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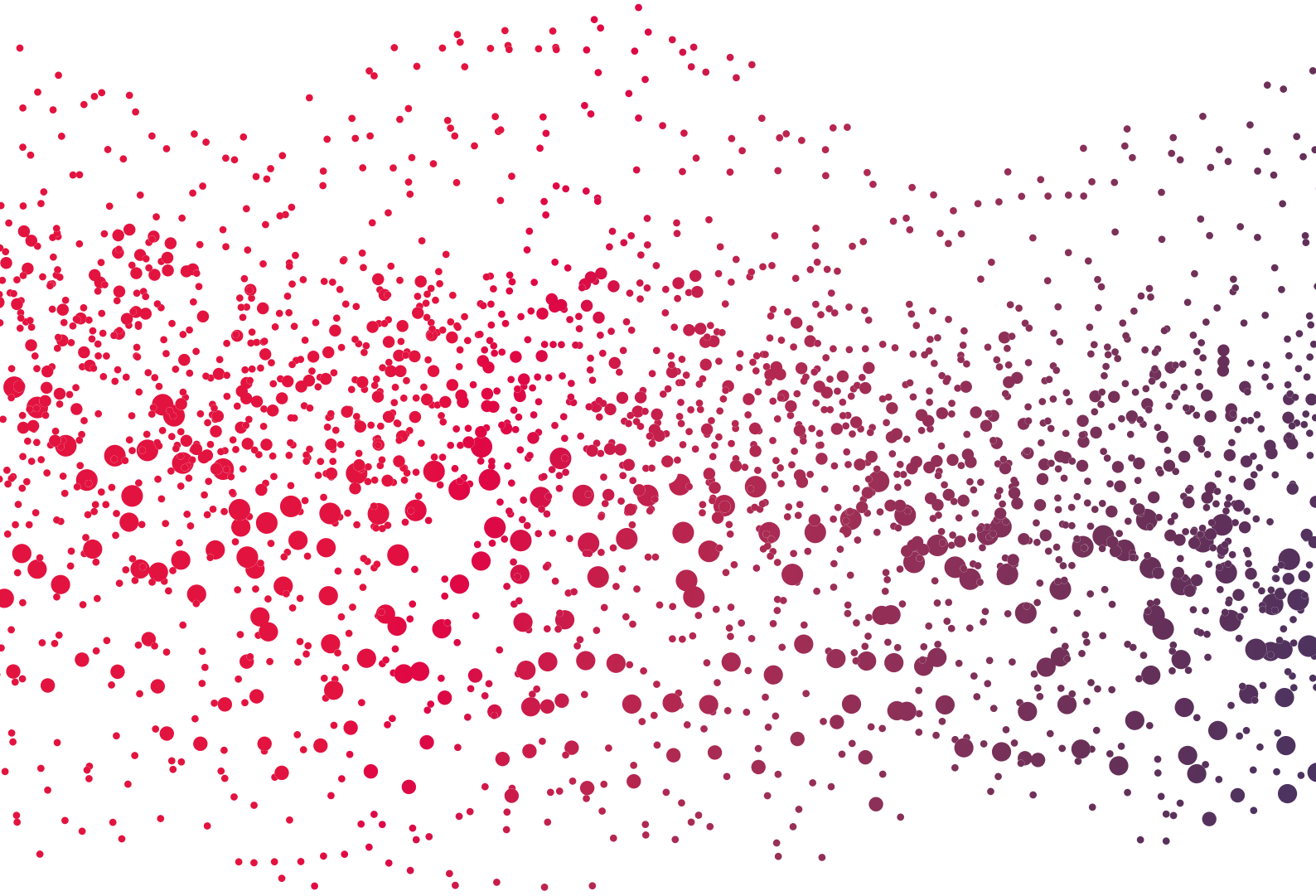
Otology & Audiology Article Review



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- Effects of aging on audio-visual speech integration (p 11)
  - *Huyse A.et al.*
  - *J. Acoust. Soc. Am. 136 (4), October 2014: 1918–1931*
  - *Two groups of normal hearing listeners comprised of 15 young adults and 15 older adults were tested for AV integration under different auditory and visual conditions. Very interesting how older listeners in more degraded visual conditions compensate well for lip-reading abilities by using the auditory information available in the valleys of noise. Even more significant how the older listeners increase the reliance on audition when the AV integration is degraded.*

- The Influence of Sound Generator Associated With Conventional Amplification for Tinnitus Control: Randomized Blind Clinical Trial (p 12)
  - *Gisele Munhoes dos Santos et al.*
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- Effects of Fast, Slow, and Adaptive Amplitude Compression on Children's and Adults' Perception of Meaningful Acoustic Information (p 13)
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  - *Bearing in mind that fast acting gain compression can compromise the signal-to-noise ratio, slow-acting or adaptive compression should be considered when clients are not performing well in noise (high ANL) and in reading span tests. On the other hand good performers are less disturbed by background noise and can benefit from the extra information which fast compression can provide.*
- The Role of Spectral Resolution, Working Memory, and Audibility in Explaining Variance in Susceptibility to Temporal Envelope Distortion (p 14)
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- A survey of the attitudes of practitioners toward teleaudiology (p 14)
  - *Singh G., Pichora-Fuller K, Malkowski M., Boretzki M & Launer S.*
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  - *Interesting research on the effect of teleaudiology on the hearing healthcare services and the belief of practitioners in the use of teleaudiology for different types of patients and tasks. Not surprisingly, the believed effect on hearing healthcare varies from minimal to positive with a difference for different tasks,. Interesting findings regarding the difference between new and returning clients and the overall more positive attitude towards teleaudiology, giving the right message that, for clients and practitioners, teleaudiology can be of value.*
- The Effect of Hearing Aid Noise Reduction (NR) on Listening Effort in Hearing-Impaired Adults. (p 16)
  - *Desjardins, J. L. & Doherty, K. A.*
  - *Ear & Hearing. Vol. 35, No.6, 600-610 November-December 2014.*
  - *Despite the widespread use in commercial hearing aids, there is no report of NR algorithms significantly improving listeners' SNR. Nevertheless, hearing aid users often prefer the sound quality of listening with NR when in background noise. The findings from this study show that NR can significantly decrease listening effort for hearing impaired older adults.*
- Left-Right and Front-Back Spatial Hearing with Multiple Directional Microphone Configurations in Modern Hearing Aids. (p 17)
  - *Carette E.,Van den Bogaert T., Laureyns M. & Wouters J.*
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  - *A new directional system that was developed to mimic the "Human Ear" (Low frequencies omni – high frequencies fixed directionality) preserves the binaural cues partly to allow left-right localisation and results in better front-back localisation.*

