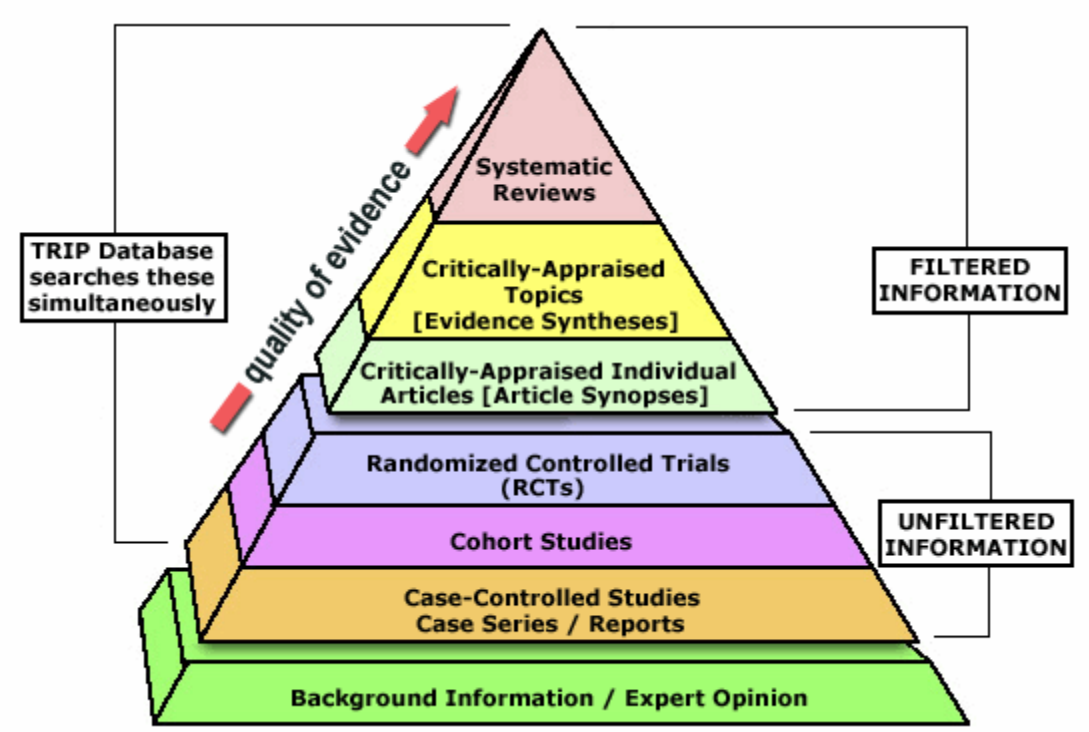
picasaweb.google.com

- EBM defined as *"The conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical experience with the best available external clinical evidence from systematic research."* Sackett et al. *BMJ.* 1996;312:71-72.


Patient
Concerns
EBM
Best research
evidence
Clinical
Expertise

bu.edu

Best research evidence



aspiruslibrary.org

EBM P1(RCT)

- RCTs and RCT meta-analysis as “best evidence” (why???)
- Reveal *average* results for *average* patient; what about *your* patient???
- Success of randomization depends on the *law of (really) large numbers* (think insurance companies), which we *never* have in SLP trials

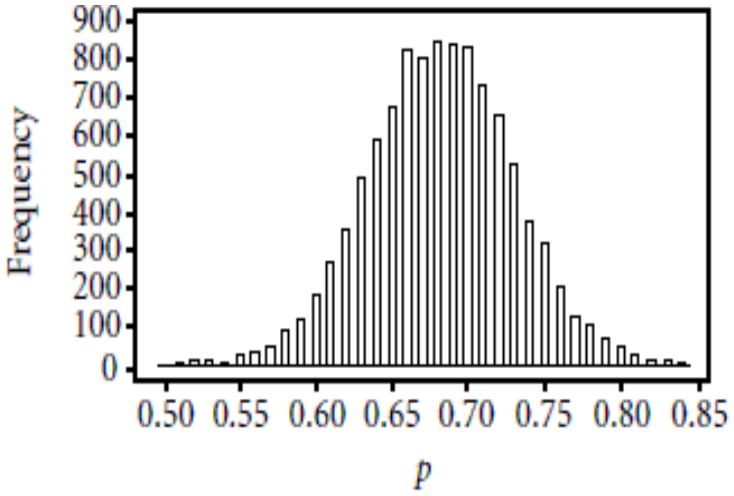


Figure 13.2

education.com

EBM P1(RCT)

- I.e., there are concerns about *deductive* reasoning
  - Deductive reasoning goes from population to individual
  - Works well for *actuarial* purposes (“average” result; relevant for insurance companies) but not necessarily so well for your individual patients
- *Casuistic* reasoning is at least as defensible for clinical practice
  - Reasoning by analogy (e.g., similar cases)
  - Can be rigorous
    - Tonelli, 1998; see also Samarkos, 2006

EBM P2 (Role of “evidence”)

- “Evidence” crowds out experience, values, and resources in the model

- Proponents of EBM remind us that experience, values, and resources are *in* the model.

http://www.flickr.com/photos/jamescridland/613445810/

EBM P2 (Role of “evidence”)

- Then why is it still called “*evidence-based* medicine???”

EBM P3 (Philosophy of science)

- Philosophy of science
  - Basic assumption in science is the future will act like the past (e.g., David Hume; John Cobb)
- Fundamental fallacy
  - Future conditions are never identical to past conditions
  - Even if conditions were identical, stochasticity (randomness) determines different results

EBM P3 (Philosophy of science)

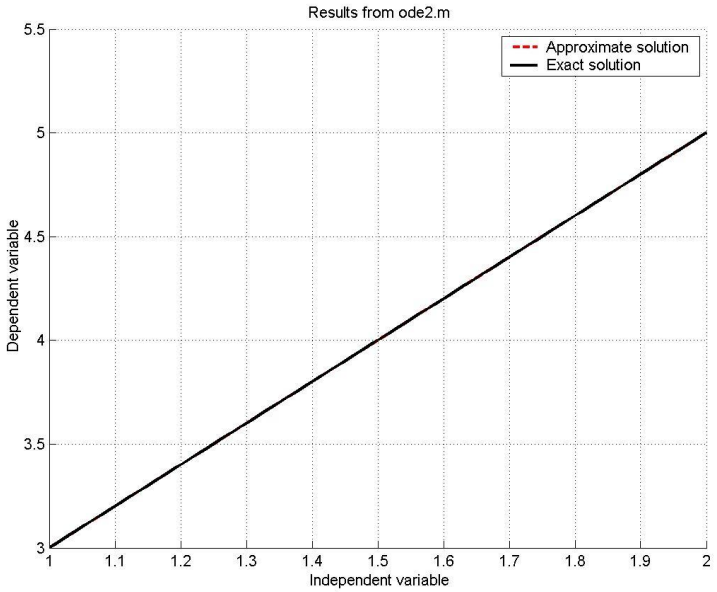
- So are there basic philosophical cautions about what evidence from the *past* can tell us about our patient in the *future*?

hammertap.com

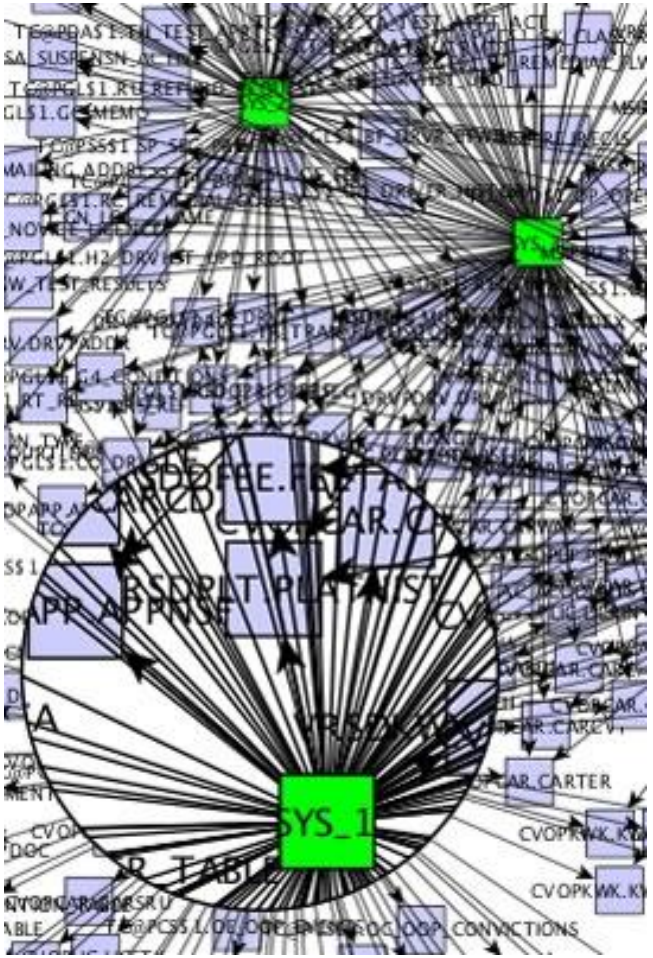
EBM P4 (Reality of nature)

- Moreover, human health is much more complex than typically implied by linear models in most EBM:
  - y = mx + b (linear)
- Complexity
  - *Non*-linearity
  - Variability
  - Stochasticity (random element)
    - E.g. Li et al., 2009;

EBM P4 (Reality of nature)



faculty.uca.edu



m arkettechnologies.com

EBM P5 (Epistemology)

- Epistemology
  - How do we come to "know" things?
  - Only standing "*outside* the problem" as with "evidence," or also standing "*inside* the problem" (explanation follows)?

EBM P6 (Evidence itself!)

- There is no evidence that evidence-based medicine improves clinical outcomes!

naturalhealthcarereviews.com

Possible solutions

- Evidence: Expand the scope of *type* of "evidence" we use, beyond RCTs

- Beyond evidence: Reclaim
  - First principles
  - Intuition and creativity

simple.wikipedia.org

Possible solutions: Expanding scope of “evidence”

- SS evidence: Casuistic reasoning (reasoning by *analogy*, including analogy with other patients of *yours,* i.e., “in my hands” evidence) (Tonelli, 1998; see also Samarkos, 2006)

totallylookslike.icanhascheezburger.com; I’m sparing you the George W. Bush look-alike

Possible solutions:
Beyond “evidence”

- <u>The principle of “first principles”</u>
  - Many first principles don’t need clinical “evidence” about their clinical utility, and can be used flexibly
  - E.g., parachute study

greenstandardstrust.wordpress.com

moonfrye.ning.com

Parachute study

Int J Prosthodont. 2006 Mar-Apr;19(2):126-8.

Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials.

Smith GC, Pell JP.

Source

Department of Obstetrics and Gynaecology, Cambridge University, United Kingdom. gcss2@cam.ac.uk

Abstract

OBJECTIVES:

To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.
Design Systematic review of randomised controlled trials.

DATA SOURCES:

Medline, Web of Science, Embase, and the Cochrane Library databases; appropriate internet sites and citation lists.

STUDY SELECTION:

Studies showing the effects of using a **parachute** during free fall.

MAIN OUTCOME MEASURE:

Death or major trauma, defined as an injury severity score > 15.

RESULTS:

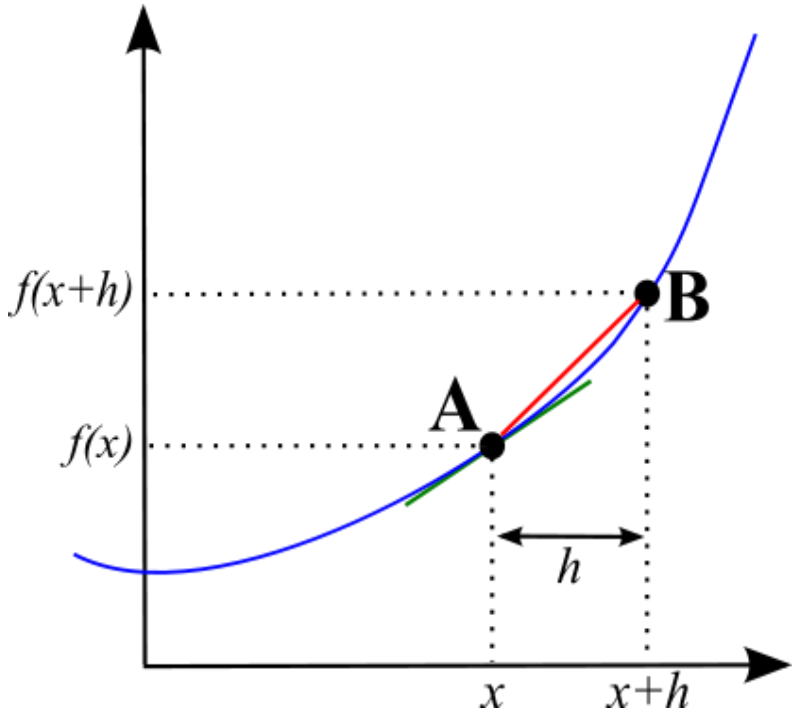
We were unable to identify any randomised controlled trials of **parachute** intervention.

CONCLUSIONS:

As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomised controlled trials. Advocates of **evidence based** medicine have criticised the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of **evidence based** medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the **parachute**.

Beyond “evidence”

- First principles: To a great extent, this course is about *first principles* we can use to flexibly create individualized voice therapy (with examples in packaged “templates”).



