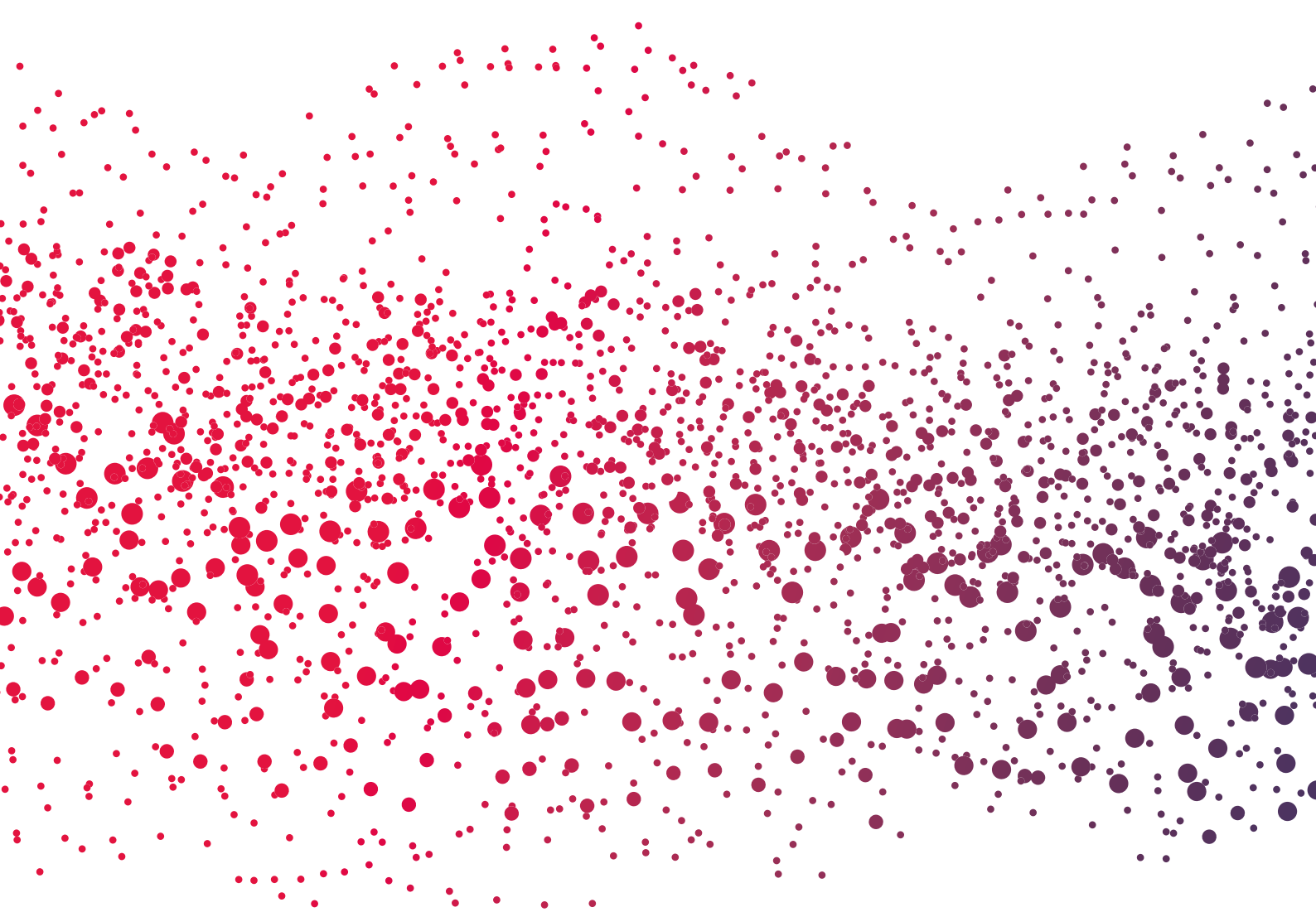




**AMPLIFON CENTRE FOR  
RESEARCH AND STUDIES**

# **CRS** SCIENTIFIC JOURNAL

Otology & Audiology Article Review



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**APRIL 2013**

## Amplifon Centre for Research & Studies: Audiology Review – April 2013

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- The Effect of Hearing Aid Signal-Processing Schemes on Acceptable Noise Levels: Perception and Prediction - Yu-Hsiang Wu and Elizabeth Stangl.

