

Why set children's hearing aids this way? What does the research tell us?

Jodie Nelson, Senior Product Audiologist for Pediatrics
Phonak Headquarters, Staefa, Switzerland

Hearing in quiet

- Junior Mode sets the microphone directionality in Calm Situation to Real Ear Sound (RES).
- RES preserves the Pinna Effect which is essential for localisation.

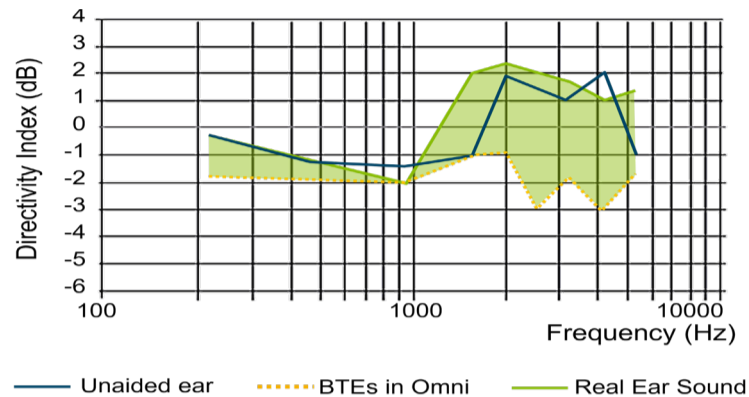


Figure 1. Comparison of Directivity Index with Unaided, Omni directional with BTE, RES with BTE

- Figure 1 shows the directivity index against frequency.
- The blue line (unaided ear) shows the effect of the human pinna on directivity. The pinna provides more directivity in the high frequencies.
- Orange dashed line – Once you place the microphone outside of the ear, the pinna effect is lost. There is no directivity in any frequency.
- Green line and region – Effect of RES on restoring the natural directivity normally provided by the pinna.
- Comparison of the polar plot for a microphone in RES (Figure 2) and Omni directional (figure 3) shows:
 - Access to low frequency sounds from all around the microphone for both RES and Omnidirectional
 - A more directional polar plot for high frequencies providing the improved high frequency directivity in RES compared with Omnidirectional.

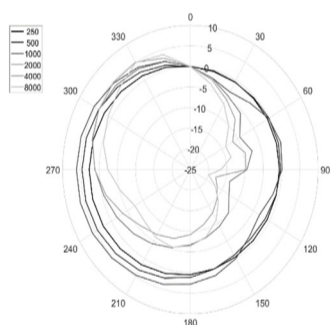


Figure 2. Polar plot for microphone set to Real Ear Sound

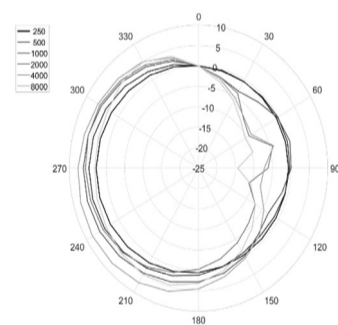


Figure 3. Polar plot for microphone set to Omni directional

Hearing in noise

- Using UltraZoom as the microphone directionality setting in speech in noise (SPiN) significantly improves speech intelligibility in noise when speech is in front of the participant (Wolfe et al. 2018). See Figure 4.
- UltraZoom is the default setting in SPiN for children in the 4 – 8, 9 – 12 and 13 – 18-year-old age groups.
- The default setting for the 0 – 3-year-old age group is RES for environmental awareness.
- A study completed by Wolfe et al at Hearts for Hearing, USA, investigated the effect of combinations of noise cleaning features on speech intelligibility, subjective preference and localisation.

Methodology

- Speech intelligibility was determined by measuring the SRT-50 (73 dBA speech) for speech from in front (0 degrees) and behind (180 degrees) for the following feature combinations:
 1. Calm situation frequency response, omnidirectional microphone, noise reduction off – this was the start-up program at the time of the study.
 2. Noise frequency response, omnidirectional microphone, noise reduction on.
 3. Calm situation frequency response, UltraZoom microphone, noise reduction off.
 4. Calm situation frequency response, RES microphone, noise reduction off.
 5. Noise frequency response, UltraZoom microphone, noise reduction on.
- Subjective preference was determined by asking participants to rate their preference for each of these combinations for:
 1. Most comfortable
 2. Best speech understanding
 3. Overall favorite.
- Localisation was assessed by evaluating how accurate the participant could select the location of a dog barking from a field of 8 loud speakers. Each speaker was used 3 times with a total of 24 presentations.