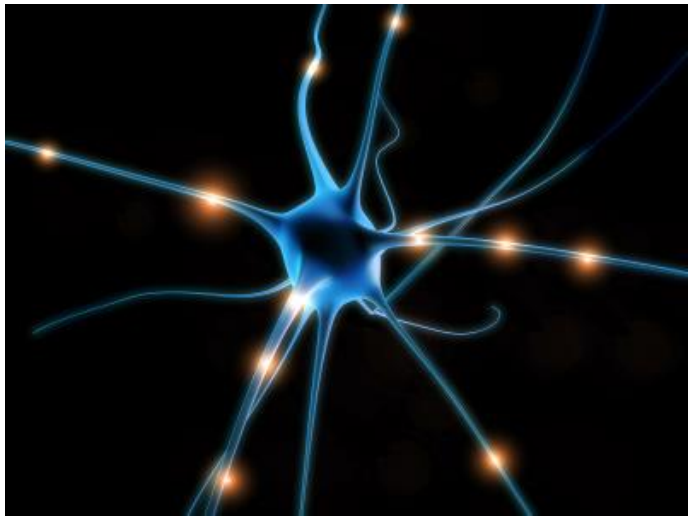
Possible solutions:
The case for *intuition* and *creativity*

- Reclaiming intuition and creativity
  - First step is being fully *present* (to capture cues we miss when we're "in our heads")

inspiration-for-singles.com

Possible solutions: The case for *intuition* and *creativity*

- Reclaiming intuition and creativity
  - Potential reliance on mirror neurons to solve clinical challenges *creatively* in the moment (e.g., Rizzolatti & Craighero, 2004) slog.thestranger.com
  - Potential reliance on nonconscious "data base" we have accumulated clinically, allowing for "intuitive *pattern detection* (e.g., master chess players; Kahneman v. Klein, 2009)



Possible solutions:
The case for *intuition* and *creativity*

- Reclaiming intuition and creativity
  - To a great extent, this course is also about reclaiming *intuition* and *creativity* as partially valid foundations for principled individualized voice therapy.

seotipss.com

Purposes of this short course

- Provide brief introduction to critical “building blocks” (first principles; “hot topics”) for voice tx in adults.
- Review recent data on the utility of the principles in voice tx.
- Demonstrate how these principles can be applied creatively to the clinical situation “in the moment.”

Aside

- Vocal abuse/misuse: *We've gotten rid of these terms, right?*
  - Circular
  - Poorly defined
  - Indistinct
  - Potentially negative for therapy outcome (by way of self-efficacy and compliance; Bandura, 1977)
    - Verdolini, 1999

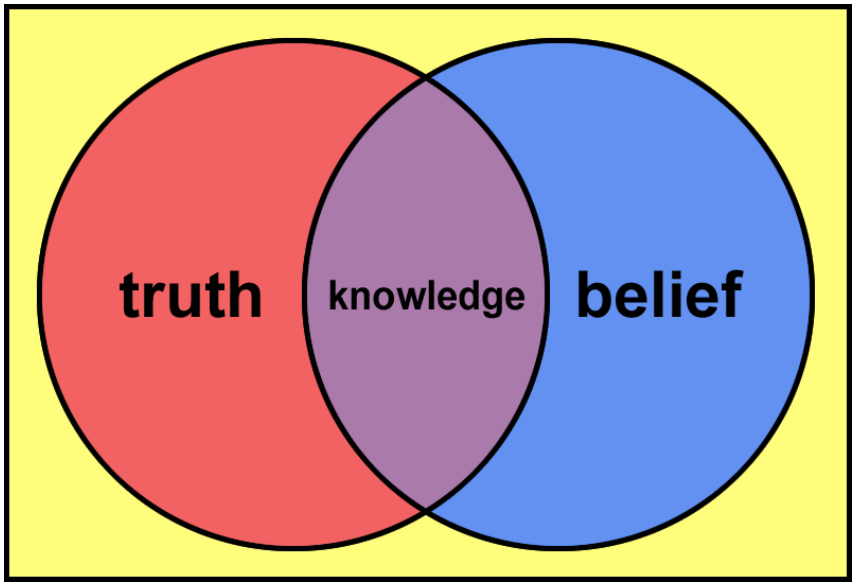
Basic building blocks

- Three parameters are necessary and sufficient to address in voice therapy
  - Physiology (biomechanics, biology): “What?”
  - Learning: “How?”
  - Compliance: “If?”
    - Verdolini-Marston et al., 1995

science-art.com

General proposal

- Knowledge regarding the three parameters
  - Is distinct
  - Is desirable to optimize likelihood of therapy success



en.wikipedia.org


University of Pittsburgh
Building block set #1:
The “what” of voice training and therapy:
Biomechanics and biology

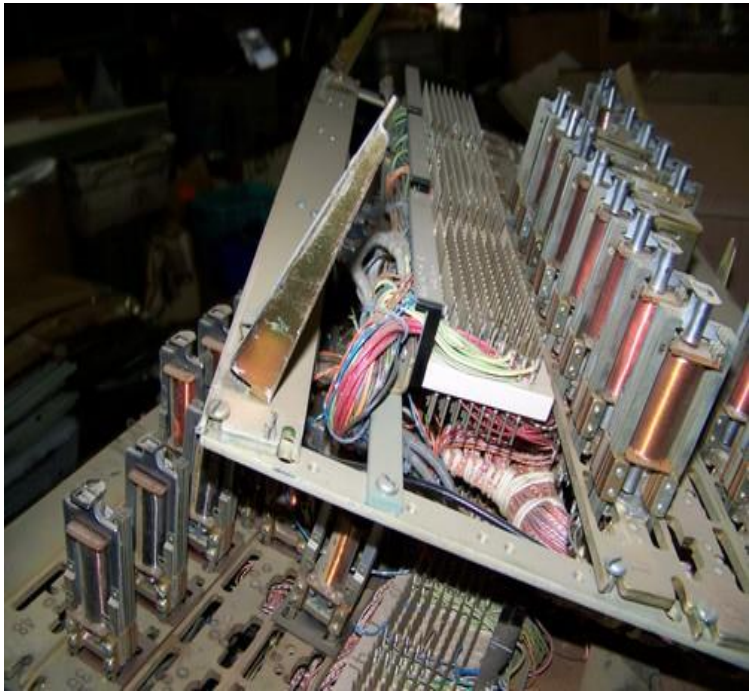
Biomechanics and biology of voice

- Direct therapy (voice training; main focus for most patients)

- Indirect therapy (voice hygiene; supportive for most patients)

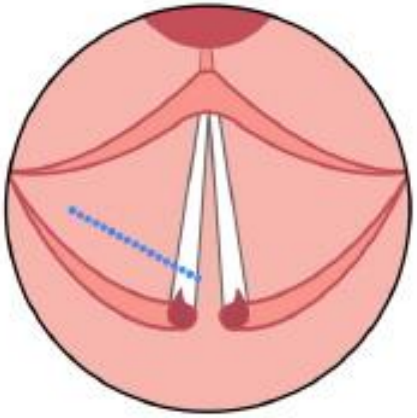
Direct therapy: Starting point

- Basic question: Is there an ideal biomechanical set-up that may optimize voice for a range of people?



Biomechanics

- "Biomechanical set up:" Here = adduction



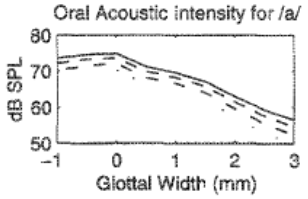
emedicine.medscape.com

- "Optimizing voice:"
  - Intense (clear) voice (dB)
  - Limited injury (SI)
  - Limited effort (PS)
    - Image from www.scientificamerican.com

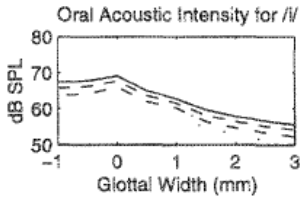
Biomechanics
How do we get good intensity?

- *Excised and simulation study (Berry et al., 2001)*

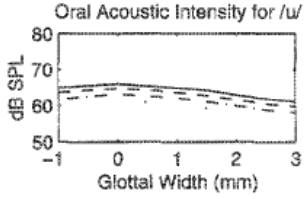
Figure 6. Oral acoustic intensity for (a) [a], (b) [i], and (c) [u], in dB SPL, as a function of glottal width (mm), for subglottal pressures of 1.0 (dotted lines), 1.2 (dashed-dotted lines), 1.4 (dashed lines), and 1.6 kPa (solid lines). Based on computer simulation with vocal tract, using a fundamental frequency of 150 Hz



(a)



(b)

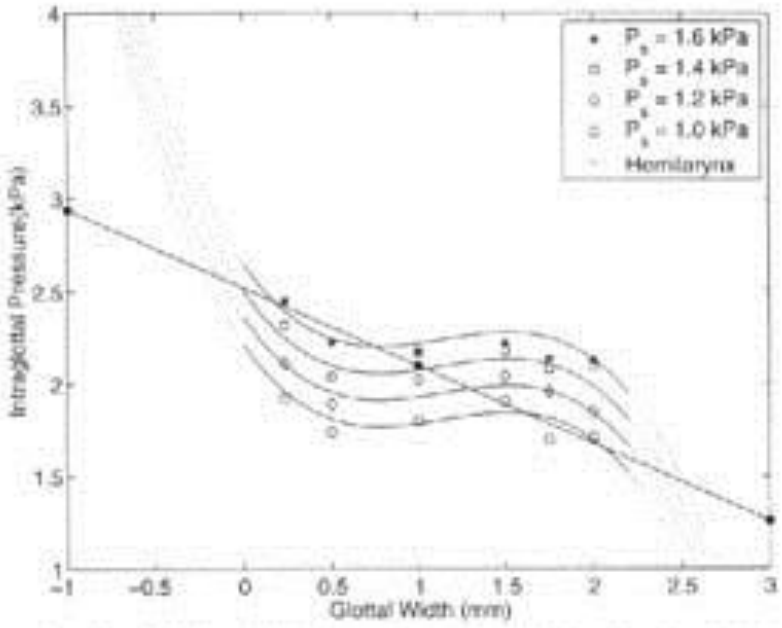


(c)

Biomechanics
How do we limit potential for injury?

- *Excised study (Berry et al., 2001)*

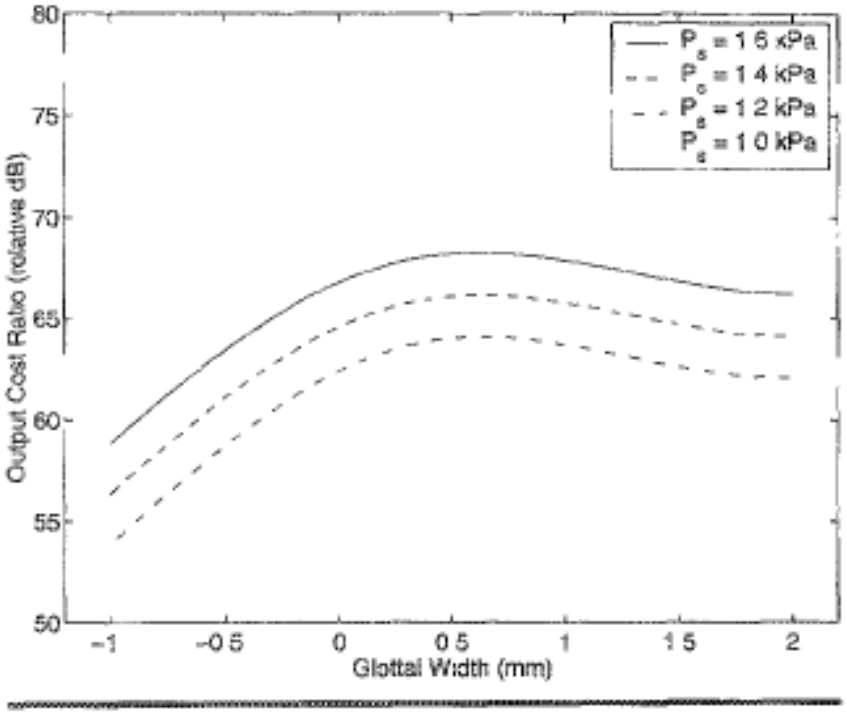
Figure 4. Vocal fold impact stress (kPa) as a function of glottal width (mm) for subglottal pressures of 1.0, 1.2, 1.4, and 1.6 kPa. Based on an excised canine larynx study, using a fundamental frequency of approximately 150 Hz.



Biomechanics
How do we get a lot of output intensity *for* limited injury potential

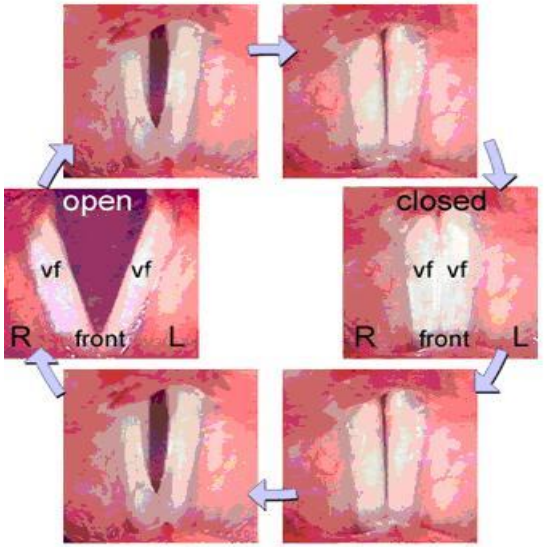
- *Divide output intensity curve by impact intensity curve ("vocal economy;" Berry et al., 2001)*

Figure 5. OCR (relative dB) as a function of glottal width (mm), for subglottal pressures of 1.0, 1.2, 1.4, and 1.6 kPa. Based on an excised canine larynx study, using a fundamental frequency of approximately 150 Hz.



Biomechanics

- Summary:

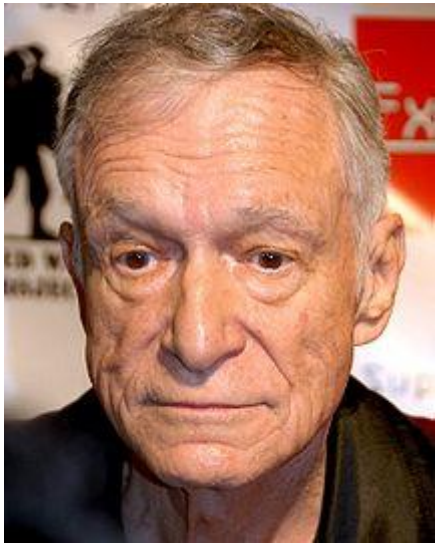


- Vocal fold posturing yielding best vocal economy: barely separated vocal folds (~0.6-0.7 mm), for conditions tested
- *Precisely* replicated results for independent human study
- Generally similar results expected for other fundamental frequencies, possibly with slight shifts (existing studies run with Fo ~ 155 – 196 Hz; Berry, personal communication)

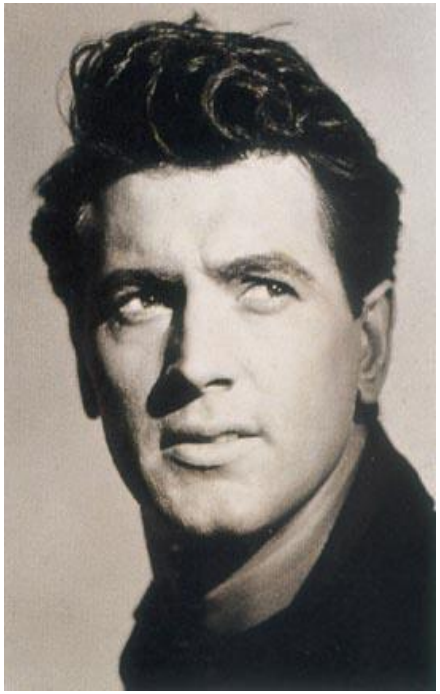
http://www.stammeringlife.com/Images/Vocal%20Folds%20(vf)%20Opening%20and%20Closing.JPG

Biomechanics

- Problem: We wanted
  - Strong output (√)
  - Limited impact (√)
  - Limited effort…(?)
  - thefullwiki.org; kimmystle.blogspot.com; radioarchives.dom



- Pick 2 out of 3???

