



Prof. Ernst Lehnhardt-Stiftung



Dr. Dr. h.c. Monika Lehnhardt

# Hearing screening on the path through life



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Lehnhardt-Foundation and  
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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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A stylized signature logo in blue and red ink, consisting of the letters 'ML'.

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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%.

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# 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

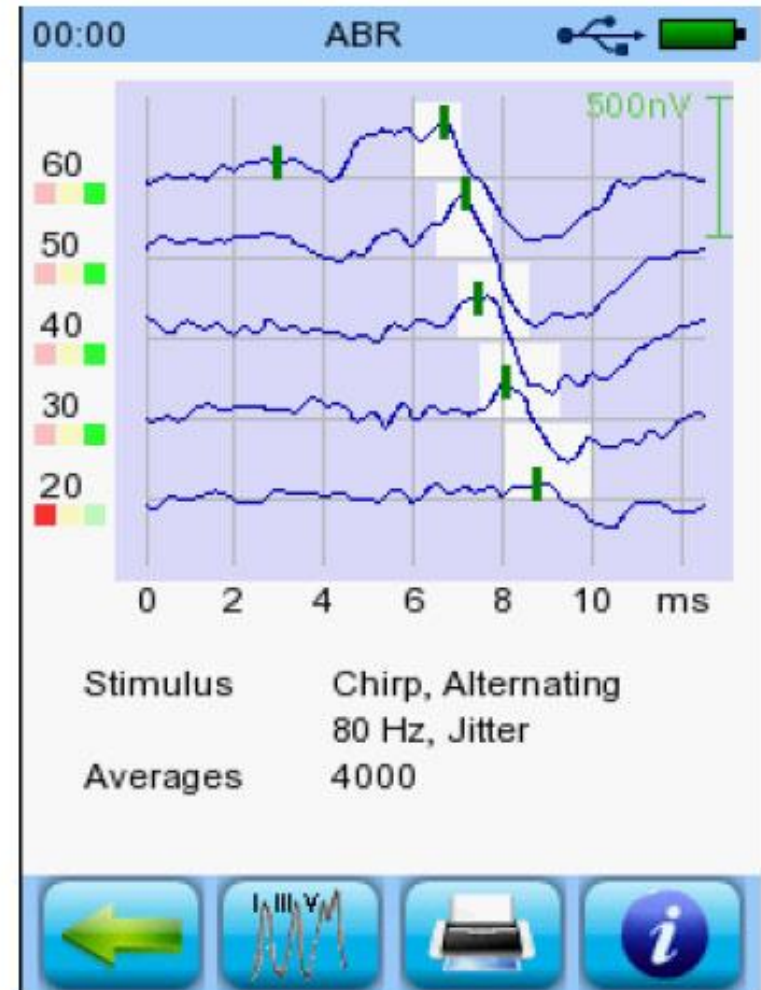
Advanced  
**Sentiero**

## **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

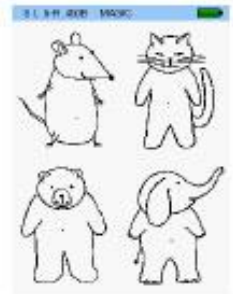


# **MAGIC \* - pure tone audiometry for children (for children > 4 years)**

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

**Different animals represent different tones.**

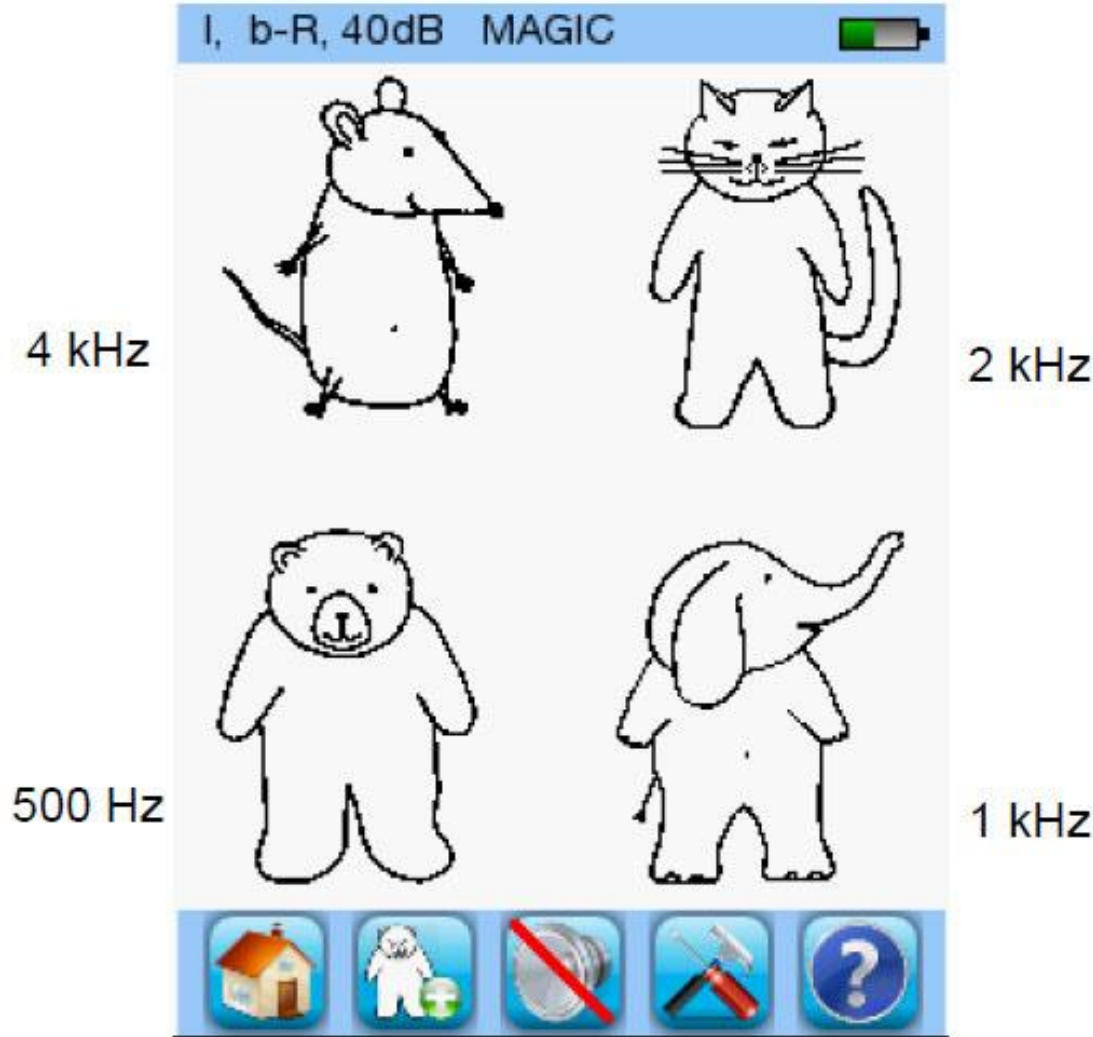
(Cow 250 Hz, bear 500 Hz, elephant 1 kHz, cat 2 kHz, sheep 3 kHz, mouse 4 kHz, bird 6 kHz, dolphin 8 kHz).



