

2015 Expert Series

<p>June 18, 2015 at 1 PM ET Interventional Audiology: When is it time to move out of the booth? <small>Presented by Catherine Bower, Ph.D.</small> With more and more professionals taking on hearing the role of cognitive decline, falls, bipolar mania, schizophrenia, and depression, it is the perfect time for audiologists to partner themselves as the profession that can help improve the patient's communication for individuals whose primary concern may not be hearing. This is our chance to show other health care providers the essential role we play in their patients' success.</p>	<p>July 24, 2015 at 12 PM ET Stimulus mechanisms, assessment, and therapy options <small>Presented by Patricia S. Antonucci, Ph.D.</small> Stimulus refers to an auditory pathway that is produced by an external sound. This seminar will focus on understanding underlying mechanisms, evaluating available assessment options, and discussion of therapy strategies for stimulus.</p>
<p>June 26, 2015 at 12 PM ET Hearing aid selection and fitting tips gleaned from recent research <small>Presented by H. Gustav Mueller, Ph.D.</small> Hundreds of hearing aid articles are published each year along with indirect clinical questions, asking if the clinical studies are still always relevant. In this course, we review recent applied research from the past year and consider many useful tips and techniques that can be immediately applied to day-to-day hearing aid selection and fitting.</p>	<p>August 20, 2015 at 9 PM ET Evaluating the amplification needs of hearing-impaired infants through evoked cortical responses <small>Presented by Thomas B. C. Clark, M.D.</small> Evoked cortical responses can provide clinicians with information about whether speech sounds or loud sounds are meaning to the auditory brain, whether the baby is enabled, aided or unaided. This application is ready for clinical use. There is also great potential for research inquiries to indicate how well babies can discriminate sounds.</p>

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2015 Expert Series with H. Gustav Mueller, Ph.D.

Hearing Aid Selection and Fitting: Tips Gleaned from Recent Research

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- Brought to you in cooperation with AudiologyOnline
- Submitted to AAA, ASHA & IHHIS for one continuing education unit (CEU)
- Learning objectives for this course:
 - Describe how pre-fitting testing can assist in the overall fitting process
 - Describe the relationship between proprietary fitting and NAI-NL2 fittings
 - Describe the impact on acclimatization on the hearing aid fitting

Introducing H. Gustav Mueller, Ph.D.



SIEMENS

Life sounds brilliant.



Hearing Aid Selection and Fitting: Tips Gleaned from Recent Research

H. Gustav Mueller
Professor, Vanderbilt University, Nashville, TN.
Consultant, Sivantos Group
Contributing Editor, *AudiologyOnline*

And today . . . Greetings from
"North Dakota's Largest Island"
On the shores of the Missouri River



Did you know:

- Not all, but many articles in the audiology literature on hearing aids report findings that have direct clinical applications.
- Keeping up with all these articles is not easy—there sometimes are 200 or more hearing aid articles published in a single year.
- Even if you read the articles, the take-home clinical point is not always obvious, as it may not have been the purpose of the study.

What we're going to do today:

- I've selected some key articles published in the last few years that I think have a clinical nugget or two.
- I'll summarize the article (briefly) and then present what I think is the take home message for those of you selecting and fitting hearing aids on a daily basis.

Before we begin . . .

Acknowledgement: For the past 12 years Catherine Palmer, Bob Turner and I have conducted a session at the annual Academy of Audiology meeting, where we review recent hearing aid articles. Some of the content today includes material from these presentations.

In general, we'll talk about four important components of fitting hearing aids:

- Pre-fitting testing and considerations
- Selection of technology
- Verification of the fitting
- Post-fitting follow-up and counseling

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Let's talk about a pre-fitting test developed at the University of Tennessee



Acceptable noise level test (ANL)

- Determine the patient's MCL for continuous discourse
- With the discourse playing at the patient's MCL, determine the level of background noise (called the BNL) that the patient can "put up with" (while still following the story).
- The BNL subtracted from the MCL is the patient's ANL (an SNR)
- The average ANL for both normal hearing and hearing impaired is 8 dB or so.

Some thoughts on how you might use ANL scores:

- **ANL Score 7 dB or less:** These individuals have a good prognosis for regular use and acceptance of hearing aids; may not need as much follow-up counseling and guidance as the average patient.
- **ANL Score 8-12 dB:** These are your more common patients and have an "average" prognosis for regular use and acceptance of hearing aids.
- **ANL Score 13 dB or more:** These patients are "at risk" for reduced utilization of hearing aids and may need additional post-fitting counseling and guidance.



