



Prof. Ernst Lehnhardt-Stiftung



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# Hearing screening on the path through life



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# Определение и качество скрининга

Всемирная организация здравоохранения

- Основной целью скрининга является первичная идентификация заболеваний и расстройств, которые не выявляются другими способами, с помощью соответствующих методов. Скрининг позволяет выделить из всего населения группы повышенного риска.



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# Определение и качество скрининга

Американская академия педиатрии, 1999

- Чувствительность, специфичность и простота в использовании (минимизация перенаправлений)
- Неопределяемость нарушения через клинические исследования
- Доступность методов вмешательства с целью коррекции проблем, определенных скринингом.
- Ранний скрининг, диагностика и вмешательство способствуют улучшению результатов.
- Приемлемая стоимость.

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# Определение и качество скрининга

Неонатальный скрининг отвечает всем критериям

- Глухота – наиболее частое расстройство у новорожденных.
- Скрининг на предмет врожденной потери слуха является неинвазивным, объективным и недорогим.
- Доступно оборудование для измерения ОАЭ и АРСП.
- Ведущие производители утверждают, что чувствительность их оборудования достигает 99%, а специфичность – 97%.

# Overview of the Worldwide Situation

The situation is very heterogeneous



*USA:*

90% of newborns screened

*Germany:*

Law passed in 2009,  
responsibility lies with  
federal lands

Loss to follow-up varies within  
2 to 50%.

# Facts



- the incidence of hearing loss in very young children is high
- suitable screening equipment is available

Still, the necessity of hearing screening for children in pre-school age is unfortunately not yet discussed on a broad basis



# Facts





Reputable audiologists and companies emphasize the importance of repeated hearing screenings at junctures in life, e.g. before school entry



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# The world is aging.

## Demographic development on a global perspective

| Country        | Raw Death Rate | Life Expectation | Shape                                                                                        |
|----------------|----------------|------------------|----------------------------------------------------------------------------------------------|
| Germany (2008) | 10,80 / 1000   | 79,01 yrs        |  Urn      |
| Mexiko (2008)  | 4,78 / 1000    | 75,84 yrs        |  Pyramid  |
| China (2008)   | 7,03 / 1000    | 73,18 yrs        |  Beehive |
| Russia (2008)  | 16,06 / 1000   | 65,94 yrs        |  Urn    |



# Screening for the elderly

Also a growing necessity



- There is a growing ageing population in developed countries
- The hearing loss in elderly people may be progressive, thus they accommodate to it and do not notice it
- Once the elderly person retires from social life due to deafness, it is almost too late for hearing aids to be effective

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# Motivate the elderly to maintain their hearing

People in the „third quarter of their life“ stay more active and feel younger, as long as they live self-sufficiently

Interaction with their environment and participation in social life is fundamental for self-esteem and well-being

Hearing and understanding are fundamental to „social competence“

# Requirements

## Criteria for test equipment



- easy to understand for both teenagers and the older generation
- reliable and fast
- small and portable
- usable outside doctors' offices

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# Senti & Sentiero



are portable hand-held device designed for facilitating the assessment of hearing impairment in infants and children.

They offer both:  
psycho-acoustical and physiological  
test procedures in one device



- Conventional pure-tone audiometer (class 3 or 4, IEC 60645-1, incl.bone conduction, high frequency audiometry,...)
- Image-based pure-tone audiometry (MAGIC Audiogram/Screen)
- Image-based Speech testing (SUN, Mainz1a,...)
- Otoacoustic emissions (DPOAE Threshold, DPOAE Quick, TEOAE Diagnostics, TEOAE Quick)
- Diagnostic ABR with click and chirp stimuli