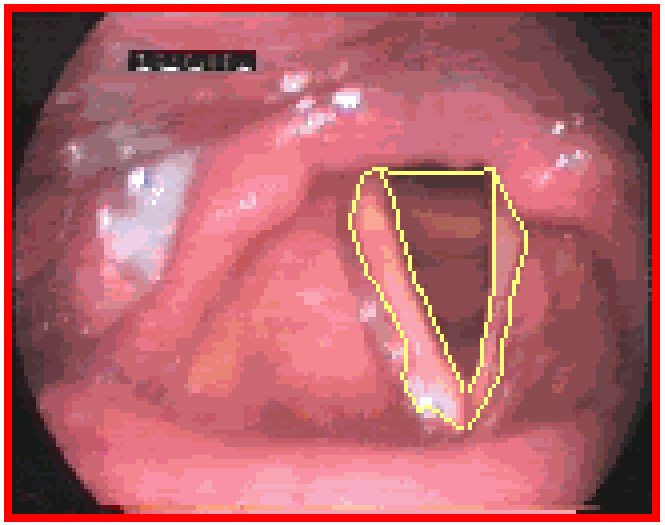


Biomechanics

- Nope.
- $PL \geq \frac{k}{T} B c w$
  - Titze, 1988

  - *k* = constant
  - *B* = damping coefficient (~viscosity)
  - *c* = speed of mucosal wave
  - *w* = prephonatory width at vocal processes

drspeech.com



Biomechanics

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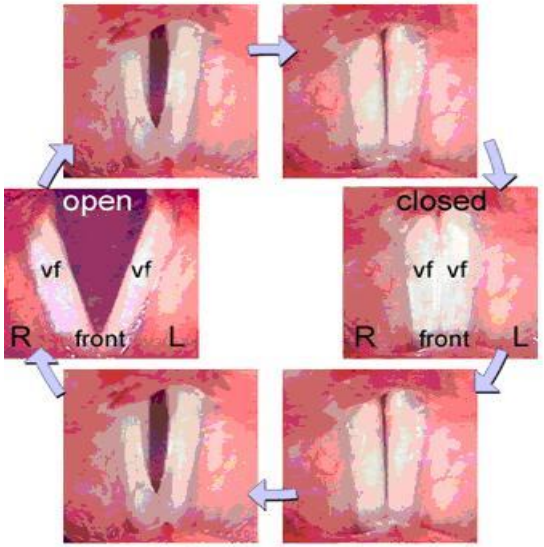


- Barely touching or barely separated VF posture gives us biomechanical target relevant for wide sector of population with voice disorders
  - Strong acoustic output
  - Minimal impact stress
  - Minimal phonatory effort

http://www.stammeringlife.com/Images/Vocal%20Folds%20(vf)%20Opening%20and%20Closing.JPG

Biomechanics

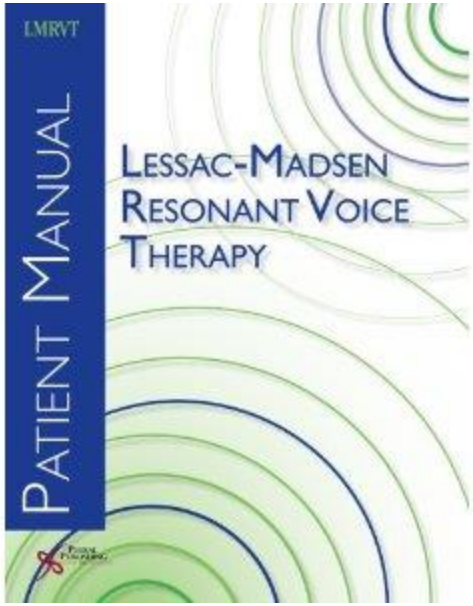
- As chance would have it

- "Resonant voice" – produced with this general posturing
  - Peterson et al., 1994
  - Verdolini et al., 1998

http://api.ning.com/files/vlzj-gWGwag4ns0bp0kF-GRoztWyRSrxo78oTwyb9rO3-28SsjXn5aOOtT9C0j*clTfJTE8-SiaRPWY0pByJ7xMTTK-adcrj/singer.jpg

Biomechanics

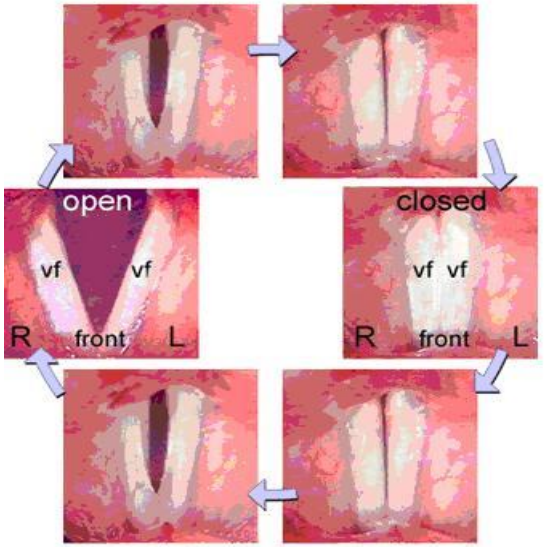
- Resonant voice



- Voice produced with perceptible anterior oral vibrations, in the context of “easy” voice
- Involves *large-amplitude, low-impact vocal fold oscillations*
  - Verdolini-Marston et al., 1995; Verdolini, 2000; Peterson et al., 1994; Verdolini et al., 1998; video

Biomechanics

- Summary to this point



- Barely ad/abducted vocal folds optimize relation between voice output intensity (strong) and impact stress (small). Same configuration relatively minimizes vocal effort as well.

- Target configuration corresponds to percept of “resonant voice” (anterior oral vibrations, easy voice, involving *large-amplitude, low-impact VF oscillations*)

http://www.stammeringlife.com/Images/Vocal%20Folds%20(vf)%20Opening%20and%20Closing.JPG

Links to a “spectrum”of voice therapies

theblackbat.com

LEGEND (APPROX EQUIV)

1 = PRESSED VOICE

2 = NORMAL VOICE, RESONANT VOICE, VOCAL FUNCTION EXERCISES, ACCENT METHOD, LSVT

3 = FLOW VOICE

4 = YAWN-SIGH/FALSETTO

5 = BREATHY VOICE

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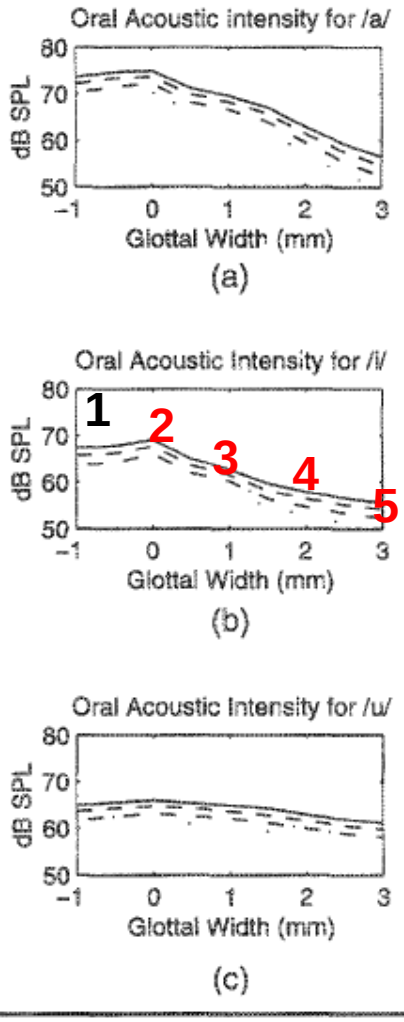

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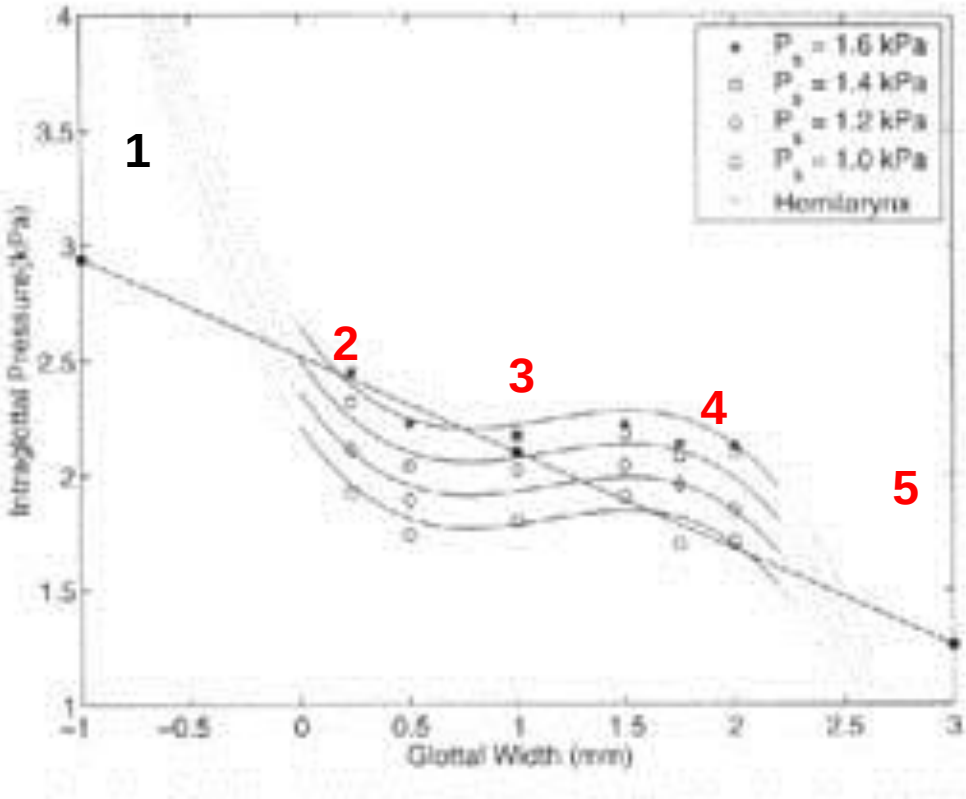

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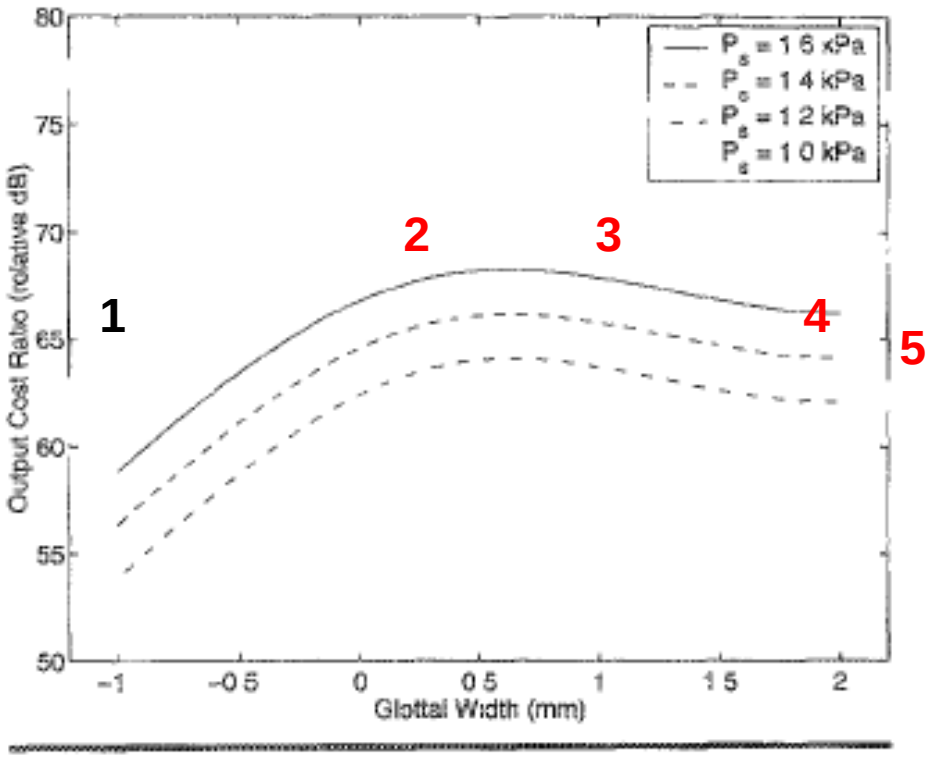


Momentary pause in the action

- Based on this information (alone), which voice pattern would you select for different patients in voice therapy?

http://www.fairview.org/Services/Rehab/Services/Voicetherapy/index.htm

But what about the new “black” in voice science and therapy?

- **The new buzz: “SEMI-OCCLUDED VOCAL TRACT”**

flypaper.bluefly.com

What is a semi-occluded vocal tract?

- Vocal tract with narrowing at any point
- Including
  - Epiglottal/pharyngeal narrowing
  - (Voiced) consonant production
  - Nasal sounds (narrowing at palate)

http://liongadgets.com/wordpress/wp-content/uploads/2012/09/question-mark.jpg

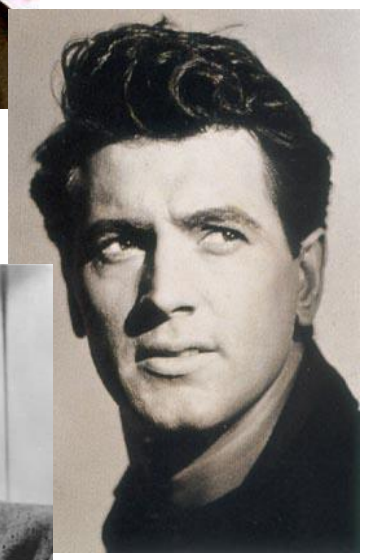
Biomechanics
SOVT gets you

- Facilitation of VF oscillation (possibly increased output intensity)
- Decreased VF adduction (decreased impact intensity)
- Decreased phonation threshold pressure (increased vocal ease)

- Titze, 1988; 2006; 2009; 2011

Yay!