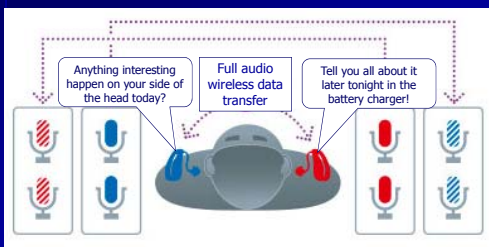
The ANL Test . . .
It's *not* "Just For
Knoxville Anymore!"

For some reason, researchers have become very interested in studying the ANL test

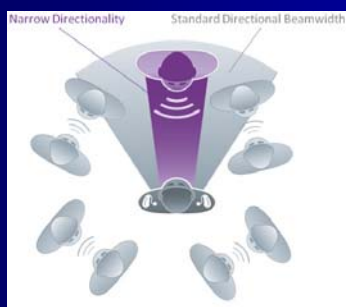
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Hearing aid have been talking to each other for more than ten years, but now they are saying *real words!*



Bilateral wireless audio communication allows for new algorithms: One of which is a "narrow focus" for directionality.



Research by Picou, Aspel and Ricketts (2014, Ear and Hearing) examined this new technology:

- What they compared:
 - Omnidirectional with "pinna compensation," which they refer to as "mild directional"
 - Standard adaptive directional, which they referred to as "moderate."
 - Bilateral beamforming, which they referred to as "strong."

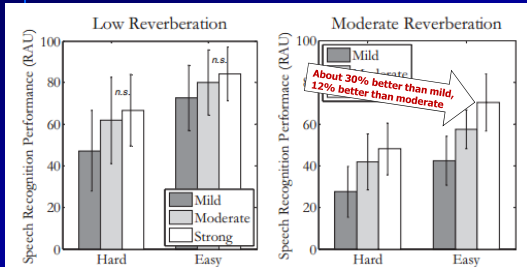
Some components of the study:

- What they compared:
 - Speech recognition: CST conducted at two different SNRs, at two different levels of room reverberation
 - Gross localization (assessed both with and without visual cues)
 - Listening effort
 - Subjective preference

General findings:

- The only measurable negative consequence of the beamforming technology was impaired localization accuracy at larger eccentricities (± 60 degrees) when visual cues were not available.
- The beamformer had no positive (or negative) consequences on listening effort, or subjective preferences in real-world listening.

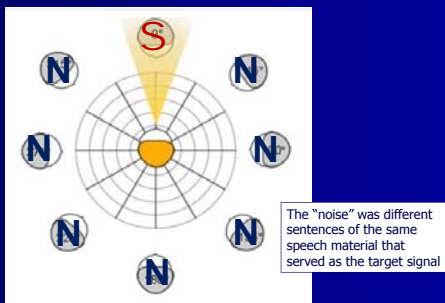
Findings for speech recognition:



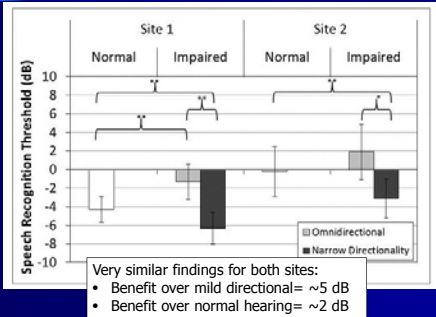
Another study examining the benefits of binaural beamforming: Froehlich, Freels and Powers (2015), AudiologyOnline

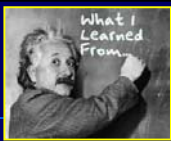
- Conducted testing at two sites
- Used the HINT and Olsa (German) speech test; similar to HINT).
- Hearing impaired were tested with omnidirectional (mild directional) and the beamforming algorithm.
- Age-matched normal hearing individuals also tested (unaided)

Clinical Protocol: Deliver the target speech message from the front; noise from seven loudspeakers surrounding the listener. Same condition for both hearing impaired and normal hearing individuals.



HINT findings for testing at two different sites:





Clinical Tips From These Articles?

- Bilateral beamforming provides better speech understanding than traditional directional for at least some listening situations.
- For some conditions, may allow hearing-impaired to perform equal to or better than their normal hearing counterparts.
- There does not seem to be any major negative consequences of using this algorithm.

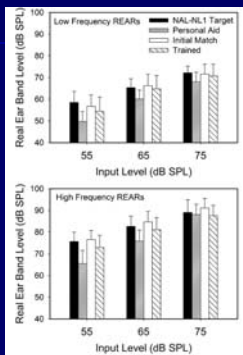
Recent research on trainable hearing aids: Mueller and Hornsby, 2014, *AudiologyOnline*



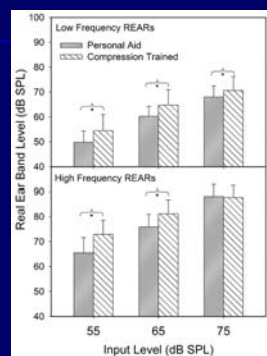
General design:

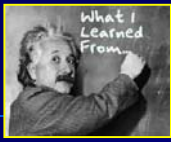
- Questioned if previous users would train hearing aids to their previous use gain after being fitted differently.
- Fitted experienced users to the NAL-NL2; this fitting provided about 10 dB more gain for soft inputs, and 5 dB more gain for average inputs than what the patients were accustomed to using.
- Patients trained their hearing aids for four weeks. Training was situational and input specific (e.g., compression training).