# **Sentiero**

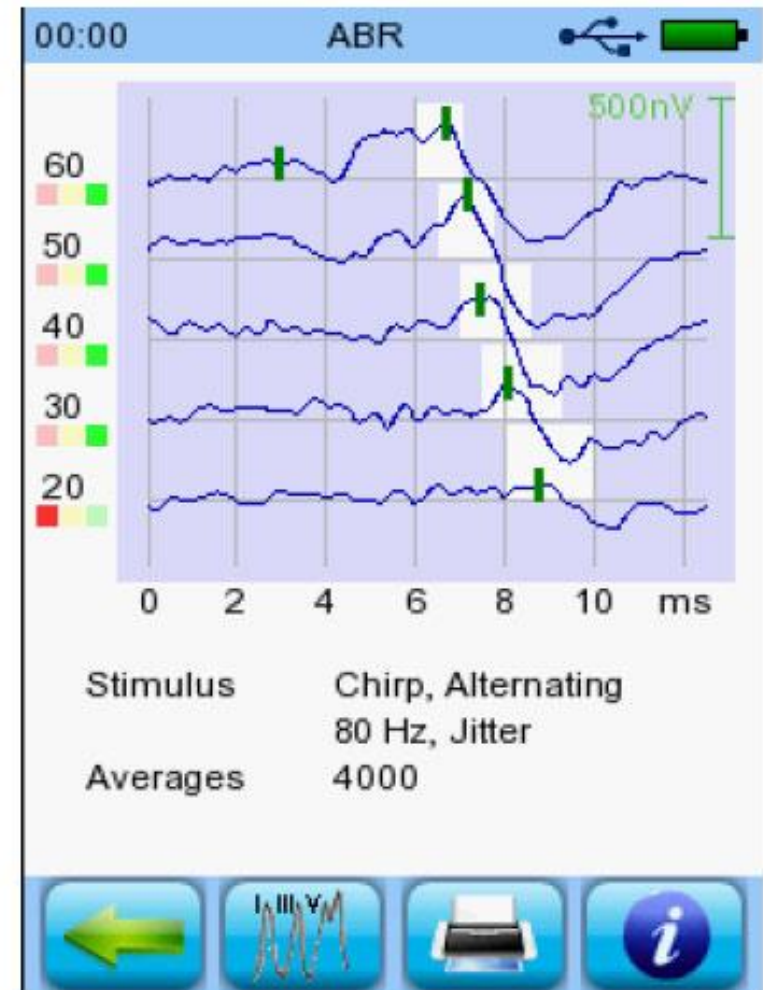
Advanced

## **Click / tone burst ABR**

- **3 electrodes**
- **Stimulation via Headphone or insert phones**
- **Probe and Bone conductor as future extension**
- **Click and chirp stimuli, up to 90 dB HL**
- **Configurable parameters**
- **Weighted averaging drastically reduces artifacts**
- **50Hz, 60Hz and adaptive digital comb filtering**

## ABR -Measurement / Display

- normative values shown as boxes
- editable peak markers
- up to 5 traces per sequence
- traffic lights indicate statistic significance
- more data available by touching the information region
- click and chirp stimuli
- future: multifrequency stimuli