- What is important for hearing aid satisfaction? Application of the expectancy-disconfirmation model. (p 19)
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  - *Is there a relationship between overall hearing-aid satisfaction and measures of hearing-aid performance and disconfirmation? According to the expectancy-disconfirmation model, the expectations are mostly formed by the expectations linked directly to the product and actual product performance. The expectations of the client can be positively disconfirmed (better than) or negatively disconfirmed (less well).*
- The effect of repeated measurements and working memory on the most comfortable level in the ANL test (p 21)
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  - *An article which studies the effect of a large number of repetitions on the most comfortable level (MCL) when doing the acceptable noise level (ANL) test, and also explores if MCL variability is related to central cognitive processes.*

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'Getting used to' hearing aids from the perspective of adult hearing-aid users.

Dawes P. ,Maslin M. & Munro K.J.

International Journal of Audiology 2014; 53: 861-870

It is well known that there are psychological, social, acoustical and functional obstacles that a hearing impaired person who uses HA (hearing aids) has to overcome. The audiologist's role in the rehabilitation process is an important one.

This qualitative study used 3 focus groups (total of 16 participants) in order to explore the meaning of 'getting used to' HA based on the experience of adult HA users. The participants sampling was purposive in order to recruit participants of both gender with a range of views on the topic, different using habits, range of satisfaction from the HA and different family status, occupations and educational levels. The participants were fitted with HA by NHS audiologists in the UK and came for a follow-up meeting 3 weeks later. For each one, the audiologist provided counselling, recommendations and instructions regarding the use of the instruments. Fine tuning was done based on the patient's complaints. The information was given face to face as well as in writing. The patients were advised to use the HA constantly and for as much time as possible. The groups' discussions were recorded, transcribed and then analysed based on qualitative content analysis.

Five thematic categories were found: annoying sounds, distorted sounds, practical use, experimenting with use and psychosocial factors. According to participants the 'getting used to' HA process involves changes in thinking as well as in auditory perception, finding and managing the benefits and limitations of the HA and managing practical issues of using them. The participants did not report any improvements in aided speech perception consistent with auditory acclimatisation and they developed personal patterns of HA use based on their experience with the instruments. The absence of the audiologist as having a central role in the process was striking. This may be because the users didn't know the full scale of support and services they can get from the audiologist or they had difficulties understanding the information their audiologist gave them. The audiologists must take into consideration these findings and address them by seeking more effective ways of supporting their patients through their rehabilitation process. The findings from this study indicated that getting used to HA is a multi-factorial process and represent a significant challenge to both patients and audiologist. The primary limitations of this study are that the participants were all older adults with age-related HL and had their HA from the NHS. Themes identified by these groups may not be transferable to other populations although they are generally in line with those previously identified in audiology literature. One might expect that other themes can be found when studying other populations.

Topics related to getting used to hearing aids

- Annying sounds
- Distorted sounds
- Practical use
- Experimenting with use
- Psychosocial factors

This article put the patient's perspective in the spot light. We, audiologists, should not forget that each patient has their own personal rehabilitation journey and our role is to guide them to success. We have to be certain that we listen to the patient, understand their needs and expectations and make sure to adapt our counselling, instructions and services to each and every one personally.

The Effect of Hearing Aid Noise Reduction (NR) on Listening Effort in Hearing-Impaired Adults.

Desjardins, J. L. & Doherty, K. A.

Ear & Hearing. 35: No.6, 600-610 November-December 2014.

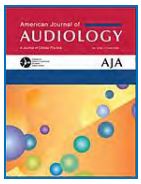
12 hearing aid wearers participated in this study. A dual-task paradigm was used to measure their listening effort with and without NR activated. This task contained 25 high-context and 25 low-context sentences in noise and was combined with a visual-tracking test (Digital Pursuit Rotor Tracking-DPRT).

The results show that NR significantly reduces listening effort in background noise, but only for the difficult listening condition (i.e. 50% correct). Participants scored significantly better on the high-context sentences compared with the low-context variants. There is no statistically significant relationship found between participants listening effort and working memory function.
So, NR has no effect on speech recognition in noise, however there is an effect on listening effort in the more difficult situations.

When listening effort decreases, capacity is freed up for other cognitive tasks. This is interesting because in daily life, people need to be able to multitask. (e.g. combine walking and talking)

Critically conducted study, thorough protocol. No significant results could also be due to relatively small sample size. Keep in mind that it is important to use more than just speech recognition scores when evaluating hearing aid technology. Don't forget to ask about your patients' experiences (m@p-questions before and after trial period, COSI,...).

Relating Working Memory to Compression Parameters in Clinically Fit Hearing Aids.



Souza P.E . and Sirow L.