Findings following training:



Findings following training:





Clinical Tip From This Article?

- It may not be wise to assume that what a patient is "using" is what they prefer, or what is best for them.
- Indirectly, these data show that the NAL-NL2 is a reasonable starting point—on average, trained values were very close to NAL-NL2 values.

In general, we'll talk about four important components of fitting hearing aids:

- Pre-fitting testing and considerations
- Selection of technology
- Verification of the fitting
- Post-fitting follow-up and counseling

Three common choices used by audiologists when fitting hearing aids



- Verify With Probe-Mic
- Push "NAL or DSL" Button
- Push "First Fit" Button

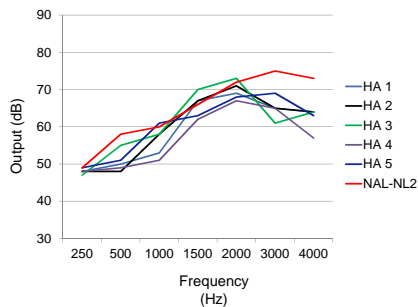
How might things work when using the other two methods? Good enough?

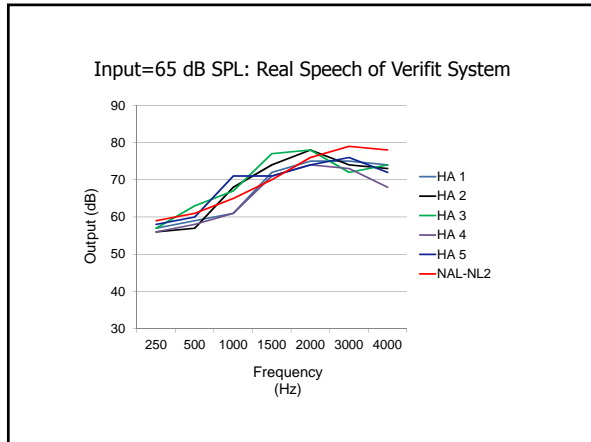
RESEARCH
Manufacturers' NAL-NL2 Fittings Fail Real-ear Verification
Published on February 16, 2015
Research | March 2015 *Hearing Review*
One more reason why probe-mic verification is crucial in any Best Practice protocol
By Jordan Sanders, BS, Tina M. Stoody, PhD, Jennifer E. Weber, AuD, and H. Gustav Mueller, PhD

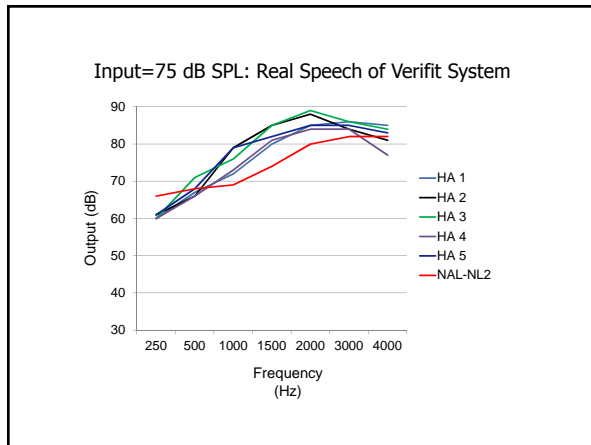
Protocol for Sanders et al, 2015 (Data collected December, 2014)

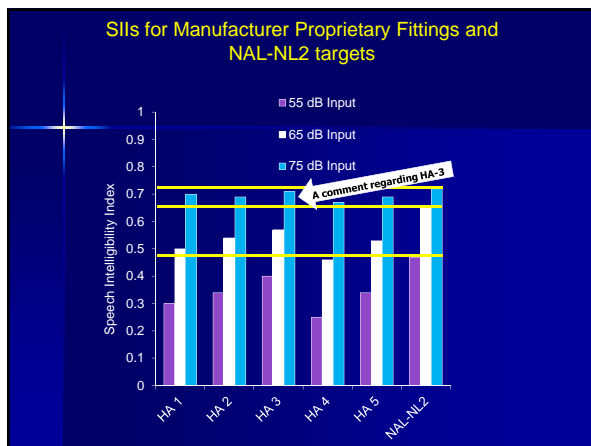
- Selected the premier hearing aid from the five leading manufacturers.
- Selected the manufacturer's "default" fitting in the software for typical downward sloping hearing loss; entered appropriate data for earmold plumbing, etc.
- Matched all fitting and patient characteristics between software and probe-mic equipment.
- Conducted probe-mic measures using speech mapping (male passage from the Verifit); 16 ears tested (8 male, 8 female)

