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Efficacy of Individual Auditory Training in Adults: systematic review and clinical implications

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Does evidence exist supporting improvement in communication skills through individual auditory training in an adult hearing-impaired population?

Oscar Howe and the Visual Politics of Agriculture: A Corn-Textual Analysis by Travis Nygard 12 Aug 2008

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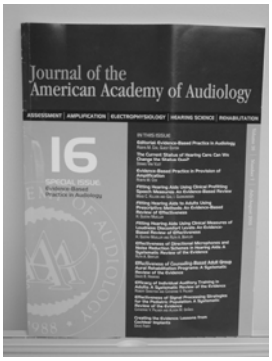

Inclusion Criteria

- Adults
- Hearing loss
- Not cochlear implant users
- Training paradigms had to be the independent variable (analytic/synthetic)
- Dependent variable had to be one or more outcome measures related to communication skills

Systematic Review: Key Words

- Adult
- Hearing impaired
- Hearing loss
- Hard of hearing
- Hearing problems
- Auditory
- Aural Rehabilitation
- Communication Skills
- Communication Abilities
- Speech Recognition
- Temporal Resolution
- Intensity Resolution
- Training
- Learning
- Feedback
- Synthetic
- Analytic
- Top-down processing
- Communication Training
- Perceptual Training
- Listening Training
- Speech Discrimination
- Frequency resolution

Databases

- Medline
- CINAHL (Cumulative Index to Nursing and Allied Health Literature)
- Psych Info
- EMBASE
- Applied Social Science Index and Abstracts
- Rehabilitation Literature Index
- 7 Text books (to conduct related author search)
- Web of Science Cited Reference (identifies articles using the target articles as a reference)
- No limits on date
- English was a limiting factor

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Levels of Evidence

1. Systematic reviews and meta-analyses of randomized controlled trials
2. Randomized controlled trials
3. Non-randomized intervention studies
4. Descriptive studies (cross-sectional surveys, cohort studies, case-control designs)
5. Case studies
6. Expert opinion

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Grades of Recommendation

A. Consistent level 1 or 2 studies
B. Consistent level 3 or 4 studies or extrapolations (data are being used in a clinically different situation) from level 1 or 2 studies
C. Level 5 studies or extrapolations from level 3 and 4 studies
D. Level 6 evidence or troubling inconsistencies or inconclusive studies at any level

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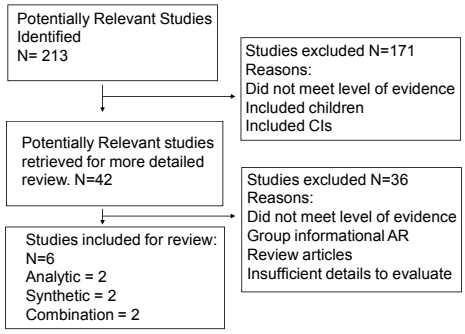
Levels accepted

- Randomized controlled trials
- Non randomized controlled trials
- Cohort
- Before/after designs with or without a control group



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Quality Assessment

- 1) Description of the randomization process if it existed
- 2) Inclusion of a control group
- 3) Number of subjects and power analysis
- 4) Blinding of experimenters and/or subjects
- 5) Psychometrically sound outcome measures with a clear relationship to communication skills
- 6) Feedback used in the training paradigms
- 7) Follow up examining long-term impact of training
- 8) Generalization to other materials or communication situations

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Evidence Levels

- Levels 2 and 3
- Grades B, C, and D

Data Synthesis

- Lack of consistency between training paradigms, provision of feedback, use of a variety of outcome measures

Table 2. Summary of Study Quality

Study	Blinding	Randomized to Groups	Control Group	Power Calculation	Validated Outcome Measure	Finding
Analytic						
Bode and Oyer (1970)	X	X	X	X	C/T	A+
Walden et al (1981)	X	*	*	X	C/T	A+
Synthetic						
Kricos et al (1992)	X	*	*	X	C/T	S-
Montgomery et al (1984)	X	*	*	X	C/T	S+
Synthetic and Analytic						
Rubinstein and Boothroyd (1987)	X	X	X	X	*	S+, S/A+
Kricos and Holmes (1996)	X	X	*	X	*	S+, A-

- Only 1 study had a sample size over 25
- 19 to 85 years of age
- 2 studies included only male veterans
- 2 studies used new hearing aid wearers
- 1 study conducted all training in quiet
- 1 study reported follow up after a month
- 0 studies reported generalization

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Summary of results

- Little evidence for the effectiveness of individual auditory training (Does it work in the real world?)
- Some evidence for efficacy (Can it work?)

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The article provided future directions

- Distribution of practice should be suitable for the task to be learned
- Active participation by the learner is superior to passive receptivity
- Practice material should be varied so that the learner can adapt to realistic variation so that motivation during drill is improved
- Accurate performance records – for evaluation
- Learning theory indicates feedback is needed

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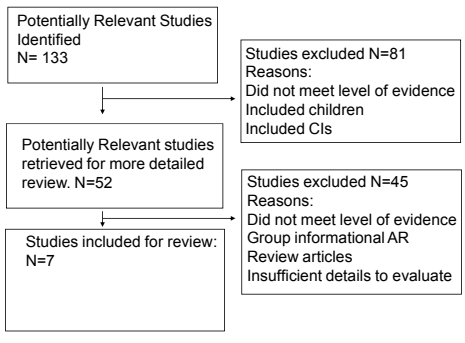
Auditory Training Programs

- Must be cost effective
- Easy, fun, rewarding
- Practical and easily accessible
- Verifiable
- Top-down and bottom-up
- Feedback

- Optimal training paradigms
- Optimal outcome measures
- Real world benefit
- Retention of benefit
- Generalization

Now it is 2011, anything new?