American Journal of Audiology. Vol. 23, p 394–401 (2014)

It is known that individuals with similar audiograms may have a difference in speech identification scores both in quiet and in noise. A variety of factors including the working memory have been offered as possible reasons for such differences. Working memory refers to the system that provides temporary storage and manipulation of the information during complex cognitive tasks.

There is a known literature trying to study the effect of working memory on a variety of hearing aid features including the compression parameters – compression attack and/or release times. These studies were conducted mostly with 2-channel hearing aids and recent studies have used a 6-channel hearing aid but in a master hearing aid that doesn't entirely replicate real hearing aids. The goal of the present study was to understand the relationship between compression speed and speech recognition ability in a real life clinical setup and also to check if this was consistent with the findings of laboratory studies.

27 subjects with age range 62-100 years (mean 83 years) participated in the study. Their audiograms mostly had more hearing loss at higher frequencies. They were first administered with a Reading Span Test to measure the working memory capacity. The score was % correctly identified words (in a list of written sentences presented in time-pressed manner).

Each participant was then fitted with at least 3 pairs of hearing aids of different manufacturers for across-manufacturer comparison. Within-manufacturer comparison was also done where compression speed was changed for one product. In the final data set, 17 patients were tested with three different aids and 10 patients with four different aids. The order of compression speeds was randomly selected for each patient. The attack and release times varied and measured in 4 conditions (2 slow and 2 fast). In unaided as well as each of the aided conditions, Speech-in-Noise threshold was obtained using QuickSIN.

The results are:

1. *Working memory (Reading Span Test) results varied from 17%-50%.*
2. *As shown in above Figure, the SIN threshold was same for patients with low or high working memory with hearing aids using slow compression speed.*
3. *The SIN thresholds were higher for individuals with low working memory. The thresholds did not change significantly for the high working memory group.*
4. *Scatter plots showed that fast compression speeds were not suitable for low working memory group.There was improvement provided by slow compression speed for these individuals but this was not significantly high.*

The authors however, strongly recommend using cognitive examination as a part of routine audiological practice before a hearing aid is selected.

This study has been successful in replicating the laboratory studies in a real life setting, on this debated subject. The study was designed and conducted well in a private audiology clinic. The statistical procedures used to examine the data in detail were very good. The recommendation to use cognitive testing in routine audiological practice was also a pragmatic one.

'Acoustic shock': A new occupational disease? Observations from clinical and medico-legal practice.

Parker W et al.

International Journal of Audiology 2014; Vol. 53 (10), 764-769.

There is a large young workforce employed in call centers exposed to a modern day version of NIHL – Acoustic Shock. Acoustic Shock has been defined by the International Telecommunications Union as "any temporary or permanent disturbance of the functioning of the ear, or of the nervous system, which may be caused to the user of a telephone earphone by a sudden sharp rise in the acoustic pressure produced by it".

Acoustic Shock seems to result from a repetitive exposure to acoustic incidents transmitted in telephone lines which are defined as unexpected randomly occurring high pitched and startling stimului, typically tones of 2 – 3 or 3 – 4 kHz at intensities varying from 82 to 120 dB SPL at the tympanic membrane with rise times of 0 – 20 milliseconds. Individuals with a history of various psychotic and neurotic conditions seem to be more vulnerable to Acoustic Shock.

This study attempts to characterise the demographic, symptomatological, psychological, epidemiological, and audiometric aspects of Acoustic Shock.

30 patients with history of persistent symptoms of exposure to alleged acoustic incidents participated in the study. 17 reported exposure to just one such incident whereas the others reported exposure to more than 3 events. The symptoms were ear pain, ear discharge, hearing loss, but tinnitus was reported by the majority of participants. 70% participants reported past history of otological symptoms.

PTA revealed normal hearing in many patients, but SN hearing loss (4-6 kHz notch) was seen in almost as many subjects. 4 subjects showed non-organic hearing loss.

The authors have shown that 'Acoustic Shock' exists as a clinical condition. However, there is nothing clear about the symptomatological and clinical presentation. Authors call for more studies on the disorder so that these subjects can find a medico-legal solution to their problems.

Associations between dietary quality, noise, and hearing: Data from the National Health and Nutrition Examination Survey, 1999–2002.

Spankovick C. and Le Prell C.G..

International Journal of Audiology 2014; Vol. 53: 796–809.

There is a lot of literature to suggest that a particular diet may give long-term relief from NIHL and safeguard HF hearing threshold levels. Some of the nutrients suggested to play a role in human hearing are vitamins, including vitamins A, B (specifically B2, B9, and B12), C, and E. However, there are also studies that report no statistically significant relationships between these specific vitamins and hearing. Some of the minerals suggested to play a role in hearing include magnesium (Mg) and selenium (Se), although there are also studies reporting no statistically significant relationship between Mg and hearing.

Given the mixed nature of results of these studies, the current study was taken up to understand the relationship between the dietary pattern and hearing status. The authors used Healthy Eating Index (HEI), which provides an overall assessment of type, quantity, and variety of foods, and compliance with US dietary recommendations, to examine the role of diet. The survey hypothesis was that there may be an interaction between noise history and dietary quality, with an increased risk of hearing loss in those with both poorer diets and greater noise exposure. The maximum HEI score was 100, automatically calculated based on the intake of vegetables, meat, dairy, fruits, grains.

Of the survey conducted from 1999-2002, 2176 participants were included in the final analysis as complete audiometric and HEI data was available. Low-frequency pure-tone-average (LFPTA) at 0.5, 1, and 2 kHz, and a high-frequency pure-tone-average (HFPTA) at 3, 4, 6, and 8 kHz was measured for each of the participants.

