Listening in Spatialized Noise – Sentences
What is LiSN-S?

The Listening in Spatialized Noise - Sentences Test, or LiSN-S, assesses the ability of children to understand speech when noise is arriving from different directions.

Understanding speech in competing noise is a problem commonly experienced by children with auditory processing disorder (APD). LiSN-S uses a totally new and ingenious way of testing these children’s auditory skills.

Test stimuli are presented under PC-connected headphones. Using advanced mathematical algorithms, a virtual three-dimensional acoustic space is created under these. By then moving the competing noise from the front to the sides, LiSN-S tests whether children are able to make use of spatial advantage.

What the experts say ...

“LiSN-S is an excellent example of a new generation of well-designed and evidence based clinical measures of auditory-specific processing. LiSN-S taps into critical auditory processes that are not evaluated by the existing APD test battery.”
James W. “Jay” Hall III, PhD.
Clinical Professor and Associate Chair of the Department of Communicative Disorders, University of Florida, Gainesville, Florida

“LiSN-S adds a new dimension to the clinical assessment of Auditory Processing Disorder.”
Jennifer L. Smart, PhD.
Assistant Professor, Towson University Department of Audiology, Speech-Language Pathology, and Deaf Studies, Towson, Maryland

“LiSN-S – a unique approach to the assessment of Auditory Processing Disorders.”
Robert W. Keith, PhD.
Adjunct Professor Department of Communication Sciences and Disorders College of Allied Health Sciences University of Cincinnati
LiSN-S was developed by Dr. Sharon Cameron, a research scientist at National Acoustics Laboratories (NAL) in Australia, and Dr. Harvey Dillon, NAL’s director. Both are highly respected in the international scientific community for their innovative and outstanding contributions, and NAL itself is one of the world’s leading research institutes. As the research division of Australian Hearing, a Commonwealth Government Authority under the Department of Human Services, NAL undertakes scientific investigations into hearing, hearing habilitation and rehabilitation, and the prevention of hearing loss.

Phonak, the exclusive worldwide distributor of LiSN-S, is proud and privileged to be associated with NAL.

**Who developed LiSN-S?**

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The test’s inventor, Dr. Sharon Cameron, has applied the highest standards of scientific rigor in designing and validating LiSN-S. It is a model for how tests in this area should be developed.

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**Developed by NAL**

**Distributed by Phonak**
What is LiSN-S testing?

The Listening in Spatialized Noise – Sentences Test, or LiSN-S, assesses a child’s ability to understand speech when noise is arriving from different directions. The brain works by using directional cues when sound reaches the left and right ears at different times and different levels. By measuring a child’s speech understanding when noises are arriving from different directions, hearing professionals can accurately recreate real-life situations such as noisy classrooms, in which children can encounter severe communication challenges.

Test stimuli are presented through special PC-connected headphones, which use advanced mathematical algorithms to create a three-dimensional acoustic space. To test whether a child can use spatial advantage, the competing noises are manipulated, keeping the target speech directly ahead, but bringing in different competing speech sounds from other directions.

LiSN-S is an adaptive test. It works by broadcasting sentences to the child using the special headphones, and the child must then simply repeat all the words he or she hears. The hearing professional then enters the number of correctly repeated words directly into the LiSN-S software.

The noise of the competing speech is presented at a constant level of 55 dB SPL. The target sentences are initially presented at a level of 62 dB SPL. The presentation level is adjusted adaptively, depending on the child’s response to a sentence. After 22 to 30 sentences the child’s ‘speech reception threshold’ is calculated.

The LiSN-S test assesses a child’s hearing comprehension in four different conditions. In all four conditions the target speech comes directly from the front.

**Condition 1: High Cue SRT**

In the first test, the competing noise is composed of different voices than that of the target speaker, and these noises come from the left and right sides. This gives the child several aural cues to help him or her filter out and identify the target speech. The result of this test is called the child’s ‘high cue speech reception threshold’, or ‘high cue SRT’.