- We enhance all those benefits – which we wanted – from the barely ad/abducted VF configuration (resonant voice).



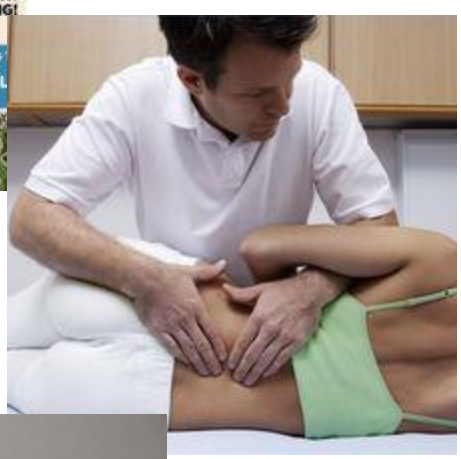
Transition to Biology

- Why is this exciting?
  - SOVT→VF abduction may be seen as biological injury *prevention* factor (SI minimized)
  - SOVT→Large VF vibrations may be a biology injury *treatment* factor (see why next slides)
  - SOVT→reduced PTP may be a *physical ease* factor

topwomensmagazines.com

ehow.com

keetsa.com



Biology

- <u>Treatment factor:</u>
  - Some forms of tissue mobilization—as with large amplitude VF vibrations from SOVT -- may have anti-inflammatory effects (e.g., periodontics)

newdentalimplants.org

Biology

- Relevant for us:
  - Anti-inflammatory benefits of tissue mobilization appears related to *cell deformation from tissue elongation*….
  - ….as may occur with large-amplitude VF vibrations (with SOVT).

icky.blogspot.com

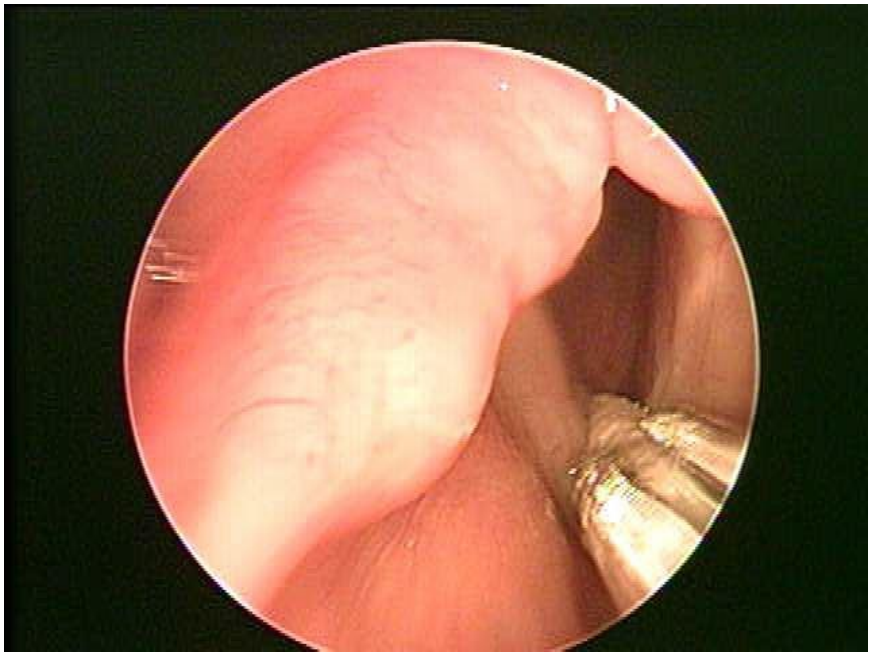
Biology

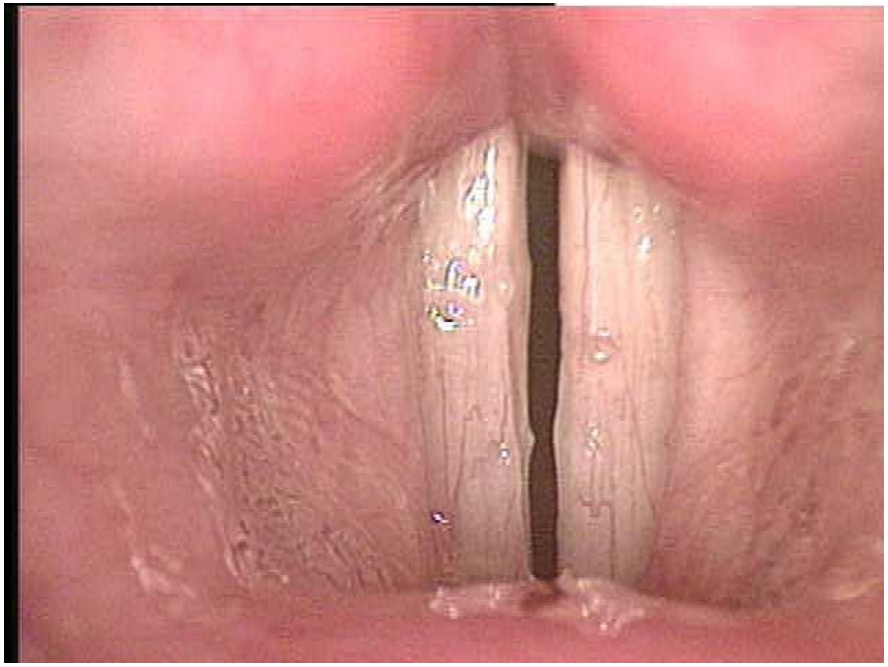
- Inflammatory mediator modulation is important not only for the *acute phase* of wound healing, but also for *long-term phases* of healing, as *initial events shape long-term outcomes*.

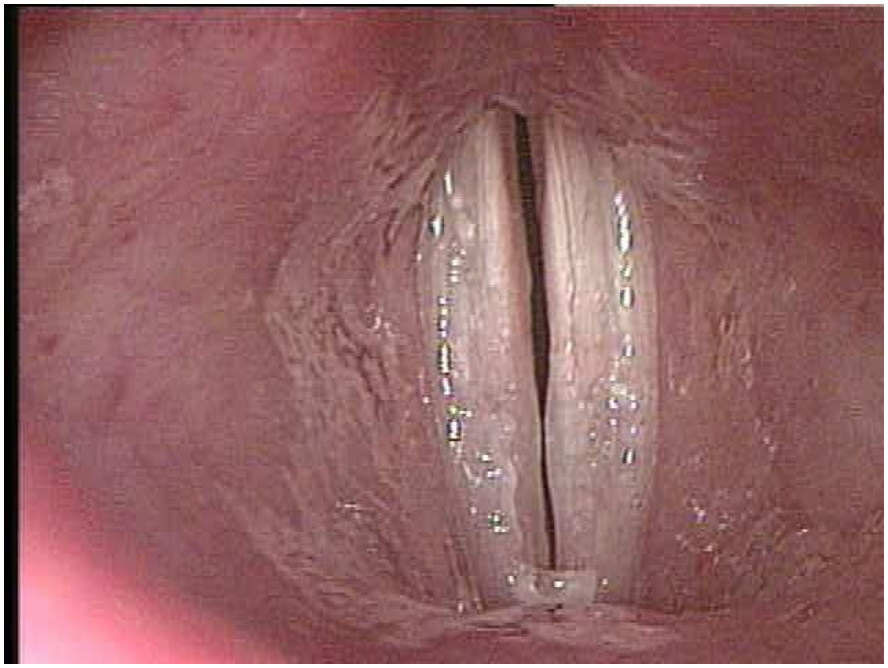
- (Agarwal et al. 2003; Charon, Luger, Mergenhagen, & Oppenheimer, 1982; Clark, 1988; Cockbill, 2002; Ghosh & Karin, 2002; Karin & Lin, 2002; Kirsner & Eaglstien, 1993; Long, Buckley, Liu, Kapur, & Agarwal, 2002; Long, Hu, Piesco, Buckley, & Agarwal, 2001; Viatour, Merville, Bours, & Chariot, 2005; Witte & Barbul, 1997).

Biology

- Test in vocal fold →



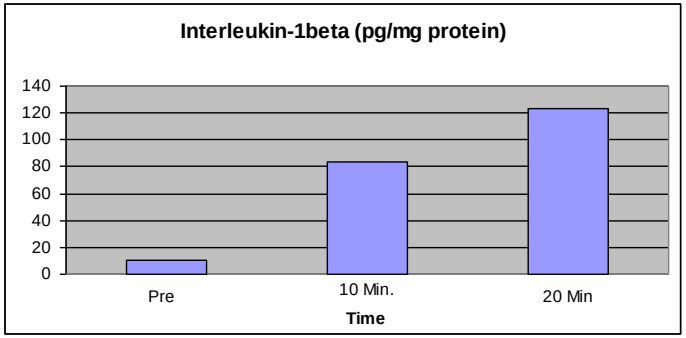


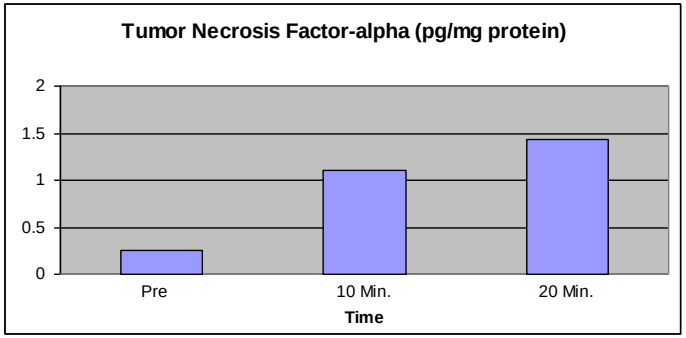


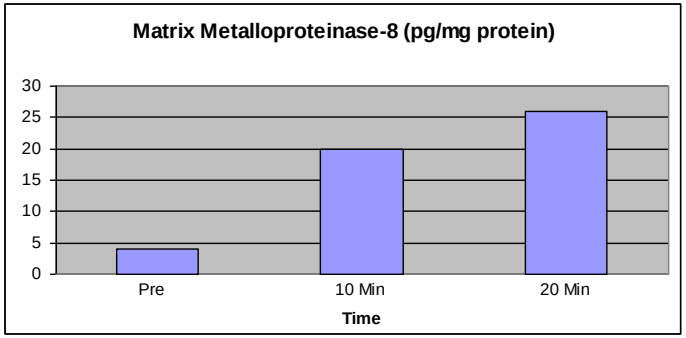
Biology

- First study showed we detect (presumably) VF inflammatory mediator concentrations in vocal fold secretions; *controversial*

Verdolini et al., 2003

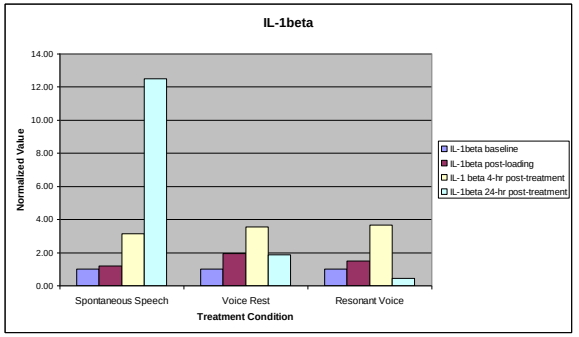


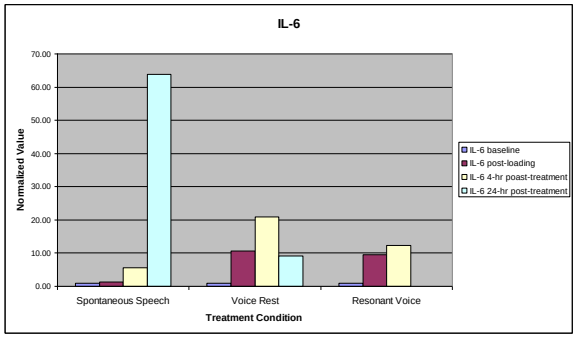


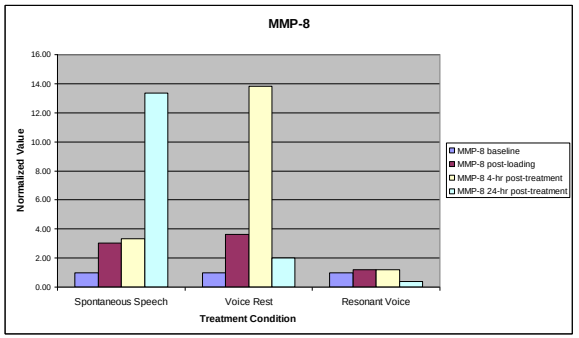


Biology

- Scream study







Verdolini Abbott et al., 2012

	IL-1β			IL-6		
	SS	**Rest**	**RV**	**SS**	**Rest**	**RV**
N	1	1	1	2	1	2
Post	1.21 (0.00)	1.93 (0.00)	1.51 (0.00)	2.65 (1.33)	10.62 (0.00)	8.31 (1.24)
4hr post	3.13 (0.00)	3.54 (0.00)	3.68 (0.00)	3.44 (2.12)	20.94 (0.00)	6.30 (5.96)
24hr post	12.52 (0.00)	1.87 (0.00)	0.45 (0.00)	32.25 (31.61)	9.16 (0.00)	2.72 (2.72)
	IL-8			**TNF-α**		
	SS	**Rest**	**RV**	**SS**	**Rest**	**RV**
N	1	0	1	1	1	1
Post	4.57 (0.00)	Nil	6.22 (0.00)	1.25 (0.00)	1.18 (0.00)	1.26 (0.00)
4hr post	4.18 (0.00)	Nil	4.23 (0.00)	0.96 (0.00)	1.22 (0.00)	1.30 (0.00)
24hr post	14.81 (0.00)	Nil	2.08 (0.00)	4.69 (0.00)	1.11 (0.00)	1.14 (0.00)
	MMP-8			**IL-10**		
	SS	**Rest**	**RV**	**SS**	**Rest**	**RV**
N	1	1	1	2	1	1
Post	3.04 (0.00)	3.62 (0.00)	1.21 (0.00)	1.53 (0.44)	2.48 (0.00)	1.16 (0.00)
4hr post	3.33 (0.00)	13.82 (0.00)	1.18 (0.00)	2.85 (1.07)	0.56 (0.00)	1.59 (0.00)
24hr post	13.34 (0.00)	2.00 (0.00)	0.38 (0.00)	2.62 (1.54)	1.38 (0.00)	4.09 (0.00)

