PSYCHO ACOUSTICS (VTAF01)

20180524

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WHY CONSIDER THE ACOUSTICS IN A ROOM?

Concentration
Productivity

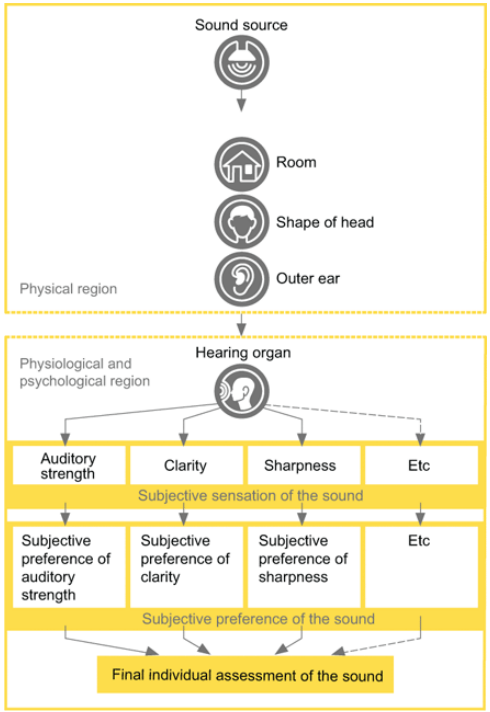
Faster recovery

Learning,
higher grades

Pleasure

Good room acoustics

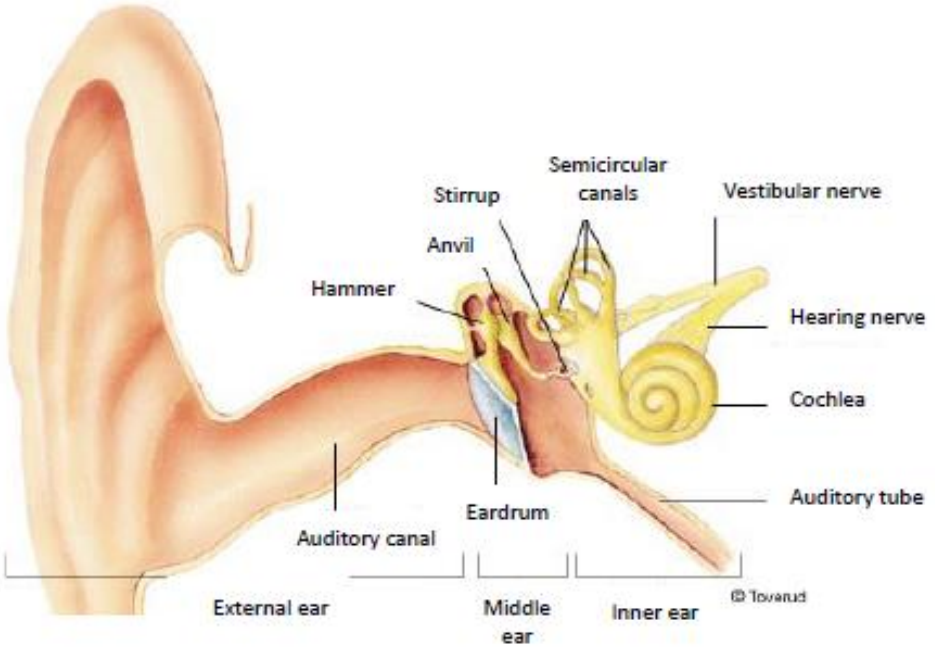
TO CONSIDER IN ACOUSTIC DESIGN



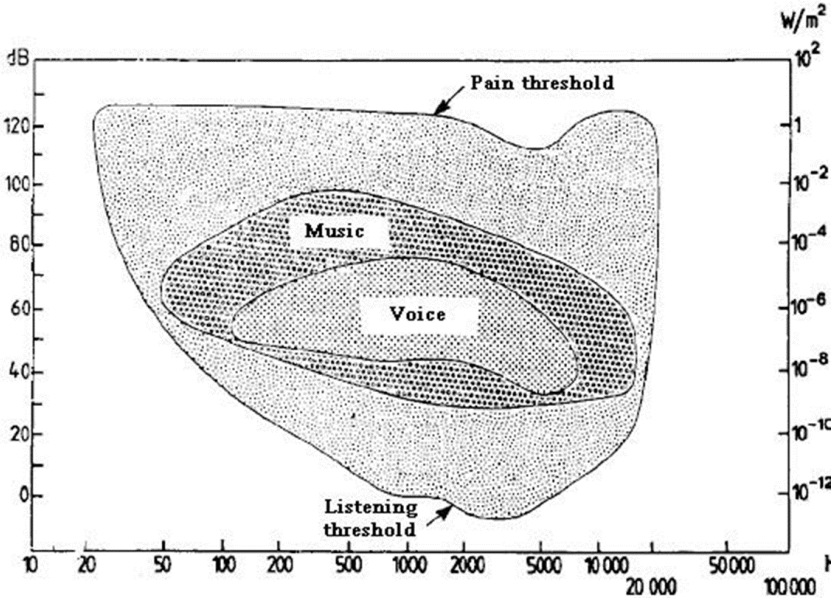
TODAY:

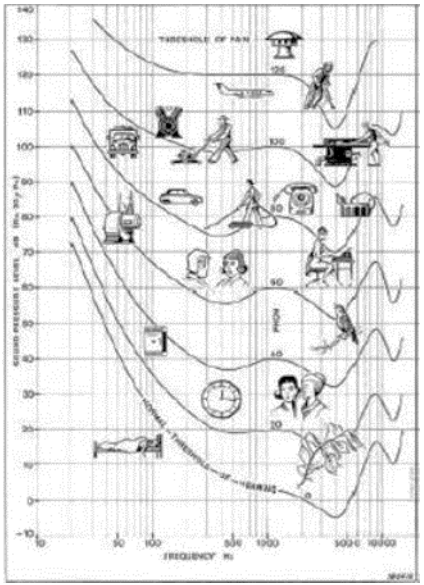
Psycho-acoustics
- psychological and physiological perception of sound

PERCEPTION OF SOUND
Auditory organs



PERCEPTION OF SOUND

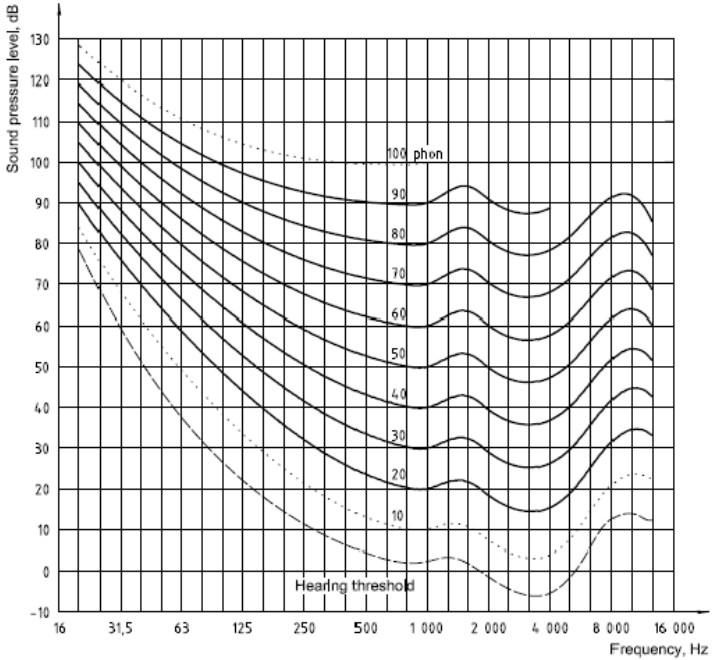




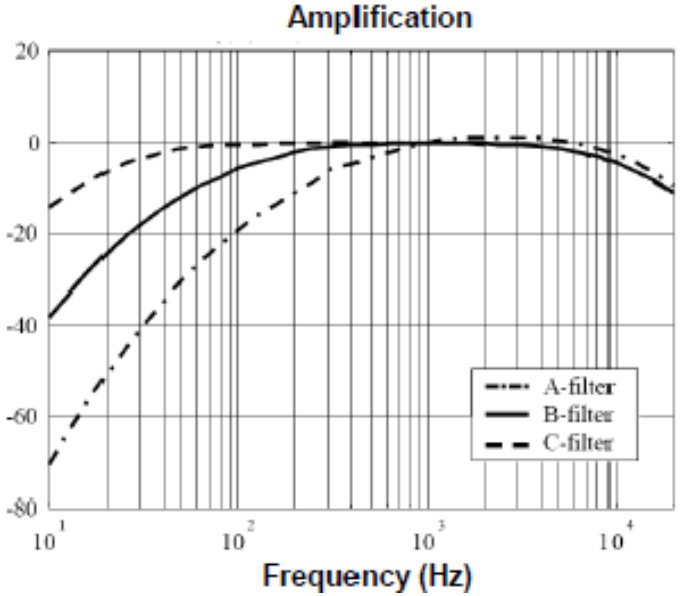
PERCEPTION OF SOUND

Loudness; the subjective impression of sound

Equal-loudness curves
- comparing subjective experience correlated to the difference in sensitivity for different frequencies



WEIGHTING AND FILTER



$$L_{Weighting} = 10\,log\left(\sum 10^{(L_n+weighting)/10}\right)$$

$$L_{eq,T} = 10\,log\left(\frac{1}{T}\int_0^T \frac{p^2}{p_{ref}^2}dt\right) = 10\log\left(\frac{1}{T}\int_0^T 10^{L_p(t)/10}\,dt\right)$$