Quintile Analysis and further subgrouping based on exposure to noise levels indicted a clear pattern. HFPTA was compared for bottom 40% and top 60% across 4 types of noise sources as shown in the picture. In any type of noise source, when exposed to (Yes as shown in the figure), the HFPTA is significantly lower for individuals who take better diet (top 60%). The mean difference was 3 dB in occupational and non-occupational types of noise, and it was more than 5 dB for subjects exposed to fire arms and military noise sources.

The authors advocate for a public education drive to use a proper diet to prevent occupational NIHL apart from other safety, administrative and engineering solutions.

The authors, being experts in the field of nutrition and hearing, have made a big effort to understand the problem as a whole and gathered huge data. They have looked into a variety of variables in analysing the data which makes this study a reference guide for future research in this direction. The major outcome has been linking the balanced diet to the vulnerability to hearing loss, which has been proven beyond doubt.

The Relationship between the Acceptance of Noise and Acoustic Environments in Young Adults with Normal Hearing: A Pilot Study.

Franklin C.A., White L.J., Franklin T.C. & Smith-Olinde L.

J. Am. Acad. Audiol.; 25: 584-591 (2014)

The premise of the ANL prediction of hearing aid use is that the procedure captures the amount of background noise that a listener is willing to accept while listening to speech. The aim of this study is to examine if the ANL procedure also gives an indication about the proportion of time a person spends in 4 different acoustic environments (noise, speech in noise, speech and quiet).

A group of 29 normal hearing listeners aged between 21 and 45 years were recruited amongst employed and unemployed students, full time students with external and no external employment. Hearing and middle ear function testing was undertaken to determine normal hearing functionality. All the participants were regarded as naive listeners as they had no previous knowledge of the ANL procedure or its possible correlation with listening environments. As an ulterior criterion for participation either a high ANL (>16 dB) or a low ANL (<6dB) was required. The participants were divided into two groups based upon their ANL level. The low ANL group was comprised of 21 listeners and the high ANL level group of 8 participants. Each participant was provided a lapel-style data-logging device (classified as noise, speech in noise, speech in quiet, and quiet), the sound activity meter (SAM) produced by Oticon, and instructed to wear the device for 3 consecutive days. The data retrieved from the SAM reflected the percentage of time that the participant wore the device in each type of acoustic environment. Each participant's most comfortable level (MCL) was obtained three times and averaged. The background noise level (BNL) was similarly obtained three time and averaged.

The results show that the ANL is a statistically significant factor in the percentage of time that listeners spent in 'noisy' environments and is not a factor for influencing the percentage of time the listeners spent in the two 'non-noisy environments. According to the study, the ANL is a predictive value as it relates to listener behaviour, not exclusive to hearing-aid use. Therefore, further studies may involve replicating the present study using listeners with hearing loss and the data-logging feature of their personal hearing aids.

Although based solely on young and normal hearing listeners, this very interesting descriptive pilot study not only corroborates the vast literature and evidence available on ANL, at the same time it also exalts the great, and perhaps not fully explored potentialities of data logging for listener acoustic scenario profiling. This may provide added value towards counselling and interesting possibilities towards a more meaningful personalisation of the hearing solution.
Overall well conducted study but a small sample size, limited time for data collection and the minimal control of activities in which listeners participated. It would be challenging to predict the amount of time that any individual person spends in noise-based environments on knowledge of his or her ANL.

Assessment of auditory spatial awareness in complex listening environments.

Brungart D.S. ,Cohen J., Cord M.& Zion D.

Journal of the Acoustical Society of America. October 2014: 1808–1820.

Thirty subjects participated in this test and were divided into two groups. The first group consisted of ten "young normal hearing" and the second group of older "hearing impaired listeners" with neurosensory hearing losses ranging from mild to severe. The test procedure was divided into three subtasks of increasing complexity where listeners were required to localise and indentify a two second signal presented randomly from one of the speakers in a 26 loudspeakers array. Subsequently, listeners had to identify a six second long added signal amongst a multiple simultaneous sound auditory scene, and finally to identify and localize the removed signal in the same listening conditions. To determine the sensitivity of the "localize, add and remove" spatial identification capabilities in the hearing impaired group, the task was undertaken unaided, monaurally aided, and bilaterally aided conditions. The SSQ (Gatehouse and Noble 2004) was used to determine the subjective localisation performance. Not surprisingly, normal hearing listeners were more efficient in angular error between localisation of the target signal and response.

This study, based upon the missing source localisation paradigm (Simpson et al 2007), analyses in great detail different aspects of sound cue identification and localisation and it would have been very interesting to have categorised performance based upon type of hearing aid and microphone deployed. The paper could well be an interesting precursor for further tests regarding drivers licence renewal procedures in the older population.

Effects of aging on audio-visual speech integration

Huyse A., Leybaert J. & Berthommier F. Bjorn

Journal of the Acoustical Society of America. 136 (4), October 2014: 1918–1931.

Fifteen young adults and fifteen older adults were recruited for this study. For inclusion they were prescreened for auditory impairment for the frequencies 250-4000 Hz. The older listeners were also screened for dementia using the Mini Mental State Exam. The AV integration performance was tested in a dimly lit quit room. Listeners were requested to identify syllables and report it aloud. The stimuli used were composed of VCV syllables with the consonants interposed between two /a/ vowels. A male speaker was videotaped while pronouncing the syllables. In half of the experiment the quality of the visual component was degraded.

First results in the auditory only modality were analysed statistically. The results indicate the more adverse effects on AV integration caused by stationary noise compared to modulated noise. This emerged particularly in the group of older listeners where stationary noise exacerbated AV integration and where both groups tended to rely more on visually based responses. In the older listeners group, visual reduction caused an increase in the number of auditory based responses. Interesting how older listeners maintain their lip-reading abilities and AV integration skills when visual speech cues are not degraded.