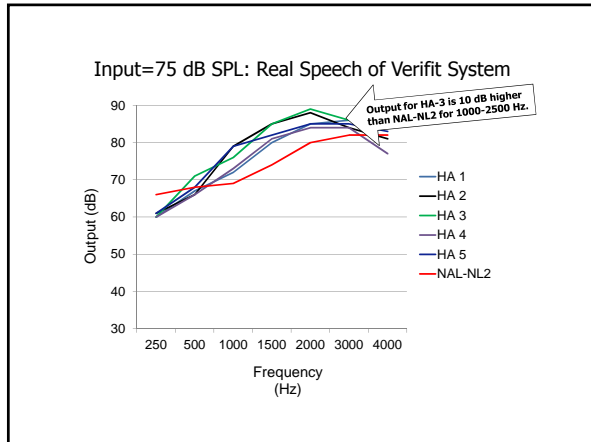
Input=55 dB SPL: Real Speech of Verifit System

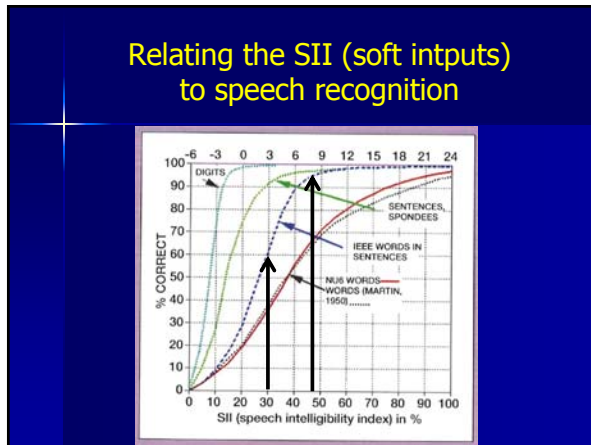












Three common choices used by audiologists when fitting hearing aids

Fitting Method

- Verify With Probe-Mic
- Push "NAL or DSL" Button
- Push "First Fit" Button

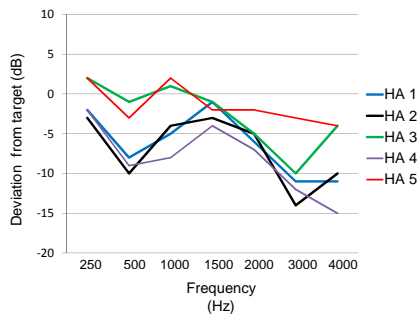
Probability of NAL fit when selecting "NAL" in the fitting software:

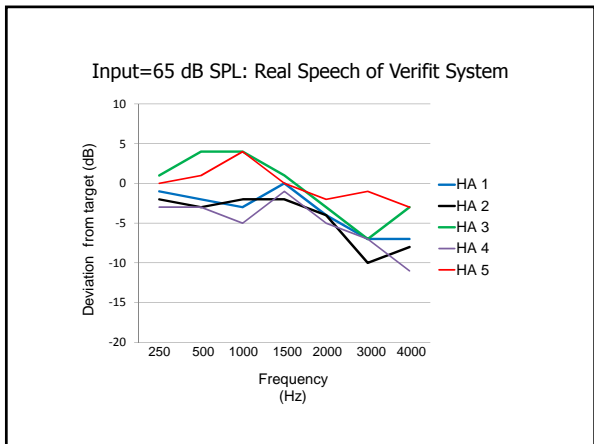
- Aazh and Moore (2007): Programmed to the manufacturer's NAL using four different types of hearing aids on 42 ears. Only 36% of fittings were within +/-10 dB of NAL targets. After re-programming, 83% were within +/-10 dB (100% for hearing aids with four or more channels).
- Aazh et al (2012): Of 51 fittings, after programming to the manufacturer's NAL, only 29% were within 10 dB of NAL targets; after re-programming, a match was obtained for 82% of the fittings.

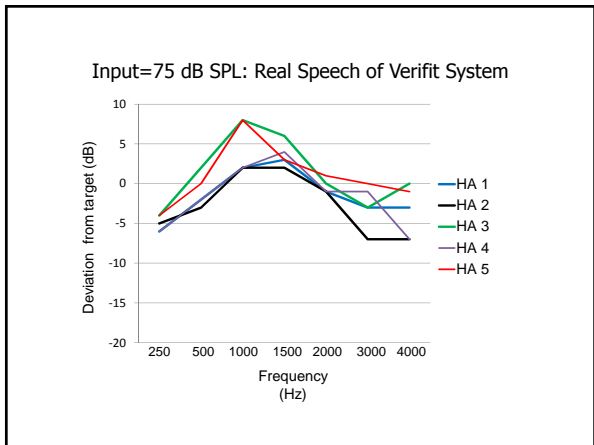
So maybe things have gotten better? Or the problem is only with one or two manufacturers?