*In this study the impact of signal processing like Wide Dynamic Range Compression (WDRC), Digital Noise Reduction (DNR) and Directionality (ANL) on Acceptable Noise Levels (Noise tolerance) was evaluated. **WDRC has a negative impact on noise tolerance, while DNR has a positive impact on noise tolerance. Directionality has a positive impact in the condition where noise comes from the rear. When evaluating the SNR improvement on the output signal, DNR only has a positive impact at SNR levels between +5 and +10.***

- Acceptable noise level in Danish adult subjects diagnosed with unilateral Menière's disease - Steen Østergaard Olsen, Johannes Lantz, K. Jonas Brännström, Lars Holme Nielsen

*This study showed no within-subject ANL differences due to differences in hearing sensitivity or loudness growth patterns. **Similar mean ANL results were found in the subjects' unaffected and affected ear. No association between speech discrimination and the ANL on the affected ear with Menière's disease was found. This confirms that ANL is the result of a high level (more central) process.***

- Acoustic Experience Alters the Aged Auditory Experience – Turner J.G. et al

*Presbycusis is often treated with hearing aids which serve to reintroduce some or all of those sounds lost to peripheral hearing loss. However, little is known about **the underlying changes to the ear and brain as a result of such experience with sound at an older age.** The present study attempts to model this process by rearing **aged mice in an augmented acoustic environment (AAE).***

- Efficacy of Hearing-Aid Based Telephone Strategies for Listeners with Moderate-to-Severe Hearing Loss – Picou, Erin M; Ricketts, Todd A.

*For **people with moderate-to-severe sensorineural hearing loss, acoustic telephone listening with a hearing aid may not lead to acceptable performance in noise. Although unilateral routing options (telecoil and wireless streaming) improved performance, speech recognition and subjective ratings of ease and comfort were best when bilateral routing was used.***

### Age and Measurement Time-of-Day Effects on Speech Recognition in Noise



Carrie E. Veneman et al.

*Ear & Hearing. Published ahead of print,  
26<sup>th</sup> of November 2012.*

*Younger subjects (with normal hearing) perform significantly better in the evening on a speech in noise test than in the morning. Older subject (with normal hearing) perform significantly poorer on a speech in noise test than younger subjects, but the time of the day does impact the performance. More studies have documented that older subjects perform poorer on a speech in noise task than younger subjects.*

*With the MEQ (Morningness / Eveningness Questionnaire - Horne & Ostberg 1976) 15 younger (20–28 years) subjects "evening types" and 15 older (66–78 years) subjects "morning types" were selected for this study. All subjects had normal hearing – but the older subjects had audiograms that were slightly poorer at 4 and 6 kHz.*

*The younger subjects performed significantly better on a speech in noise task when they were at their peak performance time of day (evening) (HINT  $p= 0.004$ / QuickSIN  $p= 0.027$ ) compared to their performance in the morning. The performance of the older subjects did not differ significantly in the morning compared to the evening.*

*The younger subjects performed significantly better than the older subjects for both tests and at both measurements of day. (HINT morning ( $p = 0.007$ ) / evening ( $p < 0.001$ ) and QuickSIN morning ( $p = 0.017$ ) / evening ( $p < 0.001$ ))*

*These results have consequences for the daily practice. When comparing different technologies or rehabilitation concepts, differences in speech in noise performance could be the consequence of the time of the day in which the tests were performed for younger subjects which could result in drawing the wrong conclusions. Therefore it's advisable to perform speech in noise tests at the same time of the day for younger subjects.*

*Overall this is a very interesting study with surprising conclusions. These have consequences for both research and the daily practice of hearing health care. The weakness of this study is the limited number of subjects and the fact that only "morning type" older subjects and "evening type" younger subjects were selected.*

### The Contribution of a Frequency-Compression Hearing Aid to Contralateral Cochlear Implant Performance



Ann Perreau, et al

*J Am Acad Audiol. 2013 Feb;24(2):p105-120*

*Frequency compression is proposed for subjects with severe high frequency hearing loss – In this study the use of frequency compression a conventional hearing aid on the contralateral ear of a cochlear implant results in poorer results in a speech in noise test and no significant impact on localisation and consonant recognition. So the overall strategy is to avoid this kind of signal processing for this specific kind of fitting.*

*Localisation improved with bilateral implants both for low frequencies (dog barks) as for high frequencies (cricket chirps) and the results were better than chance – limitation of this study was that they only used 5 loudspeakers for this test – the hearing impaired subjects in the binaural CI condition, scored better than the normal hearing subjects in the monaural condition. Parental reports show similar or better results with bilateral implants for all subjects*

and a significant improvement for the group in seven daily situations. The improvements were present within six months after the second implantation.

Interesting study showing encouraging results for children bilateral cochlear implants. The set-up for the localisation task was a limitation and it would have been more realistic to use a control group experienced with a unilateral implant. But a group of sixty four hearing impaired children using bilateral implants is large enough and the critical way the data are discussed make this study certainly worthwhile.

### The Effect of Hearing Aid Signal-Processing Schemes on Acceptable Noise Levels: Perception and Prediction



Yu-Hsiang Wu and Elizabeth Stangl.

*Ear & Hearing*. Published ahead of print,  
17<sup>th</sup> of January 2013.

In this study the impact of signal processing like Wide Dynamic Range Compression (WDRC), Digital Noise Reduction (DNR) and Directionality (ANL) on Acceptable Noise Levels (Noise tolerance) was evaluated.

WDRC has a negative impact on noise tolerance, while DNR has a positive impact on noise tolerance independent of the microphone mode. Directionality has a positive impact in the condition where noise comes from the rear. When evaluating the SNR improvement on the output signal, DNR (noise reduction) only has a positive impact at SNR levels between +5 and +10 while directionality only works when the noise is coming from the rear, but at nearly all SNR levels.