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!

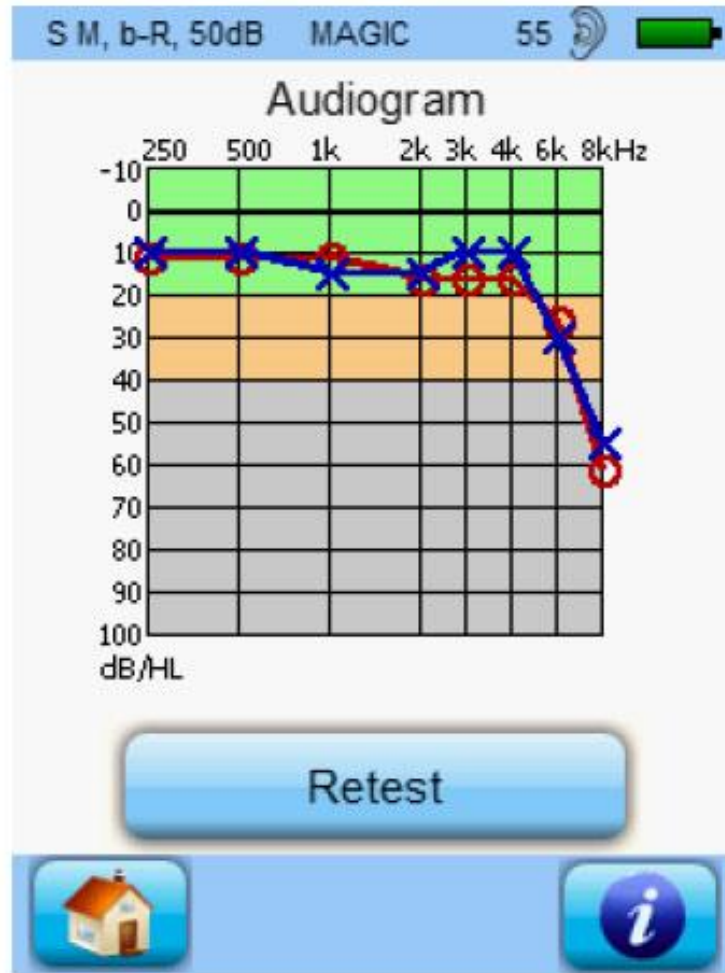
If you now **hear a  
sound:**



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.

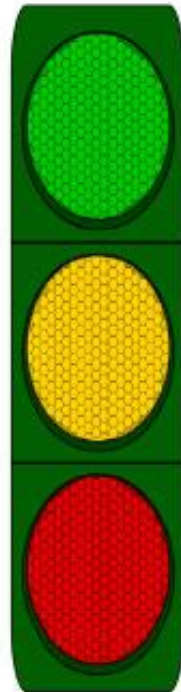
Several languages available: English, French, Italian, Hindi,...

# 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

# ...Advanced Sentiero

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

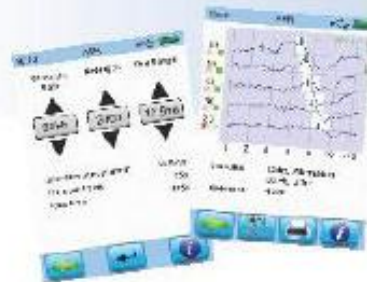


## Sentiero Advanced

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.



## ...Advanced Sentiero

The complete solution for your audiology clinic!

Compact & portable handheld, battery powered  
Easy to use touch screen, menu guided  
Flexibility Configurable test battery: PTA, MISC,  
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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