- Data collected December 2014 (Sander et al, 2015):
- Selected the premier hearing aid from the five leading manufacturers.
 - Selected "NAL-NL2" fit in the manufacturer's software; programmed for typical downward sloping hearing loss
 - Matched all fitting and patient characteristics between software and probe-mic equipment.
 - Conducted verification using speech mapping (male passage from the Verifit); 16 ears tested (8 male, 8 female)

Input=55 dB SPL: Real Speech of Verifit System



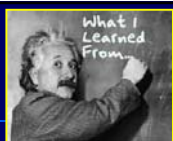




Three common choices used by audiologists when fitting hearing aids

Fitting Method

- Verify With Probe-Mic
- Push "NAL or DSL" Button
- Push "First Fit" Button



Clinical Tip From This Article?

If you believe that fitting to prescriptive target is a good thing, it is very risky to use the manufacturer's fitting algorithms, or the manufacturer's version of the NAL, without real-ear verification.



A quick reminder of a MarkeTrak VIII article related to hearing aid verification—and satisfaction
A publication from Sergei Kochkin (2010, *Hearing Review*), "with a little help from his friends."



Some of the primary purposes of the survey:

- Determine overall satisfaction with amplification
- Determine common fitting practices (as reported by the patients)
- Determine if fitting practices influence satisfaction
- Determine if specific aspects of fitting/verification impact satisfaction more significantly than others.

Survey items related to testing, verification, overall hearing aid fitting, and audiologic rehabilitation. (respondents indicated whether they received this testing/service—could respond "not sure.")

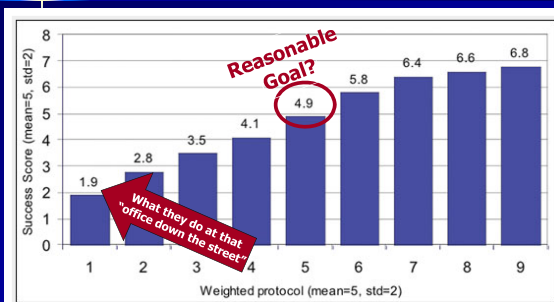
- Hearing tested in sound booth
- Loudness discomfort measurement
- Real-ear measurement used for verification
- Measurement of objective benefit (e.g., pre-post measurement of speech understanding)
- Measurement of subjective benefit
- Patient satisfaction measurement
- Auditory retraining software therapy
- Enrolled in aural rehabilitation group
- Received self-help book/literature/video
- Referred to self-help group (e.g, HLAA).

What we really want to know:

Was there a significant relationship between the testing conducted at the time of the fitting, and subsequent real-world satisfaction with hearing aids?



The effect of the overall protocol (# of tests administered) on patient satisfaction:



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Mail order hearing aids, patient satisfaction, and compliance with Best Practice protocols

A Comparison of Consumer Satisfaction, Subjective Benefit, and Quality of Life Changes Associated with Traditional and Direct-mail Aid Use

Sergei Kochkin
Hearing Review, 21(1), 2014

What he did...

- MarkeTrak survey in 2009 of traditionally fit hearing aids ≤ 3 years old (n = 1721).
- Survey in 2013 of customers of a very large US direct-mail hearing aid firm (n= 2332)
- Compared traditionally fit aids to direct-mail aids on a variety of measures including satisfaction.

The results of the survey:

Quality of Life changes (same for traditionally fit and direct-mail) vs. Best Practice

Composite best practice rank	Lot Better (%)	Better (%)	Same (%)	Worse (%)
BP10	36	57	26	0
BP9	22	29	49	0
BP8	14	48	37	0
BP7	15	14	48	23
BP6	13	39	46	0
BP5	12	34	53	0
BP4	9	30	59	0
BP3	6	29	63	0
BP2	4	20	71	0
BP1	14	14	71	0

Clinical Tip From This Article?

If fitting practices are poor, outcomes will be no better than obtained with direct mail hearing aids.

Caveat : Value is related to price, and value can impact satisfaction.

What Is Your Customer Loyalty Quotient (CLQ)?