Interesting study full of real world implications. Regarding the underlying specificity and complexity involved in real world AV integration, such as high frequency cue detection, it seems rather questionable why hearing threshold testing for inclusion was limited to 4000 Hz. This research offers further and convincing evidence of how the senses can share information and integrate when needed and the importance hearing aids have in supporting these subtle integrating properties of the brain. Possible implications for rehabilitation programmes where auditory and visual abilities need be evaluated. This paper certainly provides convincing evidence on the importance of more widespread use of auditory assistive devices.

Effects of Noise Reduction on Speech Intelligibility Perceived Listening Effort, and Personal Preference in Hearing Impaired Listeners.

Munhoes dos Santos G., Ferreira Bento R.,Torres de Medeiros I.T., Oiticcica J.,Csipai da Silva E. & Penteado S.

Trends in Hearing (January - December 2014) Vol. 18: p 1–9.

Over a few decades, hearing aids with an integrated sound generator have been used to enhance the effectiveness to reduce tinnitus annoyance. Because no study demonstrated the superiority of the combined use of amplification and sound generator regarding conventional amplification alone, the aim of the study was to verify it.

A total of 49 patients took part in a blind randomised clinical trial. Patients presented bilateral hearing loss from mild to moderate. Tinnitus annoyance was measured by Tinnitus Handicap Inventory (THI) and numerical scales. Psychoacoustic measures of tinnitus were also performed. The sound generator was set at the lowest intensity capable of providing relief from tinnitus.

Results showed that 62.5% of the patients presented a reduction in tinnitus annoyance in the combined fitting group and in the group with amplification alone, 78% showed a reduction. This difference between the groups was not statistically significant.

This is an interesting study with a well-balanced test group, also regarding degrees and slope of the audiogram curves. Unfortunately one can only find information about "masking noise" level but not about the type of noise they have used.

Effects of Fast, Slow, and Adaptive Amplitude Compression on Children's and Adults' Perception of Meaningful Acoustic Information.

Pittman A.L., Pederson A.J.& Rash M.A.

J. Am. Acad. Audiol.; 25:834–847 (2014)

Evidence suggests that attack and release times, used to compress gain in hearing aids (e.g. WDRC), can affect successful communication for some hearing aid users. Gain compression is widely used to restore audibility for the hearing impaired with reduced dynamic range. On the other hand, gain compression is only possible by using attack and release times. These settings can induce distortions in the spectral envelope.
Fast compression can improve the audibility of low-level phonemes (e.g. voiceless fricatives) without compromising the compression of vowels. Slow acting systems are designed to limit the effects of compression on the short term variations. Fast-acting compression can distort the acoustic waveform which reduces sound quality and can decrease signal-to-noise ratio by amplifying background noise.
Evidence also shows that adults with lower cognitive abilities have more difficulty with signal distortion caused by fast-acting compression. On the other hand, background noises can give important information to manage the environment (e.g. traffic noise), and are not always perceived as undesirable. These noises are helping us to interact with the environment.
Using an amplitude compressor with adaptive-time constants could improve the overall performance. When there are no large changes in input level, longer time constants are applied (>800ms)
This study tries to evaluate the possible advantages of this adaptive type of compression, using two types of stimulus:-
1. A trigger and a non-overlapping target together with background noise, and
2. The same trigger in an overlapping mode.
The triggers were short background noises and the target a word (e.g. a Birdcall combined with the word "liveguard").
At the same time the test subjects heard the sound of a playground noise during the whole stimulus.
Fast compression amplified the background noise and the target, but reduced the amplitude variations within the waveform and decreased the overall signal-to-noise ratio.

The analyses revealed that:
1. The performance of people with hearing loss was significantly poorer than that of listeners with normal hearing.
2. Children perform more poorly than adults with speech stimuli.
3. All groups performed more poorly in the overlapping condition.
The listeners with normal hearing performed best with slow compression, whereas the listeners with hearing loss performed better with the adaptive algorithm.
Subjects with hearing loss may prioritise speech and avoid environmental sound to optimise their speech perception.

Bearing in mind that fast acting gain compression can compromise the signal-to-noise ratio, slow-acting or adaptive compression should be considered when clients are not performing well in noise (high ANL) and in reading span tests. On the other hand good performers are less disturbed by background noise and can benefit from the extra information, fast compression can provide.

The Role of Spectral Resolution, Working Memory, and Audibility in Explaining Variance in Susceptibility to Temporal Envelope Distortion.

Davies-Venn E. & Souza P.

J. Am. Acad. Audiol.; 25: 592–604 (2014)

Compressed amplification introduces distortions such as overshoots at normal and high level inputs by altering the normal temporal and spectral information.
This affects mostly lower-redundancy signals, such as rapid speech or speech in background noise.
It is relevant for rehabilitation to distinguish between listeners who can benefit from compressed amplification and others who cannot.
Factors as spectral resolution, audibility and working memory are considered as contributing factors:

1. *How much do temporal envelope distortions matter?*
2. *How much is working memory related to benefit (Fast compression release times seem to benefit users with high working memory while low compression release times benefit users with limited working memory)?*
3. *Will WDRC, by enhancing audibility, improve intelligibility or compromise it by changes in spectral resolution?*

The results of this study show that:

1. *Listeners with moderate to severe hearing loss have a significantly poorer spectral resolution compared to listeners with mild to moderate hearing loss.*
2. *Limited working memory can affect performance.*
3. *At normal and higher levels the benefits of compressed amplification are less obvious compared with linear amplification.*

A survey of the attitudes of practitioners toward teleaudiology.

Singh G., Pichora-Fuller K, Malkowski M., Boretzki M & Launer S.

International Journal of Audiology 2014; 53: 850–860.