So since ANL improvement results are very much in line with SNR improvement at the Output, this makes the selection of appropriate signal processing for subjects with higher (poorer) ANL scores a lot easier.

This is the first study that shows the negative impact of compression (WDRC) on ANL results. The learning is here that you need to optimise compression to the lowest ratio to restore the dynamic range of speech particularly for subjects with noise tolerance problems. Further this study confirms that noise reduction (DNR) is only functional when the signal to noise ratio is positive and that this use of noise reduction is strongly recommended for subjects with noise tolerance issues (high ANL)

### Acceptable noise level in Danish adult subjects diagnosed with unilateral Menière's disease



Steen Østergaard Olsen, Johannes Lantz, K.  
Jonas Brännström, Lars Holme Nielsen

*Hearing, Balance and Communication*, 2013; 11  
: 17-23

The acceptable noise level (ANL) was measured in three conditions\* in both ears of eleven Danish adult subjects with unilateral Menière disease.

In the **first** condition Danish **running speech** and **speech-weighted amplitude-modulated noise** were used, while in the **second** condition Danish **running speech** and **multitalker speech babble** and in the **third** condition a **non-semantic speech-like signal (ISTS)** and **speech-weighted amplitude-modulated noise** were used. Both speech and noise signals were presented through earphones. The spread of MCL and BNL results is smaller on the affected ear than on the unaffected ear. This is probably due to recruitment in the ear affected by Menière's disease. Interestingly **the spread of the ANL results is very similar on the two ears**, which might indicate that ANL is not or only to a minor degree affected by recruitment. The clinical implication of this finding is that ANL might predict hearing aid use patterns on the poor ear independently of whether ANL was measured on the good or the poor ear.

Interesting study but the weakness of this study lies in the small number of subjects. Also it would be interesting to know if binaural testing gives the same outcome than monaural testing. The author seems to be disappointed that ANL is not ear-specific ... but may be missing the most important point **that ANL is based on central (high level) processes and therefore a very important extra dimension that needs to be considered when fitting hearing aids.**

- **Acoustic Experience Alters the Aged Auditory Experience**



Turner, Jeremy G. et al  
*Ear & Hearing*. 34(2):151-159,  
March/April 2013.

21 aged mice, male ( $n = 12$ ) and female ( $n = 9$ ), were reared in either 6 weeks of low-level (70 dB SPL) broadband noise stimulation/Augmented Acoustic Environment (AAE) or normal vivarium conditions.

Changes as a function of the treatment were measured for behaviour, auditory brainstem response thresholds, hair cell cochleograms, and neurochemistry in the key central auditory structures of the inferior colliculus and primary auditory cortex.

The findings suggest that exposing aged mice to a low level AAE alters both peripheral and central properties of the auditory system. Although direct application of these findings to hearing aid use or auditory training in aged humans would be premature, the results do begin to provide direct evidence for the underlying changes that might be occurring as a result of hearing aid use late in life.

These results suggest the aged brain retains significantly anatomical, electrophysiological, and neurochemical plasticity.

This interesting study adds to an increasing body of evidence which suggests that the ageing brain retains considerable plasticity and may enable some of the effects of auditory deprivation to be potentially reversible.

However, this study has limitations due to a small sample size and no known relevance of an augmented acoustic environment to use of hearing aids. This study indicates that there are complex variables, such as age, gender, hormone levels and hearing loss causation, which require further research in order to further understand the variability in outcomes from hearing aid use by the elderly.



- *Efficacy of Hearing-Aid Based Telephone Strategies for Listeners with Moderate-to-Severe Hearing Loss*

*Picou, Erin M; Ricketts, Todd A.*



*Journal of the American Academy of Audiology.*  
*24:59-70, Number 1 2013.*

*For eighteen experienced hearing aid users, with moderate-to-severe sensori-neural hearing loss (fitted with either Siemens Nitro or Siemens Motion 700 P, fitted with limited or no venting), the speech recognition and subjective ratings across six telephone listening strategies (in noise) were compared.*

*The strategies evaluated included acoustic telephone (contralateral ear unplugged or plugged), unilateral telecoil (contralateral ear unplugged or plugged), unilateral wireless streaming and bilateral wireless streaming. Speech recognition performance was poorest with acoustic coupling to the telephone and best with bilateral wireless routing.*

*Telecoil coupling resulted in better speech recognition performance than acoustic coupling, but was significantly poorer than bilateral wireless routing. Furthermore, unilateral wireless routing and telecoil coupling generally led to similar speech recognition performance, except in lower-level background noise conditions, for which unilateral routing resulted in better performance than the telecoil.*

*This study compared the different telephone strategies for hearing aid users with moderate-to-severe hearing loss fitted with limited or no venting. When evaluating the data from this study and a previous study (Picou and Ricketts, 2011), that included hearing aid users with mild-to-moderate hearing loss fitted with more venting, it seems that venting is the primary factor that contributes to limiting the additional benefit for bilateral wireless benefit compared to acoustic telephone listening.*