Published on August 26, 2014

Cover Story | September 2014 Hearing Review

Applying Deming and Heskett's principles to hearing healthcare practices | Hearing Review September 2014

By Sergei Kochkin, PhD; Laura Dennison, AuD, BC-HIS; and Linda Jackson

Loyalty: (Retention, Repeat Business, Referral)	Extremely dissatisfied customer	Somewhat dissatisfied customer	Slightly dissatisfied customer	Neutral to slightly satisfied customer	Satisfied customer	Very satisfied customer
100%						Zone of affection Apostles
80%						
60%						
40%						
20%						
0%	Saboteurs					

As a reminder: A few things related to patient loyalty . . .

- The majority of patients purchasing hearing aids today are previous users (63%).
- The "cost" of acquiring a new patient is 5 times the cost of retaining a previous patient.
- Unhappy customers spread the bad news more than happy customers spread good news

Data used by Kochkin:

The total national sample of hearing aid consumers (excluding direct mail customers) were asked to rate their HHP on seven factors using a 7-point Likert scale: "Very dissatisfied," "Dissatisfied," "Somewhat dissatisfied," "Neutral" (equally satisfied and dissatisfied), "Somewhat satisfied," "Satisfied," and "Very satisfied."

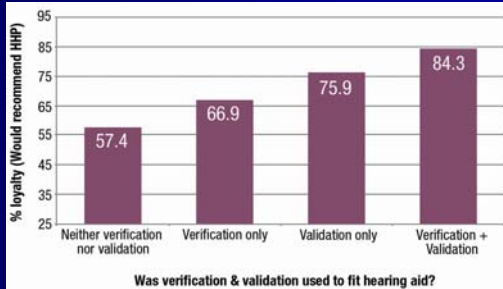
Likert ratings on the following factors were captured:

- *Professionalism*
- *Knowledge level*
- *Explained care of the hearing aid*
- *Explained hearing aid expectations*
- *Quality of service during the hearing aid fitting*
- *Quality of service post-fitting*
- *Level of empathy*

Recall from the previous slides that Kochkin also had data for:

- What tests were administered to each patient during the fitting process
- The overall hearing aid satisfaction level for each patient

Which then provides the data needed to create this chart:



Crunching some numbers: A little dispensing practice just outside of Bismarck, operated by some questionable folks



Some data for this practice:

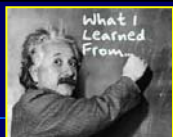
- They have been in business for 10 years.
- Each year they sell hearing aids to around 100 patients.
- Approximately 80% of fittings are bilateral: 180 hearing aids/year

After 10 years of practice, many of their patients should be returning to replace their hearing aids.

- But, about 20% have either died or moved away, or are not in a position to obtain new hearing aids.
- What about the other 80%

Using the MarkeTrak VIII data: The impact of verification and validation:

- Verification and validation *not* conducted: patient return rate=57%
57% of 80 x 1.8 = **81 hearing aids**
- Verification and validation conducted: patient return rate=84%
84% of 80 x 1.8 = **120 hearing aids**



Clinical Tip From This Article?

Not only is following Best Practice the right thing to do . . . The professional thing to do . . . The ethical thing to do . . .

It's also the "profitable" thing to do!

In general, we'll talk about four important components of fitting hearing aids:

- Pre-fitting considerations
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- Post-fitting follow-up and counseling

Old enough to remember?

Mr. McGuire: I just want to say one word to you. Just one word.

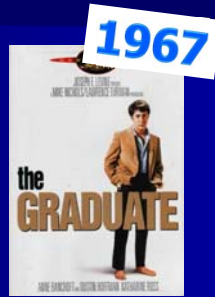
Benjamin: Yes, sir.

Mr. McGuire: Are you listening?

Benjamin: Yes, I am.

Mr. McGuire:

"Plasticity"



A 1993 *JAAA* article that generated a lot of discussion . . .



Role of Perceptual Acclimatization in the Selection of Frequency Responses for Hearing Aids

Stuart Gatehouse*

"The benefits of the prescription were not evident upon immediate testing but became statistically significant and of material clinical magnitude following experience with the prescription for 8 and 16 weeks."

Auditory acclimatization and hearing aids: Late auditory evoked potentials and speech recognition following unilateral and bilateral amplification

Dawes P, Munro K, Sridhar K, Edwards B

J Acoust Soc Am, 135(6), 2014

What they asked...

Is there acclimatization?

- Is there acclimatization in central auditory processing following unilateral and bilateral hearing aid fitting as seen in a combination of physiological and behavioral measures?

What they did...

Participants:

- Symmetrical, mild-to-moderate, sloping high frequency sensorineural hearing loss
- 10 unilateral and 13 bilateral new users
- 6 unilateral and 7 bilateral experienced users
- Mean age was 70 for new unilateral, 69 for new bilateral, and 72 for experienced

What they did...