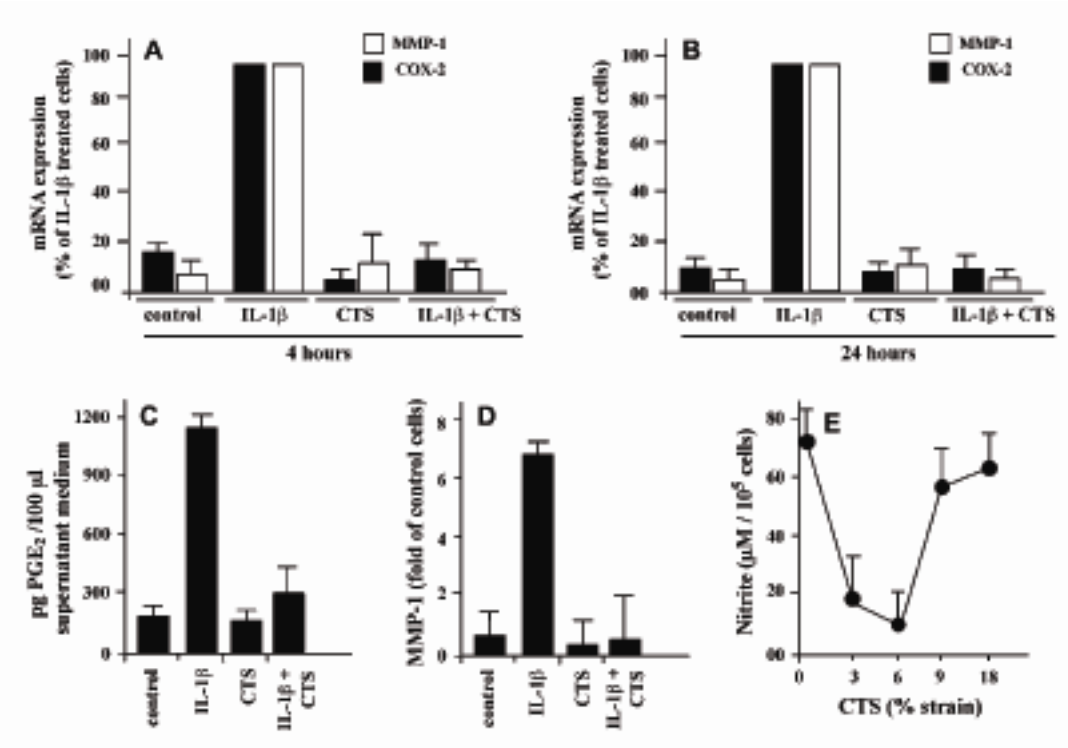
Biology

- Summary so far for biology of resonant voice using SOVT (proposal):
  - Low VF impact, helping to minimize (further) tissue damage = *biological prevention factor*
  - Large-amplitude VF oscillations (tissue mobilization) = *biological healing factor*

http://www.creatingpositivelives.co.uk/assets/Healing%20Hands%20Larger%201.jpg

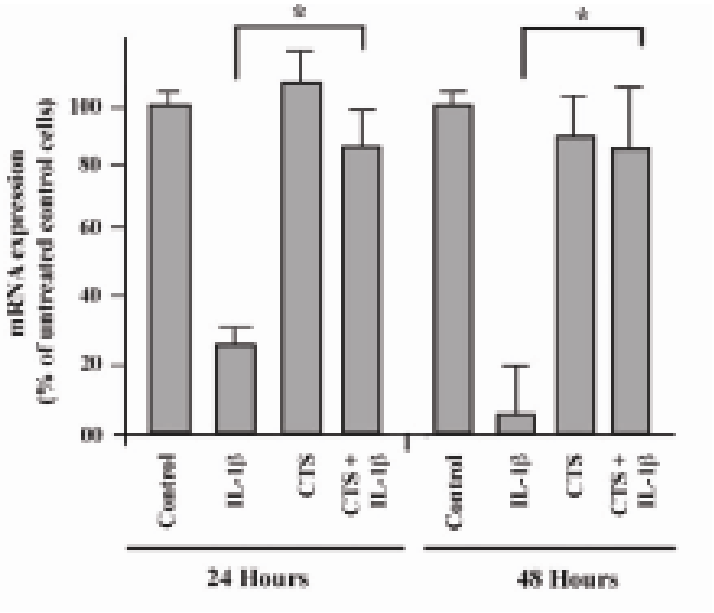
Biology

- Branski et al. (2007; Best Basic Science paper, *J Voice*)



Biology

- Branski et al. (2007; cont'd)



Biology

- Li: ABM simulation in phonotrauma

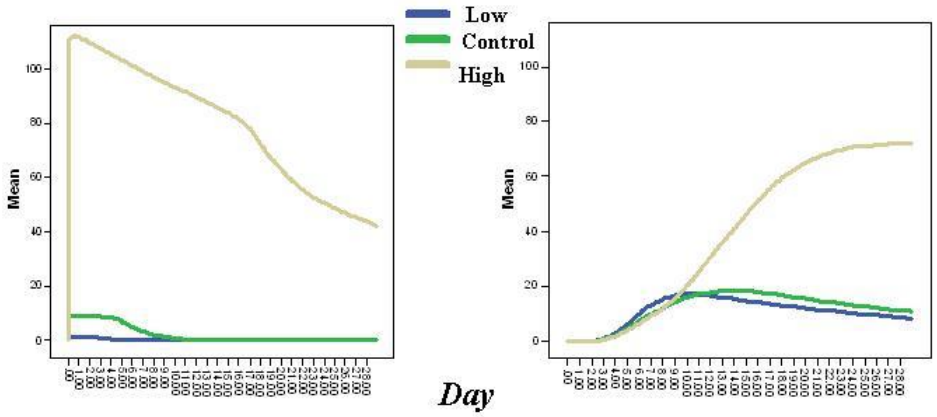


Figure 5. Prediction of tissue damage (left) and collagen accumulation (right) under the three initial magnitudes of mucosal damage: control, low and high. Both predictions are in arbitrary unit.

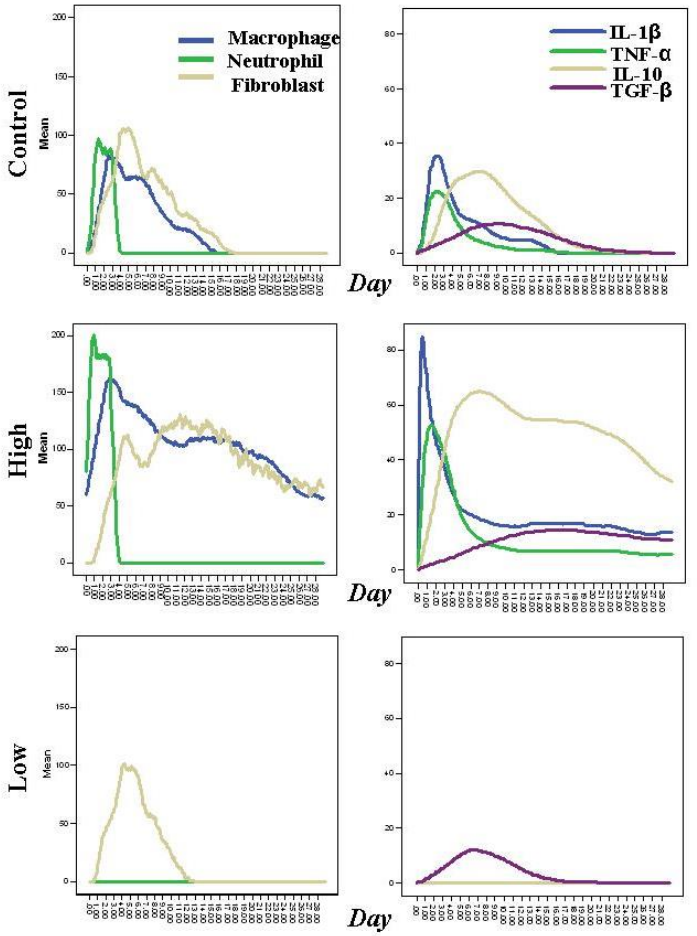


Figure 4. Predictions of inflammatory and wound healing response to acute phonotrauma. Left panels are the predicted cellular events (macrophage, neutrophil and fibroblast) and right panels are the predicted molecular events (IL-1β, TNF-α IL-10, TGF-β). The concentrations are in arbitrary unit. Predictions were run under the three initial magnitudes of mucosal damage (from top to bottom): control, high and low.

Based on Li et al., 2005; Li et al., 2011

Biology

- But wait!
- We've talked about value of resonant voice for *acute* injury
- What about *chronic* injury, which is most of what we see?

- Phases of healing
  - Inflammation (several days); evidence is encouraging
  - Protein synthesis (a few weeks)
  - **Tissue remodelling (year or longer) → proteins align according to force vectors applied during healing; thus far clear evidence not available (possibly RV helps reduce acute component of chronic injury?)**

How might these considerations impact clinical decisions?

- *Discussion*
- Clinical data

Data

- R01 DC 005643
- Teachers with phonotrauma (most) or other phonogenic voice problem (e.g., MTD; a few) (mostly females)
- Subjects run 2005-2009
- N=105 randomized (52 CSCFT; 53 LMRVT)
- 4 wk therapy (2 back-to-back sessions/wk)
- Follow-up immediately post tx, 3 mo post tx, and 1 yr post baseline
- At 1 yr post baseline, N=40 CSCFT; 42 LMRVT)

Primary outcome measure

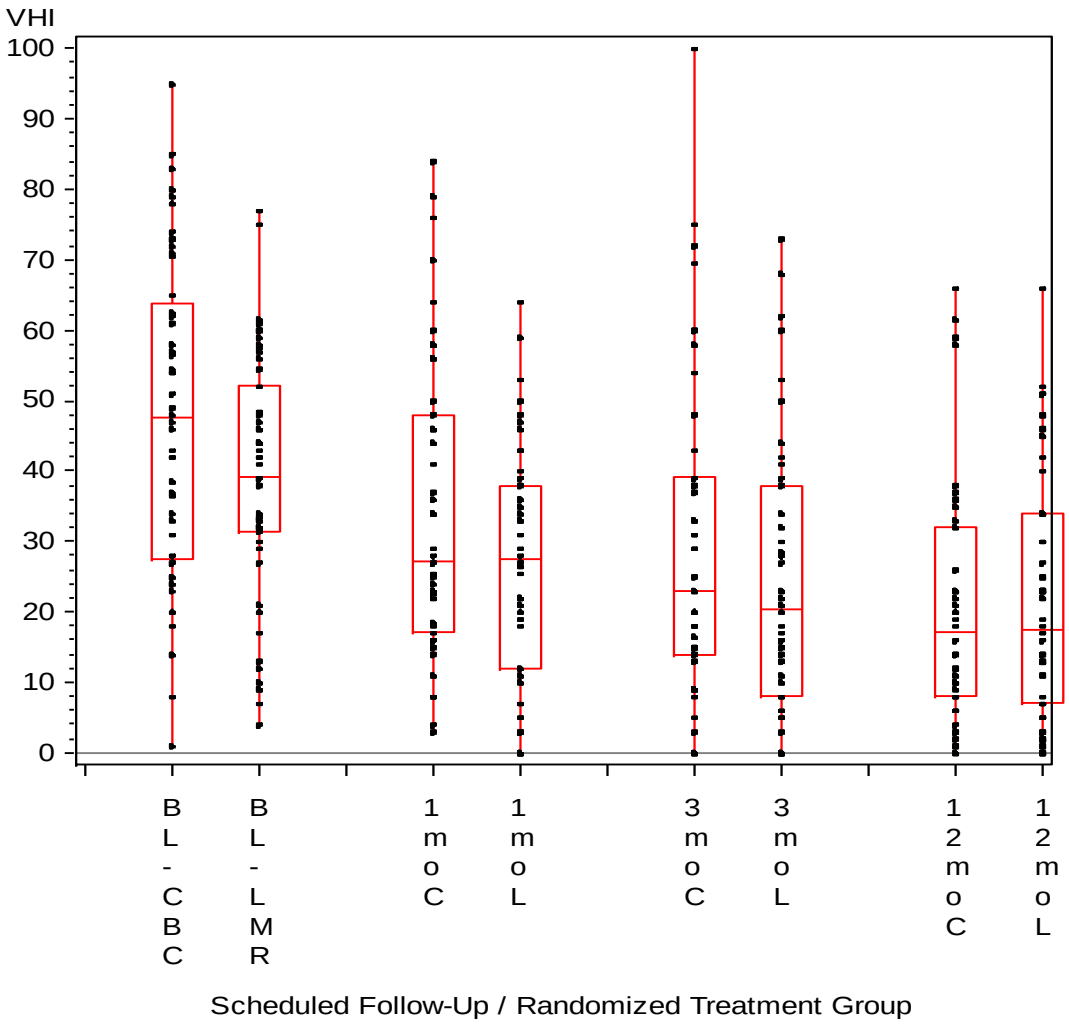
- *Voice Handicap Index*

Chart 1. Voice Handicap Index (adapted from Jacobson et al.; 1997)

0 = NEVER 1 = ALMOST NEVER 2 = SOMETIMES 3 = ALMOST ALWAYS 4 = ALWAYS

PART I: Functional aspect	
1) Do people have difficulties to understand your voice?	0 1 2 3 4
2) Do people have difficulties to understand you in noisy environments?	0 1 2 3 4
3) Does your family have difficulties hearing you when you call them at home?	0 1 2 3 4
4) Do you stop using the telephone because of your voice?	0 1 2 3 4
5) Do you avoid groups of people because of your voice?	0 1 2 3 4
6) Do you talk less to friends, neighbors and relatives because of your voice?	0 1 2 3 4
7) Do people ask you to repeat yourself when talking to you face-to-face?	0 1 2 3 4
8) Does your voice restrict you in your personal and social lives?	0 1 2 3 4
9) Do you feel left out in conversations or discussions because of your voice?	0 1 2 3 4
10) Has your voice problem caused you to lose your job?	0 1 2 3 4
PART II: Physical aspect	
1) Do you feel breathless when talking?	0 1 2 3 4
2) Does your voice vary during the day?	0 1 2 3 4
3) Do people ask: "What's wrong with your voice?"	0 1 2 3 4
4) Does your voice feel hissy or dry?	0 1 2 3 4
5) Do you struggle to produce your voice?	0 1 2 3 4
6) Is the clarity of your voice unpredictable?	0 1 2 3 4
7) Do you try to change your voice in order to sound different?	0 1 2 3 4
8) Do you make a lot of effort to speak?	0 1 2 3 4
9) Is your voice worse at the end of the day?	0 1 2 3 4
10) Does your voice fail in the middle of a conversation?	0 1 2 3 4
PART III: Emotional aspect	
1) Do you feel tense when talking to other people because of your voice?	0 1 2 3 4
2) Do people get irritated because of your voice?	0 1 2 3 4
3) Do you feel other people do not understand your voice problem?	0 1 2 3 4
4) Does your voice bother you?	0 1 2 3 4
5) Are you less sociable because of your voice?	0 1 2 3 4
6) Do feel impaired because of your voice problem?	0 1 2 3 4
7) Do you dislike it when people ask you to repeat yourself?	0 1 2 3 4
8) Do you feel embarrassed when people ask you to repeat yourself?	0 1 2 3 4
9) Does your voice make you feel incompetent?	0 1 2 3 4
10) Do you feel ashamed of your voice problem?	0 1 2 3 4

scielo.br


VHI
100
90
80
70
60
50
40
30
20
10
0
BL-CBC
BL-LMR
1moC
1moL
3moC
3moL
12moC
12moL
Scheduled Follow-Up / Randomized Treatment Group