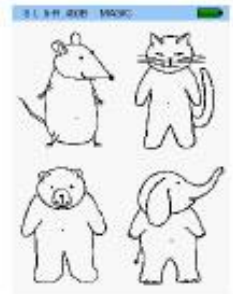


# **MAGIC \* - pure tone audiometry for children (for children > 4 years)**

**MAGIC** is a new tool with which **pure-tone thresholds** can be determined in a **playful way**.

**Different animals represent different tones.**

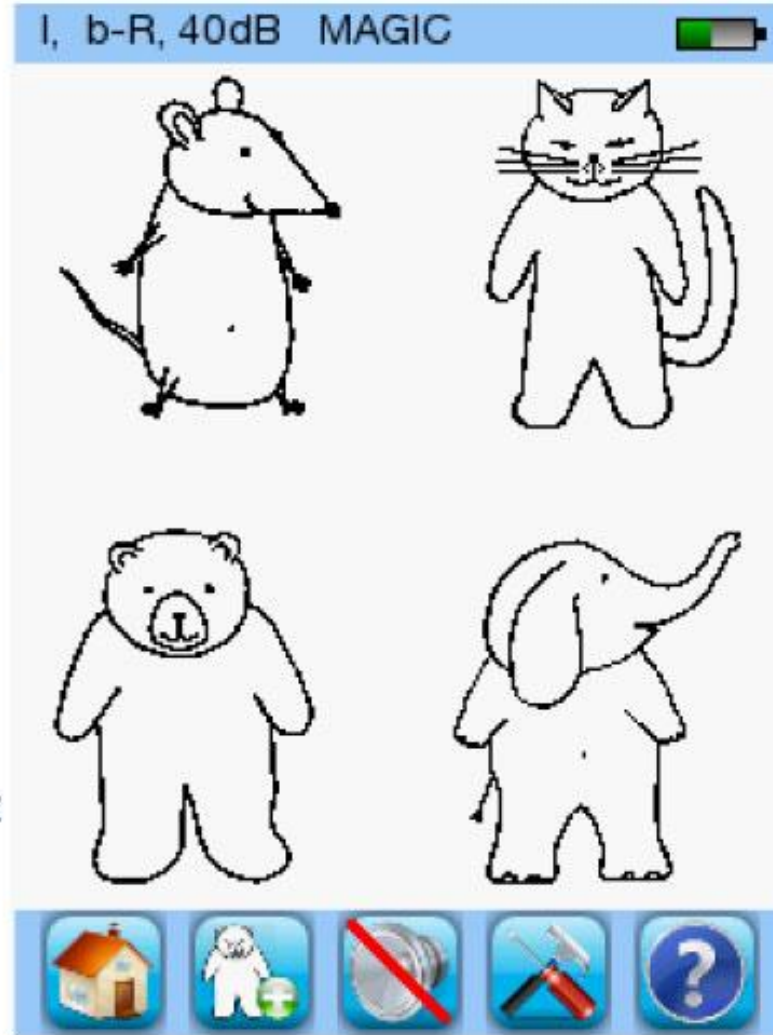
(Cow 250 Hz, bear 500 Hz, elephant 1 kHz, cat 2 kHz, sheep 3 kHz, mouse 4 kHz, bird 6 kHz, dolphin 8 kHz).



Using a self-controlled measuring procedure the child's **attentiveness is significant enhanced**.


Intended use of MAGIC is to determine pure-tone thresholds in **young children, preschool and school children**.

\* TM 'MAGIC' = Multiple Choice Auditory Graphical Interactive Check.



Choose an animal  
by touching it!



M, b-R, 25dB MAGIC 5  



Touch the bear's ,belly'  
to start the test!

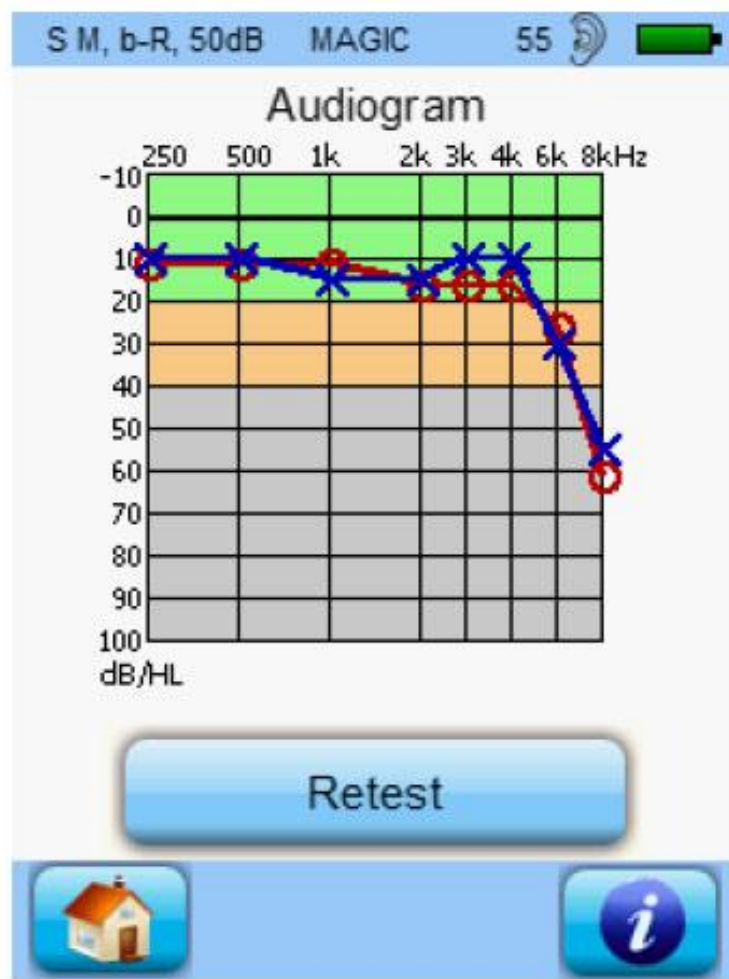
If you now **hear a sound:**  
touch the happy bear,