Hearing aids:

- BTE or CIC hearing aids fitted to the NAL-NL1 prescription (and verified)
- User could not adjust gain after 1 day fine-tuning
- Adaptive listening programs were off
- Use was logged and must wear at least 6 hours per day (average = 10 hrs)

What they did...

Testing

- Recorded event-related potentials (ERPs)
- Stimulus was 500 and 3000 Hz.
- Intensities of 65, 75, and 85 dB SPL
- Measured amplitude (area under curve) and latencies for N1 and P2

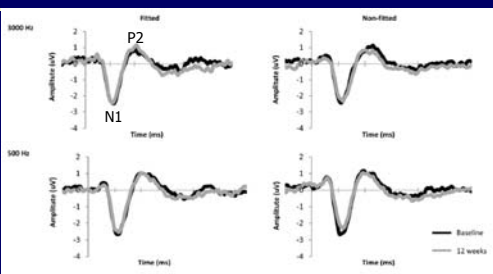
What they did...

Testing:

- Measured speech recognition in noise at SNR₅₀ using FAAF test
 - “Can you hear word X clearly?”
 - Choose X from four rhyming words (e.g., mail, bail, dale, or nail)
- Presented at 65 and 75 dB SPL
- Scored as percent correct

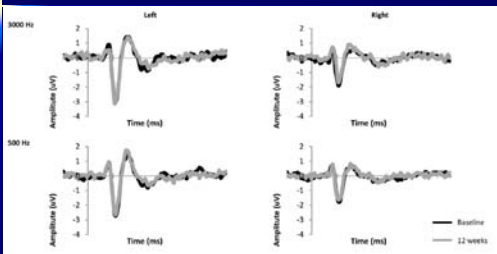
What they found...

ERP unilateral fit at baseline and 12 wks



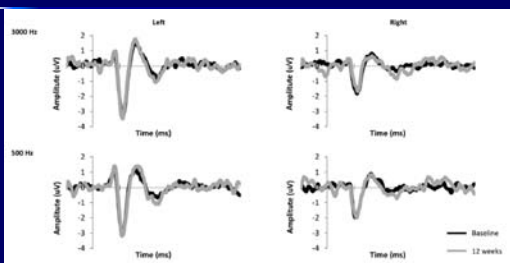
What they found...

ERP for bilateral fit at baseline and 12 wks

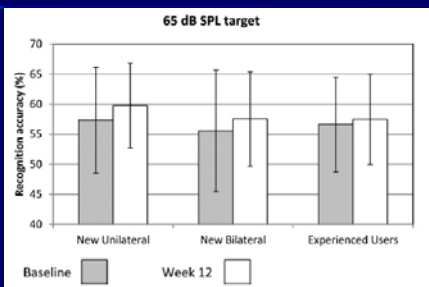


What they found...

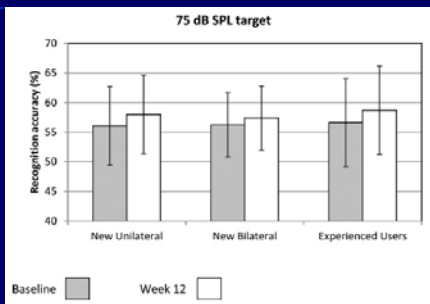
ERP for experienced users at baseline and 12 wks

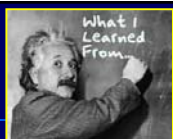


What they found...



What they found...





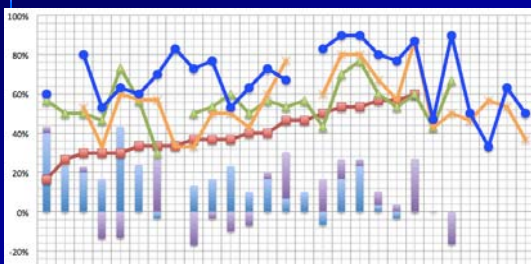
Clinical Tip From This Article?

With new hearing aid fittings, it's probably misleading to suggest to patients that their brain will "adapt" to the new sounds, and speech recognition will improve.

Caveat 1: It could be that 12 weeks is not long enough for acclimatization to occur.

Caveat 2: Adaptation could occur for loudness, which was not studied in this research.

Hearing aid outcome measures are necessary, but how many different ones do we need?