Results – Speech intelligibility

- Noise frequency response, UltraZoom, noise reduction on provides an additional 24% speech intelligibility with speech from the front compared with omnidirectional

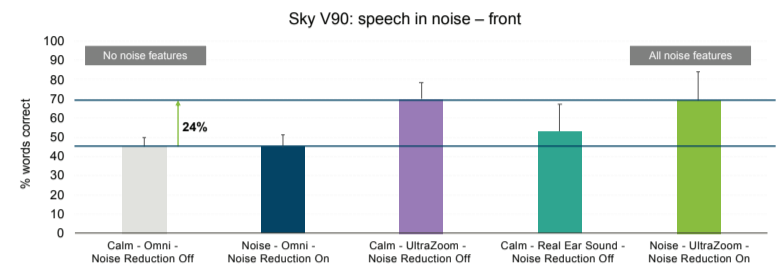


Figure 4. Comparison of speech understanding with combinations of frequency response, noise reduction and directionality settings.

Results – Participant preference

- The 'Noise/UltraZoom/Noise reduction on' setting was rated the most comfortable, gave better speech understanding and was the overall favourite regardless of whether the speech was coming from the front or from behind.
- Calm/Omni/Noise reduction off was always rated the least preferred. See Figure 5.

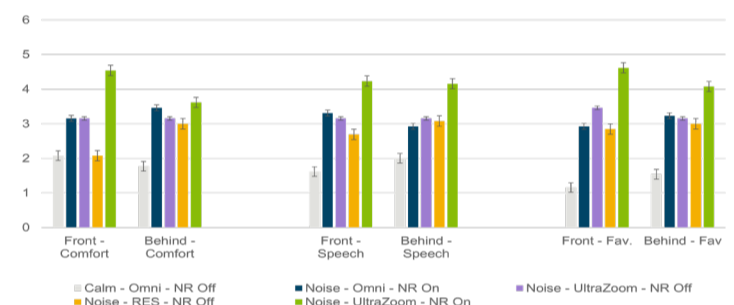
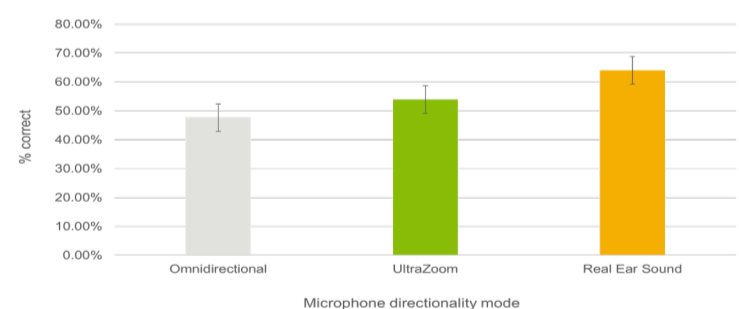


Figure 5. Participant preferences for comfort, better speech understanding, overall favourite with combinations of frequency response, noise reduction and directionality settings.

Results – Localisation

- Localization ability was significantly better in the Real Sound program relative to the programs with other two microphone modes.
- There was not a statistically significant difference in localization abilities obtained with use of the omnidirectional versus adaptive directional microphone modes. See Figure 6.



Conclusions

- At Phonak we ensure that the features in our hearing aids are appropriate for children following best practice guidelines and backed up by research with children.
- It is highly recommended that RES is maintained as the directionality of choice for the 0 – 3-year-olds in quiet and in noise rather than Omni.
- Localisation is significantly improved when using RES.
- When in challenging listening environments, children can profit from an additional 24% speech intelligibility by using UltraZoom as the microphone directionality in the SPiN classification.

Selected references

- Wolfe, J., Jones, C. & Rakita, L. (2018). Noise technologies: What do kids need and what do they want?, Phonak Field Study News, retrieved from www.phonak.com/evidence.