if you **do not** hear:  
touch the sad or ill bear!

Note: The test algorithm contains  
plausibility checks.






# MAGIC Results



S M, b-R, 50dB MAGIC 55  

### Retest

| Frequency [Hz] | Left                                | Right                               |
|----------------|-------------------------------------|-------------------------------------|
| 250            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| 500            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| 1k             | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 2k             | <input type="checkbox"/>            | <input type="checkbox"/>            |
| 3k             | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| 4k             | <input type="checkbox"/>            | <input type="checkbox"/>            |
| 6k             | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 8k             | <input type="checkbox"/>            | <input type="checkbox"/>            |

# SUN

Novel self-controlled speech test designed for screening for hearing disability using a set of **intervocalic consonants (VCVs)**.

Designed such that it is **self-convincing, fast, and of low cognitive load**

Intended use is to **assess speech understanding in noise**.

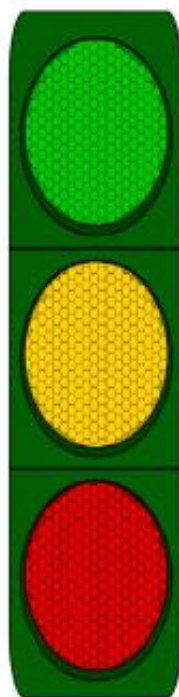
Specifically designed for the **early detection of age-related hearing loss**. Can also be used as a self-controlled speech test for school children.

Several languages available: English, French, Italian, Hindi,...

# SUN (Speech understanding in Noise, for children > 6 years to adults)

The test gives a tri-modal outcome:

- hearing ability within normal range
- hearing ability might be below the normal range
- hearing ability might be well below the normal range



**GREEN**



No listening difficulties

**YELLOW**



A hearing check would be advisable

**RED**



A hearing check is recommended



# Sentiero...Advanced

The all in one instrument for  
OAE, ABR and Audiometry!



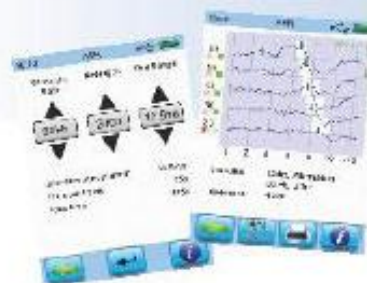
**With TEOAE, DPOAE and AEP!**

## Sentiero Advanced

For the first time a handheld device combines  
**Tone & Speech Audiometry, TEOAE, DPOAE & AEP/ABR**  
in a lightweight handheld device.

The emphasis is on test flexibility, ease of use, reliable  
diagnostics and minimum test time.

The new **diagnostic ABR** is typically used for  
NHS conformational diagnostics, neurological diagnostics  
and objective threshold assessment.



## Sentiero...Advanced

The complete solution for your audiology clinic!

Compact & portable handheld, battery powered  
Easy to use touch screen, menu guided  
Flexibility Configurable test battery: PTA, MAIGC,  
SPEECH, TEOAE, DPOAE and AEP / ABR  
Easy interpretation  
Re-editable peak markers on device and PC  
Quality parameters  
indicating statistical significance (traffic-light)

Detailed test results & test history  
up to 1000 tests stored  
Data and Patient management Software  
MIRA (PC-based)  
Easy Interface  
USB port for data communication  
Automated detection of accessories  
correct protocol and calibration used for each test



# Thank you for your attention!



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