For the 360 million individuals with disabling hearing loss, it matters whether there's a hearing care specialist in the close surroundings of their homes.. This is not an issue for the developed countries, where there's one audiologist (aud) per 20,000 people, but mostly for the developing countries (estimation of one aud/ 0.5 to 6.25 million people). Aside from this, it is estimated that over the next 15 years, the population of adults aged 65 years or older will grow by 66% in the US. They'll want to be able to function independently, including better access to better healthcare services.

The article started from these findings and looked at the possibility to use teleaudiology to bring the hearing care specialist closer to those people, reduce costs, stress on patients and family caregivers and reduce the amount of time patients and caregivers take off from work. Either in a synchronous

way (patients and practitioners meet in real time) or in an asynchronous way (central storage of clinical information used by a professional at a different location at a later time), teleaudiology can improve the services of a hearing healthcare practitioner and provide benefits for patients.
In other researches it was found that telemedicine initiatives were unsuccessful due to the operational phase (unreliable equipment and technology) but also due to the attitude of healthcare professionals to telemedicine.

The attitude of the hearing healthcare practitioner is the focus in this research. To investigate this, a survey was completed by 202 practitioners, with information about the attitudes of the practitioner towards the use of teleaudiology regarding (1) the delivery of audiological services, (2) their willingness to conduct various clinical tasks, (3) their willingness to conduct an appointment with various patient populations.

The group of practitioners was very diverse, coming both from non-profit and private practice settings, with different degrees of experience (e.g. 20% 3-5yrs; 25% 11-20yrs) and a mean age of 39.3yrs (SD=11.0). Of this group, 95% reported to have used telephone, 87% email and 10% video conferencing when communicating with a colleague about a case. The same goes for their interactions with clients, where the majority communicate using the telephone and email.

How positive/ negative the effect of teleaudiology would be, in the opinion of the practitioners, measured on different topics? The difference between the quality of the relationship with new patients (q12) compared to returning patients (q13). Overall, most practitioners responded that teleaudiology would have little negative effect on professional practice. This indicates the possible advantages such as being able to meet quickly and improved access to services.

The willingness to perform different audiological tasks using teleaudiology is also scored. This willingness depends greatly on the task to be performed. Communication (question answering) is a task where the vast majority of practitioners are willing to use teleaudiology. In contrast, for tasks like assessments and "1st fit", the willingness was very low. They find a difference in willingness to perform the task '1st fit' for new versus returning patients.

When looking at different populations of patients, they found more willingness to use teleaudiology with patients who are technology-savvy, living in remote locations (limited mobility and transportation) and busy schedules. As in the previous figures, for first time patients, the willingness is very low. Looking at the relationship between perceived effectiveness of teleaudiology, willingness to use it and demographic information, it was found that participants with more distant patients had more positive belief about teleaudiology. Other relationships were the degree of education and effect on appointment-related travel (higher degree with greater belief in decreasing travel time). Another difference was found between practitioners working in a publically-funded work setting (more positive) versus private work setting. However, there was no effect of the age of the practitioner on belief in the functionality of teleaudiology.

This is interesting research about the effect of teleaudiology on the hearing healthcare services and the belief of practitioners in the use of teleaudiology for different types of patients and tasks. Not surprisingly, the believed effect on hearing healthcare varies from minimal to positive with a difference for different tasks. Interesting findings regarding the difference between new and returning clients and the overall more positive attitude towards teleaudiology, giving the right message that, for clients and practitioners, teleaudiology can be of value.

Effects of Noise Reduction on Speech Intelligibility Perceived Listening Effort, and Personal Preference in Hearing Impaired Listeners.

Brons I., Houben R & Dreschler W.A.

Trends in Hearing (January - December 2014)
Vol. 18: p 1–10.

Twenty hearing impaired subjects between 48 and 69 years of age were recruited for their evaluation of the perceptual effects of single microphone noise reduction in three different hearing aids with the processing features in activated and deactivated conditions.

The hearing aid output was recorded and processed in such as manner as to render all three recordings to have similar output spectrums as the input signal. The recorded stimuli were presented via Sennheiser HDA200 earphones. The hearing aids' noise reduction processing characteristics were measured by long term average gain reduction for three noise reduction conditions and plotted for 6 different SNRs. The listeners intelligibility outcome measures were their individual SRT50 and the percent correct words at a fixed SNR of +4dB.

Statistical analysis does not prove any difference in intelligibility when comparing noise reduction algorithms to unprocessed conditions. Further statistical analysis procedures, on the other hand, showed how one of the devices used in the test actually significantly worsened intelligibility with processing features activated and at + 4dB input SNR.

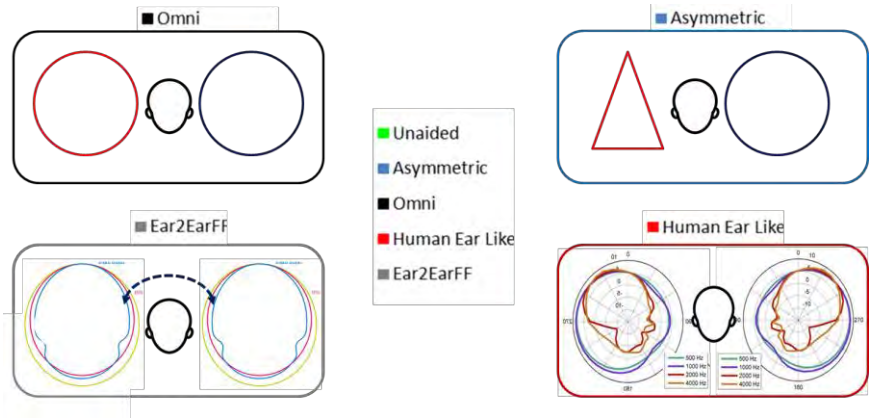
This paper offers further evidence of how those involved in hearing aid fitting should ensure realistic expectations in their patients particularly regarding the effects of noise reduction as it is argued that no improvements in intelligibility scores in noise should be expected. The paper could have mentioned how improved listening comfort and reduced noise annoyance may indirectly provide the cognitive system with more resources to enhance performance in intelligibility tasks. Instead this paper quite bluntly states that listeners prefer the trade-off of listening comfort at the expense of intelligibility. This paper does seem to make a compelling argument that hearing aid noise reduction characteristics should be made more transparent to the H.A dispenser.