Next step

- Just how are we going to get people to *learn* this laryngeal configuration?
- *Perceptual-motor learning principles*

http://liongadgets.com/wordpress/wp-content/uploads/2012/09/question-mark.jpg

Note

- So far, we've discussed biomechanics and biology of direct therapy.
- There's also indirect therapy to consider (aka voice hygiene).

disialoinc.com

We'll make this quick (time permitting)

- Starting point in considering voice hygiene piece of voice therapy: We want *targeted*, not "shot gun" intervention.

nikkibrandyberry.wordpress.com

Specifically

- We want program that is *mean and lean*, minimizing the number of things we ask people to do (see “compliance” lecture).

http://www.google.com/search?hl=en&site=imghp&tbm=isch&source=hp&biw=1440&bih=900&q=lean+and+mean&oq=lean+and+mean&gs_l=img.3..0l2j0i24l8.1771.3124.0.3650.13.9.0.4.4.0.127.594.7j2.9.0...0.0...1ac.1.5.img.cMsUP8V2Bkg#imgrc=QW9AhWqekeP7lM%3A%3BmxIAmwR4ELmOSM%3Bhttp%253A%252F%252Froufusport.com%252Fimages%252FUFC%2525201-16-06%252Fbonnarposes.jpg%3Bhttp%253A%252F%252Froufusport.com%252Fufcjan06.html%3B401%3B383

Thus

- We will target **3** parameters:
  - **Hydration**
  - **Exogenous inflammation**
  - **Uncontrolled yelling and screaming**

spendamillion.com

- We will further ***tailor*** our instructions to make them *patient-specific*.

Vocal hygiene: Dehydration (bad)

- Increases the subglottic pressure required to oscillate the vocal folds

  Fisher et al., 2001; Jiang et al., 2000; Titze, 1988; Verdolini-Marston et al., 1990; Verdolini et al., 1994; Verdolini et al., 2002

- May increase the risk of phonotrauma

  Titze, 1981

http://web.hcsps.sa.edu.au/projects/deserts/projects/group13/namib%20desert%201.jpg

Vocal hygiene: Hydration (good)

- Reduces the subglottic pressure required to oscillate the vocal folds

  Jiang et al., 2000; Verdolini-Marston et al., 1990; Verdolini et al., 1994

- May diminish phonotraumatic lesions

  Verdolini-Marston et al., 1994

http://lomophilly.files.wordpress.com/2009/09/water-drop-a.jpg

Vocal hygiene: Inflammation (bad)

Laryngopharyngeal reflux

- LPR could increase the risk of phonotraumatic lesions and other conditions (e.g. cancer; paralysis)

- According to some data, effective treatment of LPR may improve vocal fold condition and voice

(Koufman, 1991; Shaw et al., 1996, 1997)

http://science.nayland.school.nz/SimonPa/Webpage/Year11/Acid_and_base_image/Acid_med.jpg

Vocal hygiene: Inflammation (bad)
Laryngopharyngeal reflux

- <u>However</u>
  - Scary (next page)

http://images.icanhascheezburger.com/completestore/2009/4/5/128834617768108870.jpg

Laryngoscope. 2006 Jan;116(1):144-8. Links

Empiric treatment of laryngopharyngeal reflux with proton pump inhibitors: a systematic review.

Karkos PD, Wilson JA.
Department of Otolaryngology, The Freeman Hospital, Newcastle upon Tyne, UK.

OBJECTIVE: The objective of this study was to define the outcome of empiric treatment of suspected laryngopharyngeal reflux (LPR) symptoms with proton pump inhibitors (PPIs). DESIGN: The authors conducted a systematic review of the English and foreign literature. Studies that used PPIs as an empiric treatment modality for suspected LPR, whether alone or in combination with other acid suppressants and/or placebo, were included. Studies that did not include PPIs as a treatment option were excluded. MAIN OUTCOME MEASURES: A lack of common outcome measures was evident in the uncontrolled studies. In the randomized, controlled trials, outcome measures included symptom questionnaires and videolaryngoscopy. Only one study used computerized voice analysis. RESULTS: Fourteen uncontrolled studies together with one unblinded, nonrandomized study with a control group of healthy volunteers and six double-blind, placebo-controlled randomized trials were identified from 1994 to 2004. Selection bias, blinding of the results, and lack of common outcome measures were some of the problems preventing a formal metaanalysis. Although uncontrolled series reported positive results, randomized, controlled trials demonstrated no statistically significant differences for changes in severity or frequency of symptoms associated with suspected reflux between PPIs and placebo. CONCLUSIONS: Recommendations for empiric treatment of suspected LPR with PPIs, by far the most common ear, nose and throat practice in the United Kingdom, are based on poor levels of evidence from uncontrolled studies. The few randomized, controlled trials have failed to demonstrate superiority of PPIs over placebo for treatment of suspected LPR.

Vocal hygiene: Inflammation (bad)

Smoking and other

- Exogenous inflammation impairs voice and may increase the risk of phonotrauma as well.

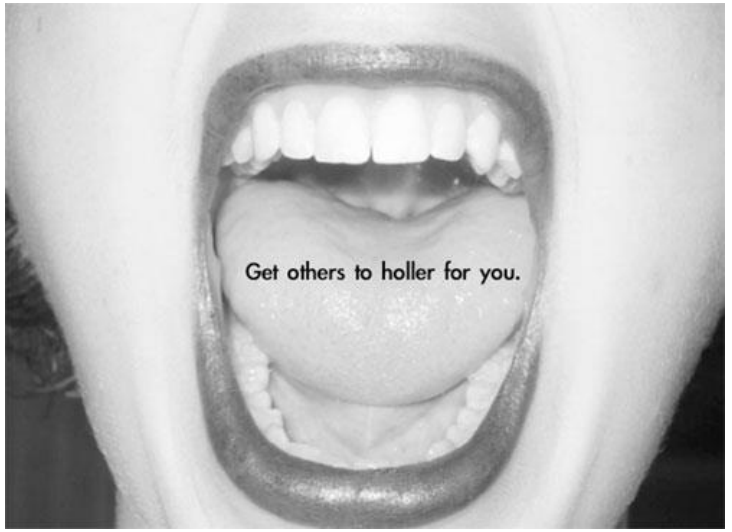
- Includes smoke and other pollutants and allergens (e.g., petrol pollution, chemical exposures) and allergens. E.g. Richter et al.

http://i.treehugger.com/images/2007-2-28/smoking.jpg

Vocal hygiene:
Screaming like crazy (bad)

- Phonotraumatic; threshold for phonotrauma person-specific.

- *Unless* you have specialized training in screaming by a knowledgeable theatre trainer (use of epiglottis as noise source; vocalization in falsetto).
  - *E.g. Ufema & Montequin, unpublished data*



http://thepeoplebrand.com/blog/wp-content/uploads/2007/03/holler2.jpg

Recent data

- Randomized study, 31 student teachers (healthy/voice problems)
  - Voice hygiene alone (targeted)
  - Voice hygiene + voice training
  - Control

- Hygiene alone: Sufficient to prevent voice problems in healthy student teachers

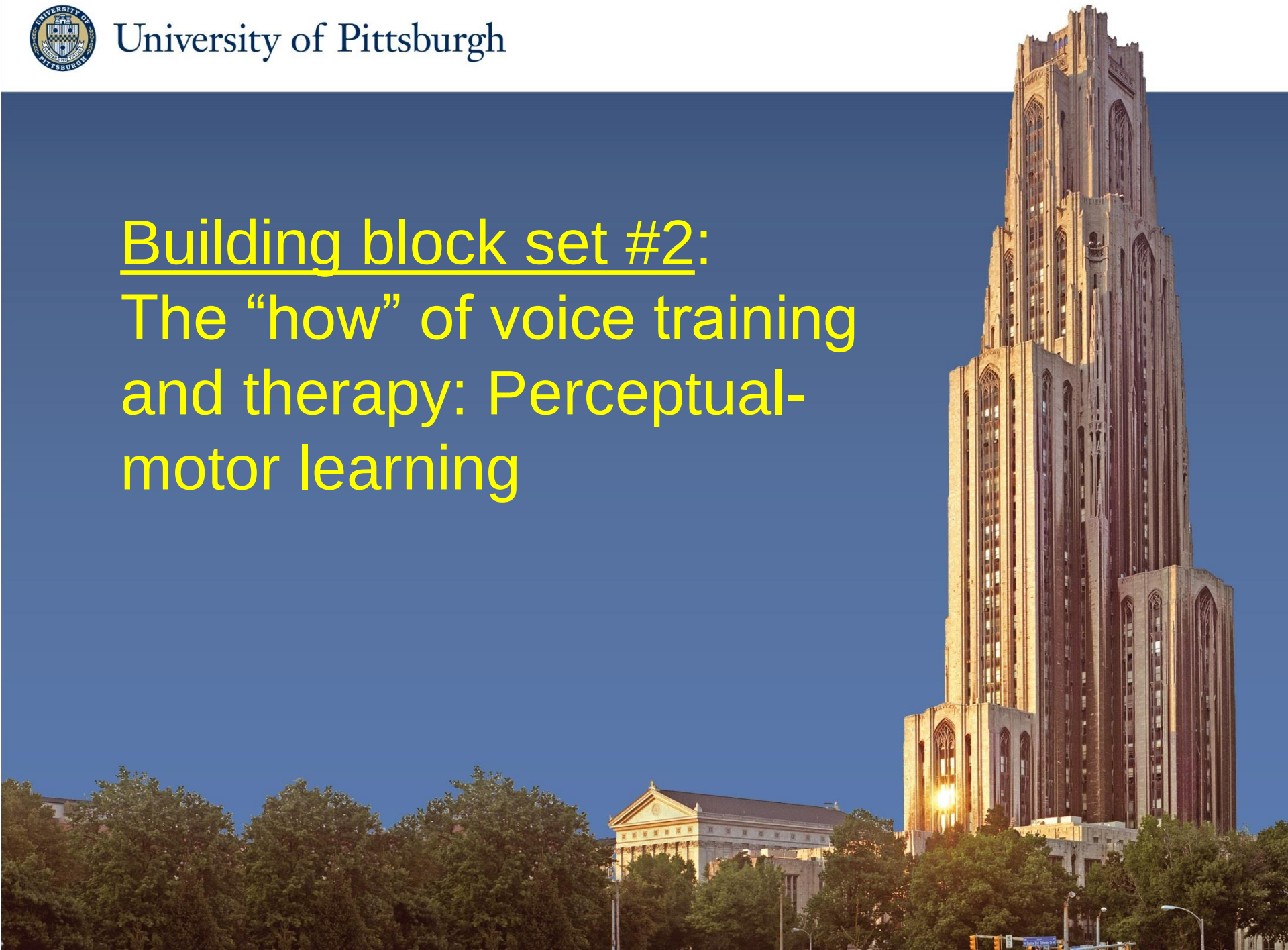
- Hygiene + voice training: Required to improve results over control condition (Nanjundeswaran et al., 2012)

Whew

- Glad that’s done.
- Next let’s move on to perceptual-motor learning.

theodoresworld.net

Building block set #2: The "how" of voice training and therapy: Perceptual-motor learning



We've discussed "what" we might train in voice therapy

- The best answer depends on learner needs and goals
- "Idealized" focus was
  - Barely ad/abducted VFs
  - Semi-occluded vocal tract

- Clinician may elect to address other issues as well, depending on clinician and patient
  - Posture
  - Breathing
  - Larynx
  - Jaw
  - Tongue
  - Neck adjustments
  - Etc.

But “how” to train???