- Repeated the systematic review
- Identical methods



Number of studies

- 6 studies met criteria from the "beginning of time" to 2005
- 7 studies met criteria from 2005-2011

Table 2. Summary of Study Quality.

Reference	Blinding	Randomized to Groups	Control Group	Power Calculation	Validated Outcome Measure	Finding
Stecker, et al (2006)	X	*	*	X	*	*
Sweetow & Sabes. (2006)	X	*	*	*	*	*
Burk and Humes (2008)	X	X	X	X	*	*
Miller, 2008	X	X	X	X	*	*
Burk & Humes 2007	X	X	X	X	*	*
Burk et al 2006	X	X	*	X	*	*
Woods & Yund,2007	X	X	*	X	*	*

Comparison of study quality

- None blinded (could blind the researcher doing the outcome measures)
- Few randomized
- Same number of studies with control groups
- 1 in the new group used a power calculation to determine # of subjects
- New group had validated outcome measures
- Both groups had positive outcomes

Studies	Generalization	Real World	Retention
Stecker et al 2006	To untrained voices	Did not have power to test	Did not test
Sweetow & Sabes 2006	To untrained tokens	Subjective improvement in noise	+ 4 weeks
Burk & Humes 2008	To unfamiliar talkers	No benefit for sentences	+14 weeks
Miller 2008	Did not test	Improvement on HINT?	Did not test
Burk & Humes 2007	To unfamiliar speakers	No improvement on sentences	Did not test
Burk et al 2006	To untrained voices	No improvement on sentences	+6 months
Woods & Yund 2007	Untrained voices	Did not test	+8 weeks

- Generalization – mostly to new voices on same tokens
- Real World – None are truly real world conditions (maybe the subjective rating)

HOW DOES CONVERSATIONAL SPEECH DIFFER FROM CLEAR

		Clear Speech	Conversational Speech
Static Cues	Fundamental frequency (f0)	Lower	Higher
	Presence of plosive burst	Distinct	Frequently eliminated by speaker
	Speaking Rate	80-100 wpm 1-2 syl. per sec	160-200 wpm 3-4 syl. per sec
Dynamic Cues	Co-articulation	Minimal	Increased (results in weaker plosive bursts and reduced spectro-intensity cues)
	Amplitude envelope	Greater amplitude modulation depth	Shallower amplitude modulation depth
	Voice onset time	More distinction between voiced and unvoiced	Shorter for voiceless plosives

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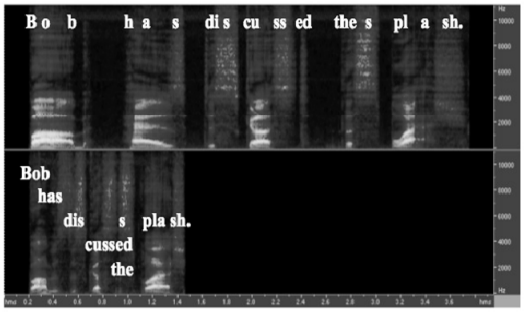
CLEAR SPEECH VERSUS CONVERSATION



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Differences between the two groups of studies…

- <2005
- Level 2 and 3
- Grades B,C,D
- All 6 in lab
- No test of generalization, real world, retention
- A few included feedback

- >2005
- Level 2 and 3
- Grade B
- 4 home based
- Did test generalization, real world, retention
- All 7 included feedback

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Conclusion

- The conclusions remain largely the same.
- Evidence for efficacy
- No strong evidence for effectiveness.
- Strongest conclusions came from Sweetow & Sabes, 2006.
- 4 articles related to computerized auditory training programs for the home since 2007 (not included in the review because they did not meet the criteria)

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Current (ongoing) Study

- Intention to treat design focused on the LACE (Learning and Communication Enhancement)
- Randomly assigned to experimental or control group
- Adults 18-85
- Hearing aid users (new or current)

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- Untrained = 18, Trained = 18
- Average differences in HINT
  - Untrained = -0.67 (stdev 5.2)
  - Trained = 6.09 (stdev 7)

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$$\frac{6.09 - (-.67)}{\sqrt{(7^2 + 5.2^2)/2}}$$

$$= \frac{6.76}{\sqrt{(49 + 27.04)/2}}$$

$$= \frac{6.76}{\sqrt{76.04/2}}$$

$$= \frac{6.76}{\sqrt{38.02}}$$

$$\approx 1.1$$

Cohen's d
.8 = large effect
.5 = medium effect
.2 = small effect

Not enough data reported in Sweetow and Sabes to determine effect size.

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Percent training who completed the study…(100% = ½ hour each day for 20 days)

- 8 completed 100%
- 1 completed 80%
- 1 completed 50% (improvement)
- 1 completed 40% (no improvement)

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7 refused to come back for post-test

- % training completed
  - 20
  - 60
  - 10
  - 35
  - 15
  - 0
  - 40
- 39% drop out rate
- Sweetow & Sabes had a 20% drop out rate (data not included in analysis)
- Sweetow & Sabes had home based and clinic

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Should you include Auditory Training in your clinical protocol?

- What do you do now?
- What if people just feel like they are doing better?
- What does Auditory Training consist of – communication strategies?