**Condition 2**

Here the competing noise is composed of the same voice as the target speech, and again comes from the left and right.

**Condition 3**

In condition three the competing noise is composed of different voices than the target speech and comes from the front – the same direction as the target speech.
Spatial Advantage
Moving distracting voices from the front to the sides allows a child to make use of spatial cues. How much an individual child benefits from this movement is easily calculated, by measuring the difference in scores between conditions 2 and 4.

This so-called 'spatial advantage' is calculated automatically by LiSN-S and is a highly sensitive indicator.

Children diagnosed with APD score very poorly in this spatial advantage test.

Talker Advantage
To assess how well a child can differentiate between different speaker voices and therefore understand speech in noise, LiSN-S also calculates the difference between a child's scores for conditions 3 and 4. The resulting figure is known as the child's 'talker advantage'.

Total Advantage
Last but not least, the difference between a child's scores in conditions 1 and 4 is referred to as his or her 'total advantage'. Like the high cue SRT, total advantage is a measure of how well a child uses the cues in the environment to filter the noise coming from different speakers and different directions.

Elimination of higher order effects
By measuring performance as a 'difference' between the scores from two LiSN-S conditions, the influence of higher order language, learning and communication skills on test performance is minimized.

This unique LiSN-S approach to measurement is highly valuable for the hearing professional as it allows for a much clearer evaluation of a child's ability to use spatial and voice cues.

Automatic evaluation of results
LiSN-S automatically calculates whether a child has displayed a performance outside of the norms on any of the measures by comparing their performance to these normal-hearing controls.

Condition 4: Low Cue SRT
In condition four, the competing noise uses the same voice as the target speech and comes from in front of the child – the same direction as the target speech.

This fourth condition is the most difficult of the four conditions as there are no spatial cues available and the target speech and competing noises are very similar. The result of this test is referred to as the child's low cue speech reception threshold or 'low cue SRT'.

LiSN-S SRT & Advantage Measures
How does the software work?

An intuitive database module is used to enter and edit client details.

Clear reports are then generated by the software. These show whether the child is within or outside normal limits for each test condition.

In this playback screen the audiologist enters the number of words correctly repeated by the child.

The playback screen includes data such as:

- The current condition (diff voices ± 90°)
- The level of noise (55 dB SPL, red line)
- The level of speech (adaptive, green line)
- The currently presented sentence
- The sentence number
- The number of reversals so far
- The SRT (in dB SNR)
Frequently Asked Questions

- **Who should administer LiSN-S?**
  Audiologists who test for APD in children.

- **How accurate is LiSN-S?**
  LiSN-S offers high test-retest reliability. Data from test-retest reliability studies has been used to develop LiSN-S ‘critical difference scores’. These scores allow the user to determine whether a child has made a genuine improvement over time, by simply retesting again with LiSN-S. Such retesting can be useful for determining, for example, whether a child’s listening skills have improved after some form of intervention.

- **What are the system’s requirements?**
  A sound treated room is required for LiSN-S, as all the system’s norms were gathered in such sound treated rooms.

- **What norms exist?**
  Norms exist for North American English and for Australian English. North American English can be used in the United States and Canada; Australian English can be used in Australia and New Zealand. Norms are also being developed for the UK. Norms exist for children aged from 6 years up to 11 years and 11 months. Norms for children from 12 to 17 years of age, as well as norms for adults, are currently being developed. Scores calculated for children outside the current normative ranges are invalid.

- **What results do I get from LiSN-S?**
  The software indicates clearly, for all five measures, whether a child is within or outside normal limits. An individualized report containing the test results is automatically generated and can be saved, printed or sent by e-mail.

- **Product specifications**
  LiSN-S comprises: proprietary software, the Phonak Soundcard and specially designed, high quality headphones. The package also contains clear instructions on installing and administering LiSN-S.

- **PC system requirements**
  Windows XP
  Windows 2000
  Windows Vista
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