Left-Right and Front-Back Spatial Hearing with Multiple Directional Microphone Configurations in Modern Hearing Aids.

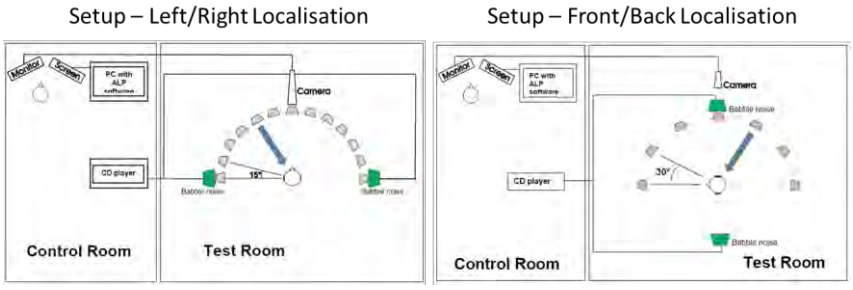
Carette E., Van den Bogaert T., Laureyns M. & Wouters J.

J. Am. Acad. Audiol.; 25:791–803 (2014)

In earlier studies the negative impact of directional microphone systems on both front-back and left-right (azimuth) localisation of sounds has been demonstrated. New directional systems claim to improve or at least leave localisation of sounds unaffected. Therefore five different directional configurations were evaluated in function of the impact on left-right and front-back localisation of sounds in this study. The conditions were (1) unaided (with corrected loudness level to make all sounds audible) – (2) Omni-directional – (3) Asymmetric (Right ear directional – Left ear omni-directional) – (4) Human Ear Like (Low frequencies omni – high frequencies fixed directionality) – (5) Ear2EarFF (Wireless communication between two devices to improve left-right localisation and directionality to respect front-back differences)

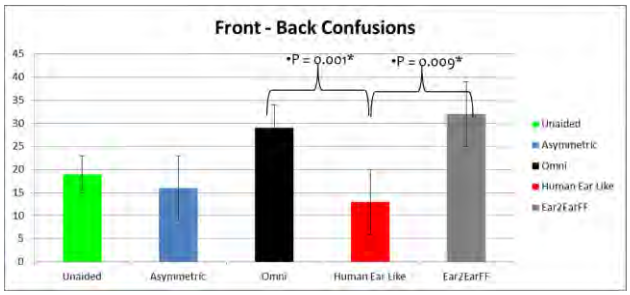


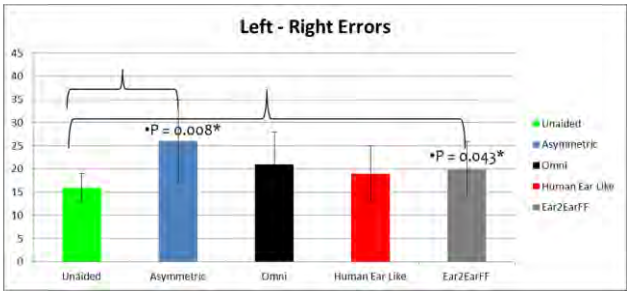
Twelve experienced hearing aid users with a moderate to severe hearing loss participated in this study and as a reference eleven normal hearing subjects have performed the same localisation test. All experimental hearing aids were fitted with the same gain and compression settings as the hearing aids the subjects were using.



A 13 semicircular speaker array was used for the localisation test. Each speaker was numbered and the subjects were asked to indicate the number of the speaker where the test signal was heard. At each presentation the level of the test signal was altered to avoid loudness cues and next to the test signal (broad band noise) a multi-talker babble signal was generate at +90° and -90°.

Results Front-Back Localisation:
The lowest number of errors was found in the "Human Ear Like" condition (Low frequencies omni – high frequencies fixed directionality) - The highest number of localisation errors was found in the "Omni" and "Ear2EarFF" condition.





Results Left-Right Localization:
The lowest number of errors was found in the "Unaided" condition (with corrected loudness level to make all sounds audible) - The highest number of localization errors was found in the "Asymmetric" condition (Right ear directional – Left ear omni-directional). The "Ear2EarFF" condition scored poorer than the "unaided" condition.

Conclusion: The new directional system that was developed to mimic the "Human Ear" (Low frequencies omni – high frequencies fixed directionality) preserves the binaural cues partly to allow left-right localisation and results in better front-back localisation.

What is important for hearing aid satisfaction? Application of the expectancy-disconfirmation model.

Meyer C., Hickson L., Khan A. & Walker D.

J. Am. Acad. Audiol.; 25: 644–655 (2014)

Is there a relationship between overall hearing-aid satisfaction and measures of hearing-aid performance and disconfirmation?
Satisfaction with hearing aids (HA) is found to be related to the ability to hear, performance in hearing that's better than expected, fewer problems with hearing-aids and with manipulation, appearance and wearer discomfort then anticipated before fitting.
New HA users have higher expectations then experienced HA users; mostly about the expected benefit, service and cost. This is in contrast with their lower expectations about appearance then experienced users. But what's the effect of unrealistic expectations on the HA satisfaction?