Some common favorites:

APHAB: General benefit

COSI: Benefit obtained for specific user situations

SADL: Overall satisfaction

IOI-HA: Snapshot of 8 different core hearing aid related dimensions

And now, we have a new assessment scale from Robyn Cox's lab: The DOSO

Development of the Device-Oriented Subjective Outcome (DOSO) Scale

Robyn M. Cox, Genevieve C. Alexander, Jingjing Xu

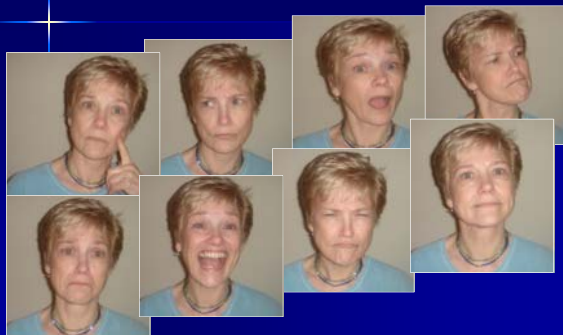
JAAA, 2014

DOSO background—Previous research by Cox and colleagues:

- They found that wording of survey items was a variable that discriminated between two types of outcomes.
- Items that clearly directed attention outward toward the amplification device produced **device-oriented data**: "How well does the hearing aid separate speech from noise?"
- Items that promoted introspection about everyday problems produced **wearer oriented data**: "How well do you understand speech in a noisy place?"

Similar questions that might provide different results

Personality also is a factor to consider!



Cox suggests that we really need both types of outcome measures:

- Manufacturers who wish to evaluate hearing aid technology in daily life would profit from using a **device-oriented questionnaire** in which effects of wearer personality issues will be reduced or eliminated.
- Third-party payers are mostly concerned with management of daily life problems. They would be best served by a **wearer-oriented questionnaire** so that daily life problems could be directly assessed.

Cox suggests that we really need both types of outcome measures:

- Researchers who wish to conduct a randomized controlled trial to assess whether a new rehabilitative approach is superior to a standard approach in resolving hearing problems, should use a **wearer-oriented questionnaire** (but ensure that the groups are matched on personality).
- Practitioners could use a **device-oriented questionnaire** to compare two different hearing aids or fittings, but use a **wearer-oriented questionnaire** to assess the extent to which the chosen hearing aids have helped to resolve the patient's hearing problems.

DOSO: The final product

- Six subscales (64% of variance)
- There is one long form (DOSO), and there are two equivalent short forms (28 items): DOSOs(a) and DOSOs(b).
- Administration time is about 8 and 5 minutes respectively.
- Interim norms have been provided

Norms for the six subscales of the DOSO

Subscale	Percentile Score						
	5	10	25	50	75	90	95
Speech Cues	1.9	2.1	2.7	3.6	4.7	5.4	5.8
Listening Effort	2.7	3.2	4.1	4.8	5.5	6.3	6.5
Pleasantness	2.5	3.0	3.8	4.5	5.3	6.0	6.4
Quietness	1.4	1.6	2.4	3.2	4.0	5.0	5.8
Convenience	3.3	3.5	4.0	4.8	5.8	6.3	6.5
Use	2.3	2.7	3.7	4.3	4.7	4.7	4.7

The "Use" subscale was based on 1-5; all others based on 1-7

Go to the HARL at University of Memphis: Click on "Applications" (A treasure-trove of good stuff!)



Easy to download the forms and scoring documents:

Free Downloads:
 Obtaining the DOSO questionnaires and scoring documents:


Formal: The DOSO Questionnaires are in PDF format and can be viewed, printed, and saved to your computer using the [free Adobe Acrobat Reader](#) program. The documents available include the DOSO forms, a list showing which items are allocated to each subscale, instructions for manual scoring, and a blank template for plotting an individual's scores against norms for other hearing aid wearers.

Purchase:
 DOSO scoring software can be purchased from the [AUSP Software Group](#) at the School of Communication Sciences and Disorders at the University of Memphis.

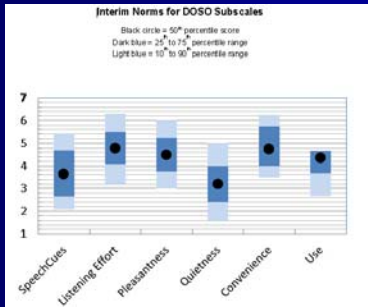
Format: The Windows version of the DOSO is available for purchase.
 Cost: \$30 (US)

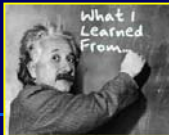
DOSO Questionnaires and Scoring Documents
 English [DOSO(a)]
 English [DOSO(b)]
 English [DOSO]
 Item allocation
 Manual scoring instructions
 Scoring software user manual
 Norms template

Translations of the DOSO Questionnaire
 Mandarin Chinese [DOSO(a)]
 Mandarin Chinese [DOSO(b)]
 Mandarin Chinese [DOSO]



You can score-by-hand and plot on form—or, scoring software is only \$30.00





Clinical Tip From This Article?

The DOSO is a handy well-researched self-assessment scale that can be added to your battery of outcome measures, or selected for specific patients when your interest lies directly with technology benefit.



**Hearing Aid
Selection and
Fitting: Tips
Gleaned from
Recent Research**

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