- “Please abduct your vocal folds by 0.6-0.7 mm, at the vocal processes.”
- “Please utilize a narrowed epilarynx while you’re at it.”

cheezburger.com

Intro: Definitions

- Motor Learning

- "A *set of processes*
- *associated with practice or experience*
- *leading to relatively permanent changes*
- *in the capability for movement."*
    - (Schmidt & Lee, 1999)

Intro: Implications

- Seen shortly in discussion of “laws of practice”
- Things we do in the clinic to improve immediate performance may mess up learning seen in the long term
- Things we do in the clinic that mess up immediate performance may enhance learning seen in the long term

Intro: Of interest

- Key concept is that motor learning = *perceptual*-motor learning
- Seen for example in studies of neurological substrates in motor learning

Summary from Cabeza & Nyberg, 2000 (p. 30); regions of activation

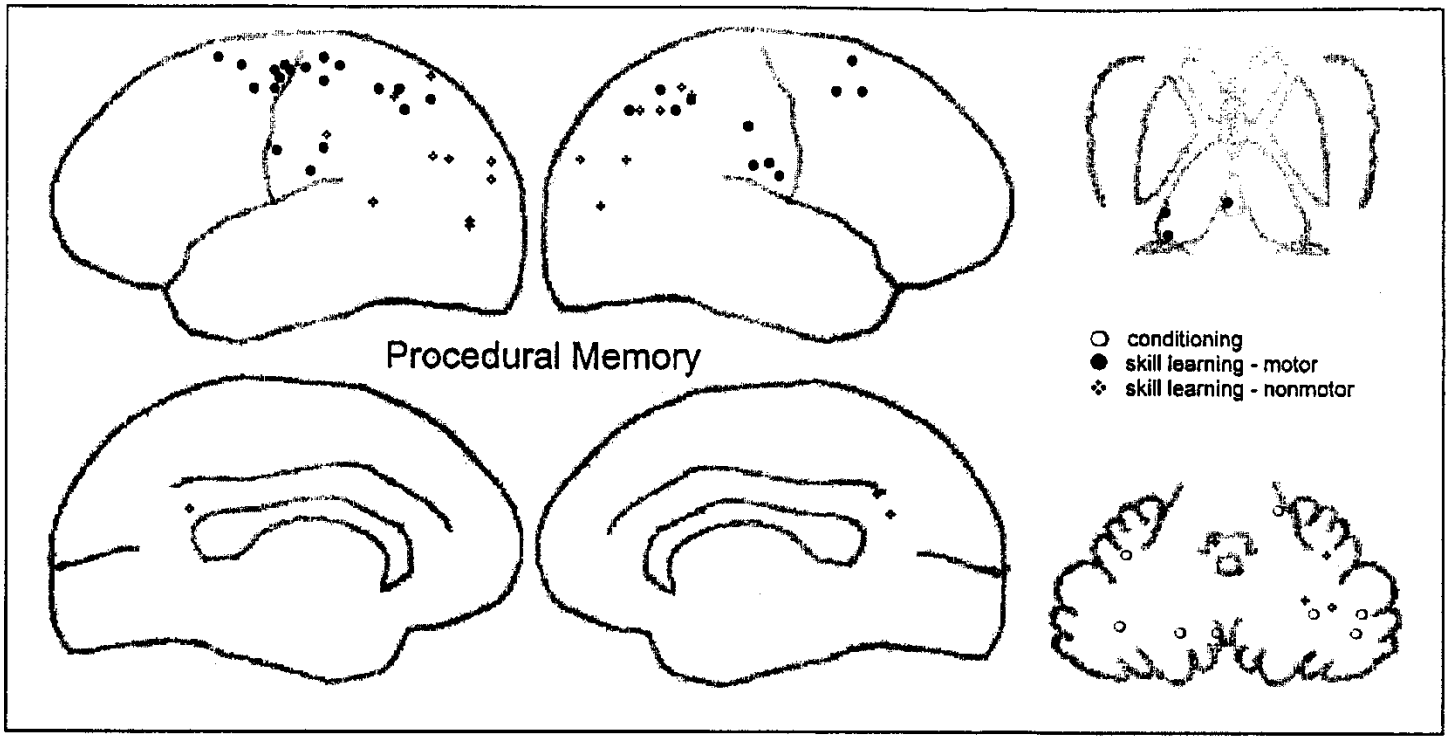


Figure 11. Representative activation peaks (published coordinates) associated to processes of procedural memory.

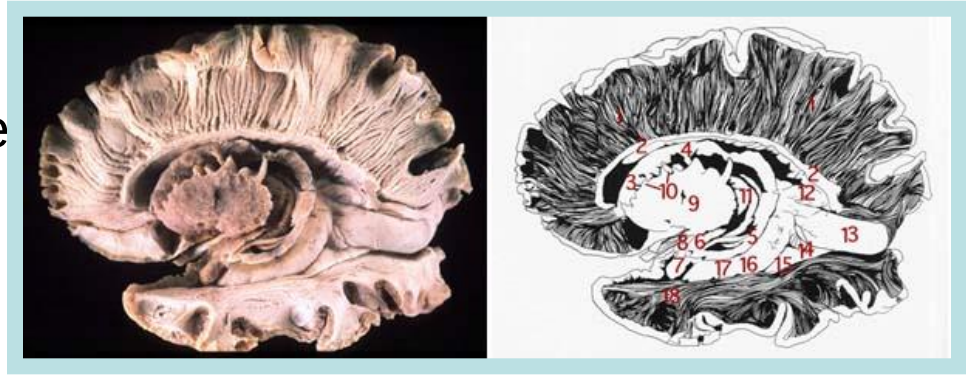
Model of motor learning

- Distinction between “declarative” and “procedural” learning

- Definitions
  - Declarative learning: → Memory for specific events and general facts about the world; seen by verbal reports (“introspection”)
  - Procedural learning: → Memory for processes or procedures; seen by performance changes following practice or exposure (*not* verbal reports or insight)
    - E.g. Squire, 1986

Model of motor learning

- Evidence of distinction:
  - Declarative learning impaired in amnesia (damage to hippocampus and amygdala)
  - Procedural learning spare in amnesia (does not depend on hippocampus and amygdala)
    - E.g. Milner, 1962



Model of motor learning

- Implication: “Book learning” and “motor learning” depend on different neuroanatomical substrates
  - Declarative memory depends on hippocampus and amygdala
  - Procedural memory does not depend on hippocampus and amygdala

Model of motor learning

- Further implication: Motor learning can and does occur without conscious memory of prior training—i.e. without conscious support of what has been learned
- What are further *cognitive characteristics* of the system that learns motor things?
  - Note: Notions of an entirely "clean distinction" between declarative and procedural learning has been challenged; for simplification we will set those aside today and consider characteristics of the "procedural" system which is *certainly involved in motor learning.*

Model of motor learning

- Declarative learning
  - ***Conscious***
  - ***Associational***
  - ***Intentional***
  - Small capacity
  - Flexible
  - Slow serial processing
  - Phylogenetically and ontogenetically new
  - Vanishing, unstable
  - ***Attention-dependent***
  - ***Repetition-dependent***

- Procedural learning
  - ***Non-conscious***
  - ***Sensory/perceptual***
  - ***Incidental***
  - Unlimited capacity
  - Stereotypic
  - Fast parallel proc-g
  - Phylogenetically and ontogenetically old
  - Stable over time
  - ***Attention-dependent***
  - ***Repetition-dependent*** (massive, for habit formation)
    - Note: Data largely from verbal "priming" studies
    - Review by Verdolini (1997)

Summary for procedural (motor) learning

- Attention: Direct to gestures' *effects,* not biomechanics
- Metaphoric images (associational processing): Don't work
- Intention: Intention to achieve goal; perceptual imaging of *target*
- Consciousness: Conscious, intellectual practice not helpful in long term; *procedural* practice is helpful
  - Review in Titze & Verdolini Abbott, 2012

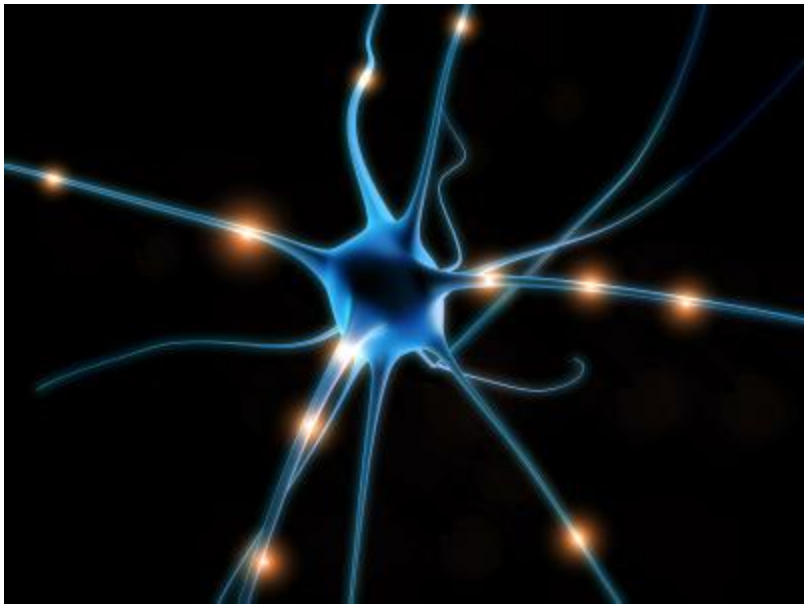
Structuring practice

- Observational learning
  - Watching others perform a task may enhance learning
  - E.g. juggling; sign language; dance; surgery (Adams & Creamer, 1962; Hayes et al., 2008; Steffens, 2007; Gray et al., 1991; Custers et al., 1999)
  - Key appears to be learner has active response to observations (Schmidt & Lee, 2010)

http://62mileclub.com/62mileblog/wp-content/uploads/2009/02/surgery_468x399.jpg

Structuring practice

- Mirror neurons implicated?
- E.g. Rizzolatti & Craighero, 2004



http://www.6seconds.org/images-static/neuron.jpg

Structuring practice

- Manipulations enhancing immediate performance often harm learning
  - Frequent augmented feedback often increases performance, decreases learning
  - Concurrent augmented feedback often increases performance, decreases learning
  - Blocked practice often increases performance, decreases learning
  - (See also Part/whole practice)
  - Non-variable practice often increases performance, decreases generalized learning
- Manipulations harming immediate performance often enhance learning
  - Infrequent augmented feedback often decreases performance, enhances learning
  - Terminal augmented feedback often decreases performance, enhances learning
  - Random practice often decreases performance, enhances learning
  - (See also Part/whole practice)
  - Variable practice often decreases performance, enhances generalized learning
    - Review by Verdolini & Lee (2002)

Structuring practice

- More on augmented feedback
  - AF about biomechanics = Knowledge of Performance (not so helpful; see preceding information about internal focus of attention)
  - AF about results = Knowledge of Results (KR) (helpful for learning)

Structuring practice

- KR timing
  - KR delay interval too brief harms learning (0 v. 3.2 sec; Swinnen ta l., 1990)
  - Subject's evaluation of own performance during the KR interval may be helpful (Hogan & Yanowitz, 1978)

Interpretation

- Could a single factor explain *many* of the variables discussed?
- Desirable difficulties (Bjork, 1998)

Other: Structuring practice

- Interpretation
  - Introducing “desirable difficulties” (increasing learner effort) during practice decreases performance but enhances learning (Bjork, 1998)
  - Caution is that if task is already inherently effortful, at least some of typical laws of practice reverse—so use frequent feedback and blocked practice to optimize learning
    - (Review by Wulf & Shea, 2002)

Other: Structuring practice

- *Implications for voice training models?*

The effect of training manipulations on the outcome of Lessac-Madsen Resonant Voice Therapy

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Data presented at 34th Symposium, Care of the Professional Voice, 2005

Acknowledgements

- Liz Grillo, M.A., CCC-SLP
- Elaine Rubenstein, Ph.D.
- Jackie Gartner-Schmidt, Ph.D., CCC-SLP
- Clark Rosen, M.D.
- Jody Kreiman, Ph.D.
- NIDCD DC005643

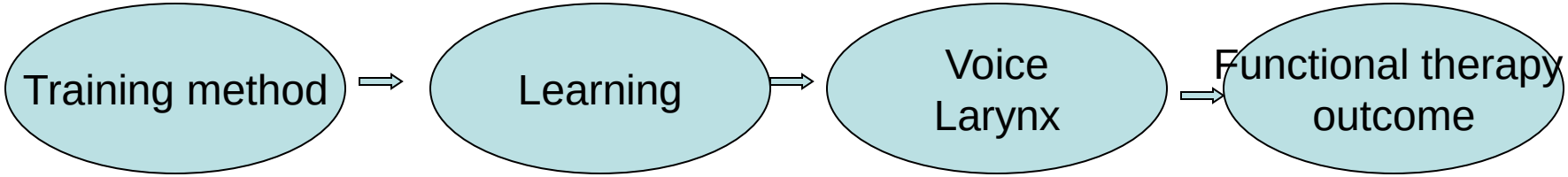
Gap in the data

- “How” people acquire novel biomechanical patterns in voice

Purpose of the study

- Hold constant the “what” in voice therapy (resonant voice, in this case)
- Systematically vary the “how” in voice therapy to assess its influence on therapy outcome

Causal model examined



Methods

- N = 40 adults (39 F; 1 M)
- Ages 16-53 yr
- Laryngology dx phonotrauma
- Considered by ENT and SLP appropriate for voice therapy

Methods

- Random prospective blinded 2 x 2 between subjects design
- “Depth of processing” x variability of practice conditions
- (Two therapists 5 subjects each cell; experienced, standardized training)

	SENSORY	METAPHOR
VARIABLE	10	10
NON-VARIABLE	10	10

Methods

- All subjects had consistent biomechanical target (O.L.C.; “resonant voice”)
- Video

- General program followed format of “Lessac-Madsen Resonant Voice Therapy”

Canonical LMRVT

	Hygiene	Stretch	RV BTG	RV Chant	RV VC	RV mini	RV messa	RV conversation	Own tx
I	xxx	xxx	xxx					C1	
II		xxx	xxx	xxx	xxx			C1	
III		xxx	xxx	xxx	xxx	xxx		C1	
IV		xxx	xxx		xxx	xxx	xxx	C2	
V		xxx	xxx		xxx	xxx	xxx	C3	
VI		xxx	xxx			xxx	xxx	C4	
VII		xxx	xxx				xxx	C5	
VIII		xxx	xxx					C6	xxx

Processing manipulations

- Sensory:
  - Attend to vibratory sensations, easy
- Metaphor:
  - Imagine voice as musical instrument

Practice manipulations

- Variable:
  - Lots of consonants
  - Lots of speech contexts
    - Normal
    - Quiet
    - Loud/distance
    - Background noise
    - Emotional
    - Challenged
- Non-variable:
  - Primarily /m/
  - Limited speech contests
    - Normal

Measures

- Baseline
- 1-wk post tx
- 2-mo post tx

- Primary outcome: *VHI*
- Secondary outcomes:
  - Auditory-perceptual
  - Visual-perceptual

Measures

- Ancillary
- Patient satisfaction
- Clinician bias

Ancillary measures: Patient satisfaction

- To what extent did you *like* the therapy you received?
- To what extent did your voice *change* since the beginning of therapy?
- To what extent did you think that any voice changes were *caused* by voice therapy?

  1-2 = negative; 3 intermediate; 4-5 = positive

Ancillary measures: Patient satisfaction

	Sensory	Image	(Ave.)
Variable	3.8	3.7	3.75
Non-variable	3.9	3.6	3.75
	3.85	3.65	

Ancillarly measures
Clinician bias

- To what extent did you *like* providing this therapy (check one)?
- To what extent do you think this therapy benefited patients' voices and voice-related quality-of-life?
- How would you rank-order the therapies in terms of your perception of the clinical "goodness" for voice?