Different studies have been conducted to look for a relationship between expectations (prior to fitting) and HA satisfaction. Some had clear results about the higher level of satisfaction for clients who had higher pre-fitting expectations (e.g. about being able to communicate in noise). However, others identified negligible effect. So, this launches the question whether we need to counsel our clients about their unrealistic expectations when some studies show expectations have limited effect on overall satisfaction with hearing-aids.
According to the expectancy-disconfirmation model, expectations are mostly those linked directly to the product and actual product performance. The expectations of the client can be positively disconfirmed (better then) or negatively disconfirmed (less well).

The correlation between pre-fitting expectations and hearing-aid performance can be found using the expectancy-disconfirmation model. The aim of this study was to determine aspects of the model that could predict overall satisfaction, using a larger sample of patients than previous studies.

The participants were selected based on the fact that they paid part of the full cost of the hearing-aids, which made a total of 123 individuals from Australia. The majority had no prior experience and obtained HA from a public audiology clinic.
The study collected personal details (demographic, hearing impairment, experience, etc) and conducted a modified PHACS questionnaire. In this modified version, the elements relating to cost, service and pre-fitting expectations were not included. The questionnaire evaluates performance, disconfirmations and satisfaction.

A test-retest was conducted and gave overall good results on reliability. Overall satisfaction ratings of 80 and higher was seen as "HA satisfaction" where less than 80 was seen as "HA dissatisfaction". 61% were considered satisfied HA users.

There are three factors that predict overall HA satisfaction:-

- *Looking at the ability to hear in a variety of listening situations, it's no surprise that this is a good predictor of satisfaction about the HA.*

Clients with no experience expect to hear better in different situations, sometimes resulting in decreased satisfaction. So, it can be beneficial to counsel new clients on this, when wanting to promote overall HA satisfaction.

Another factor was hearing-aid problems, such as noise annoyance, appearance, manipulation, etc. The participants appeared to have anticipated these problems, thus rating hearing-aid problems to be the same or better than expected.

All in all, some conclusions can be made in relation to strategies in rehabilitation. Given the importance of being able to benefit in different listening situations, the audiologist should focus on this first when aiming for HA satisfaction with the client. Aside from this, it's also a good idea to discuss potential problems they could face. At the end, when you're able to get a positive disconfirmation on hearing-aid problems and hearing ability, your client will be likely to be a more satisfied hearing-aid user.

This study claims to have provided a new direction for research, being able to identify 93% of the satisfied and dissatisfied HA users, with the expectancy-disconfirmation model. However, the findings about the how you can positively affect satisfaction are not really a surprise. It could be more interesting if the data about pre-fitting expectations were investigated but these were left out in this study.

The effect of repeated measurements and working memory on the most comfortable level in the ANL test

K. Jonas Brännström, Steen Østergaard Olsen, Lucas Holm, Tobias Kastberg & Tina Ibertsson

International Journal of Audiology 2014; 53: 787-795, December 2013.

This article studies the effect of a large number of repetitions on the most comfortable level (MCL) when doing the Acceptable Noise Level (ANL) test. It also assesses whether MCL variability is related to central cognitive processes. The ANL test was developed by Nabelek and colleagues in 1991. It quantifies the amount of background noise level (BNL) that subjects accept when following speech at the MCL. ANL is defined as the difference in dB between the MCL and the BNL. Poorer acceptance of background noise is characterised by a higher ANL, while high acceptance is indicated by a low ANL

Previous studies have examined the ANL test using a varying number of repetitions for establishing the MCL as a basis for the calculation of the ANL. However, it is not known whether the MCL, as assessed in the ANL test, is a reliable measure which is the main purpose of this study. Other studies suggest that the MCL is most likely a range of values and is influenced by preceding sound exposure. Therefore, it is relevant to examine the variability of MCL in the context of the ANL test rather than by itself.

When the ANL is measured, the MCL is found in quiet, but the ANL is often calculated as the mean value of 2 – 3 repetitions. With MCL estimations being done after one or two presentations of speech and noise, this may affect the MCL outcome. Both MCL and BNL are used to calculate the ANL. It is, therefore, relevant to understand which factors influence the MCL in order to understand its influence on the ANL.

Any task involving attention will to some extent be influenced by a subject's working memory (WM). As WM is the ability to simultaneously store and process information over a short period of time, poorer ability to perform a task may result in more variable estimates of the MCL. Phonological (PWM) and visuospatial (VSWM) components of WM are relevant to this study which also explores whether MCL variability is related to central cognitive processes.

Materials and methods for this study were:-

- *32 normally-hearing subjects between 18 and 40 years of age were recruited.*
- *A non-semantic version of the ANL test was used which uses the International Speech Test Signal (ISTS). The ISTS shares most properties of normal speech but it contains no semantic content.*
- *The MCL and BNL procedures were repeated twelve times. Two working memory tests were used. Firstly, an auditory task of serial recall of nonwords which tests PWM. Secondly, a visual task using matrix patterns which tests VSWM.*

Conclusions

The MCL results are shown in Table 2 and Table 3 below and it can be seen that the first repetition of the MCL deviates from subsequent repetitions. The possible reasons for this are

discussed in the article but the most accurate explanation of this finding is that the noise exposure between repetitions 1 and 2 confounded the results.

In summary, the findings of the study suggest that, after excluding the first repetition, the MCL in the ANL test is reliable. However, the use of a single repetition of the MCL in the ANL test should be avoided. If an interleaved methodology is used, a single ANL repetition should be added prior to the actual testing. The findings also suggest that MCL variability is associated with PWM but not VSWM.

An interesting and well written article which should enhance the validity of the ANL test when conducted in accordance with the findings of this study. However, the subjects were normally-hearing with a mean age of just under 26 years. It is to be hoped that future studies will examine the relationship between MCL variability and PWM in older subjects with hearing loss.