Ancillary measures: Clinician bias

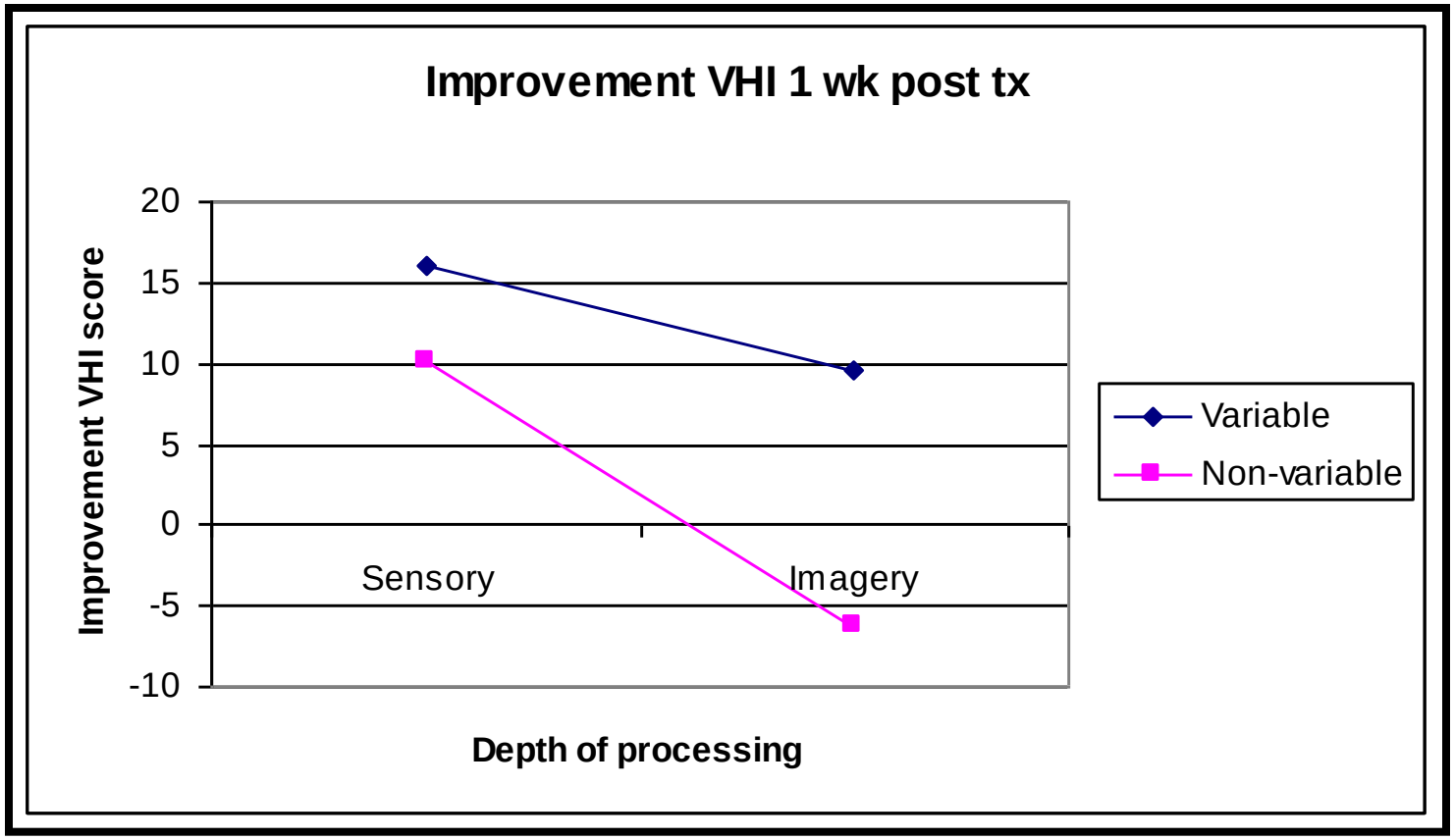
- Clinician #1:
  - Sensory > imagery
  - (Variable = non-variable)
- Clinician #2:
  - Imagery > sensory
  - Variable > non-variable

Thus

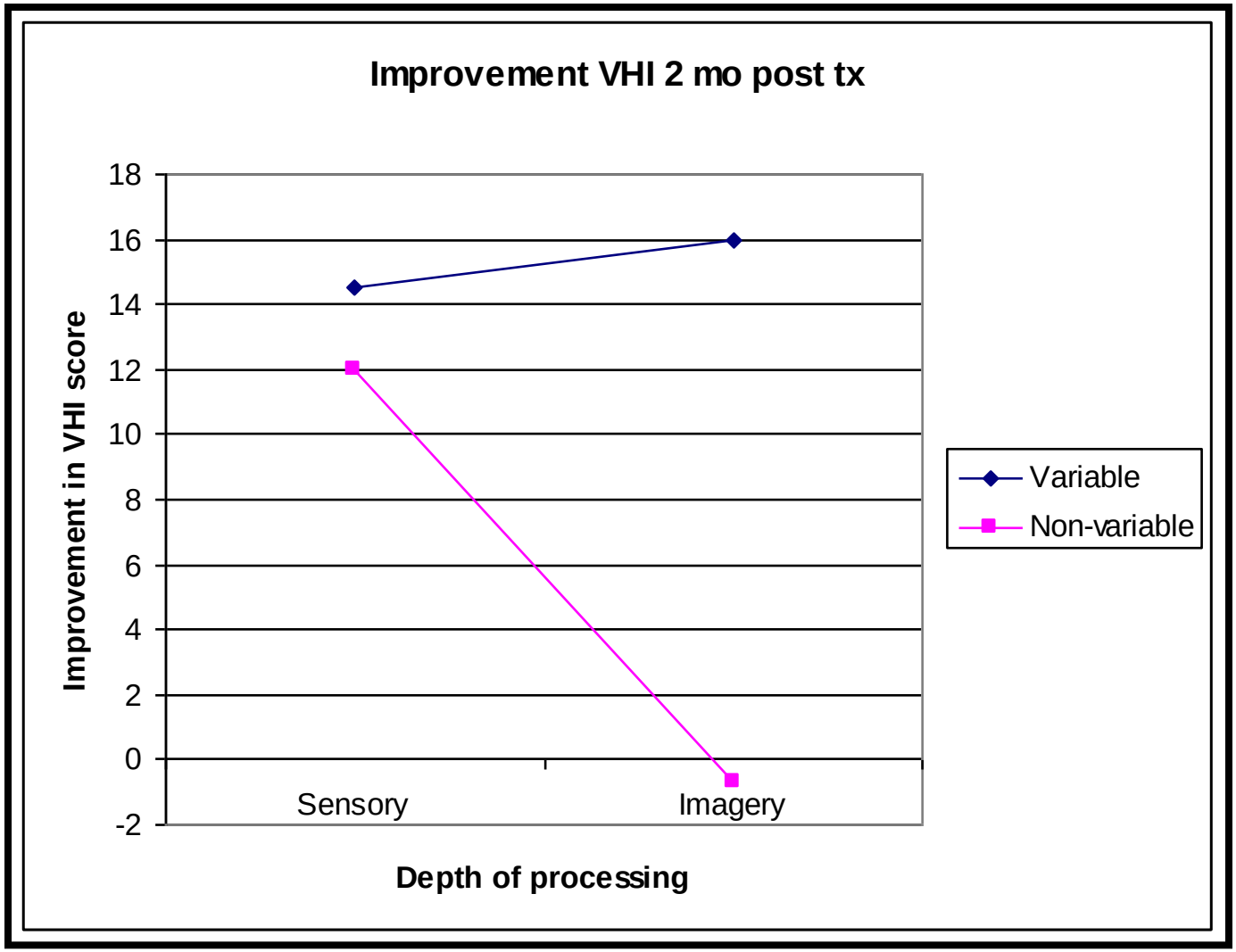
- There was no strong evidence of patient preference for the different programs
- There was no strong evidence of consistent clinician bias towards any of the programs

Primary data: VHI

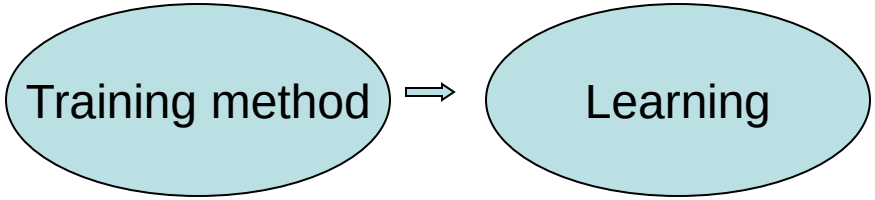
VHI results: 1 wk



VHI results: 2 mo



Secondary data: Learning
(Resonant voice)



Secondary data: Learning

- Results for learning of resonant voice = results for overall voice quality

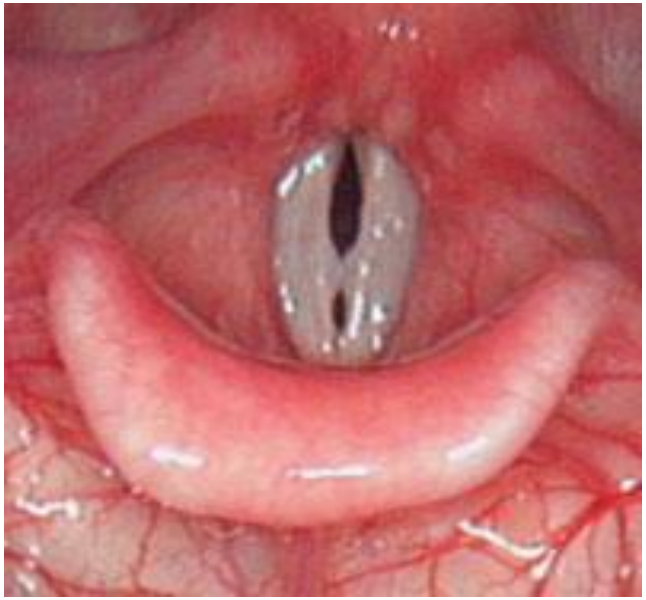
- Most subjects improved in resonant voice and voice quality over the period of the study (double-blinded)

Secondary data: RV learning

- Interaction effect shown:
  - *Sensory* processing instructions best with *variable* practice.
  - *Imagery* processing instructions best with *less-variable* practice.
  - "*Resource*" and "desirable difficulties" explanation: Tax people cognitively enough, but not too much.

Secondary data: Larynx

- Marginally significant improvements over time for group as a whole (0.06 overall).
- 1-wk and 2-mo time points had better findings than pre.
- No systematic difference between 1-wk and 2-mo time points.

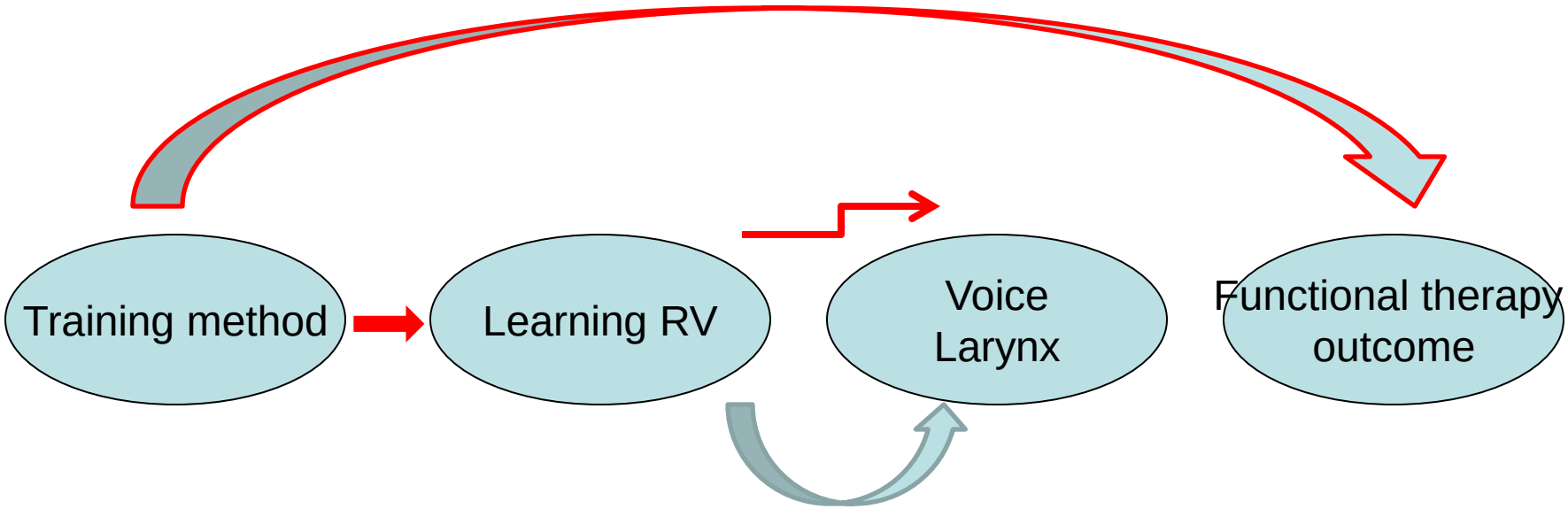


british-voice-association.com

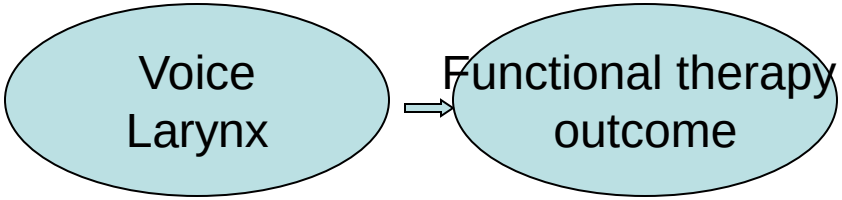
Secondary data: larynx

- Analyses ongoing, but so far no clear effects of training approach on laryngeal changes.

Recap causal model so far



Causal model



Secondary results: Voice/larynx->VHI

- Here we lost the trail of breadcrumbs
- No detectable relation between
  - Voice quality → larynx
  - Voice quality → VHI
  - Larynx → VHI

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Summary and conclusions:

- From data we do have, *learning approach appears to matter at least to a point.*
- Maybe voice measures (based on single sentence) were insufficient sample of voice to capture true variation in VHI with voice.

- Truevineproductions.blogspot.com

Summary and conclusions:

- Maybe there's an element (or more) missing in the model.

- Maybe simple linear model is insufficient to trace effects all the way from approach to learning to VHI, through intervening variables.

Putting it all together

Personalized Voice Therapy

- "IPTIM:" Individualized Principled Therapy-in-the-Moment (Verdolini Abbott, 2011)
- "Anatomy" of a voice therapy session:
  - *What*
  - *How*
  - *If*

IPTIM

WHAT

Pop-Out Phenomenon

HOW

SCAN
GEL
SHOW
TELL
Negative Practice, Negative Practice

(Variable Practice)

IF

Self-efficacy
Readiness
Clinician Presence