PERCEPTION OF SOUND
NOISE

Sound we experience as disturbing – subjective!
- Specific source can not be defined but typically when unexpected

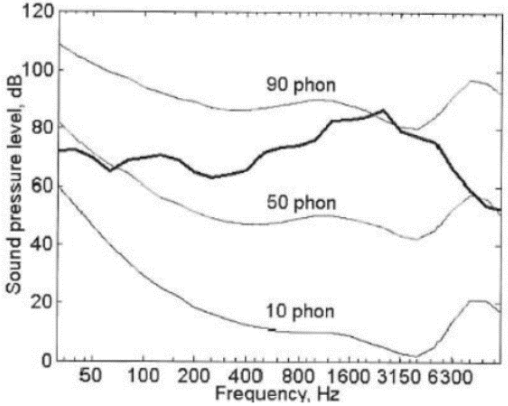
- Personality and sensitivity
- Task and activity
- Environment
- Expectations

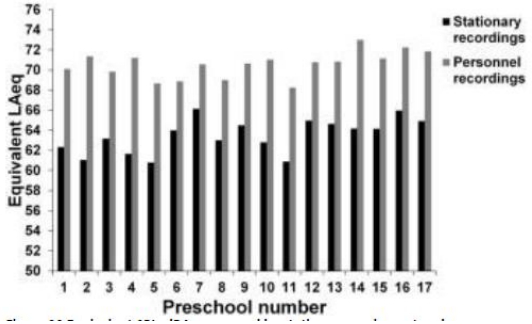
PERCEPTION OF SOUND
Noise effects on people

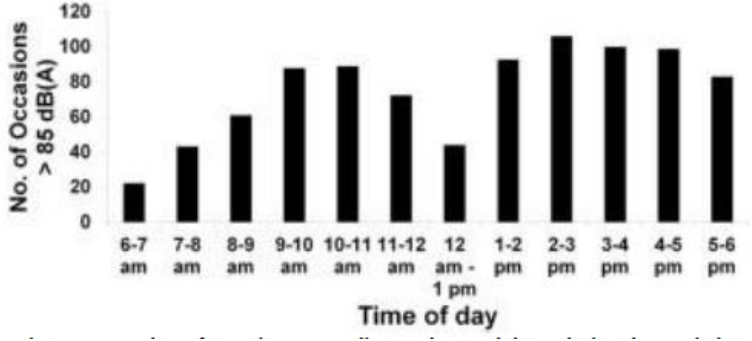
- Cardiological
  - Increased blood pressure
  - Increased heartrate
- Hearing impairments
  - Hearing losses
  - Hyperacusis
  - Deplacusis
  - Tinnitus
  - Audio fatigue
- Voice problems
  - Phonation
  - Voice quality and endurance
  - Voice endurance
- Well being
  - Energy losses
  - Stress
  - Concentration, observe correct information and perform tasks
  - Sleeping disturbance
  - Social interaction

PRESCHOOL

- Most noisy environment
- Children exposed to higher levels
- Children's auditory system more sensitive
- Several activities ongoing – several different sound sources
- Learning speech, communication and socialize





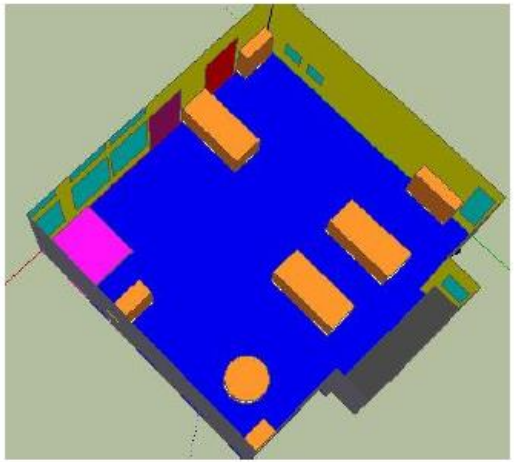


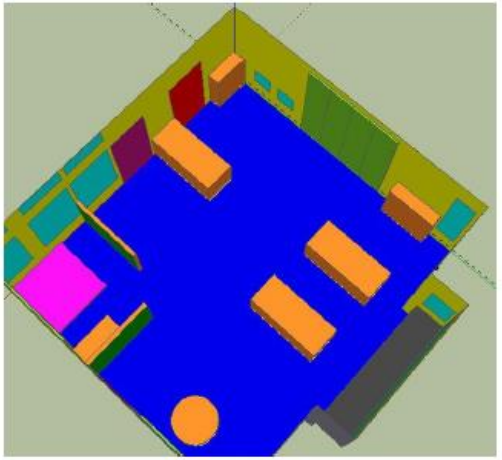
ACTIVITY BASED ACOUSTIC DESIGN – A METHOD TO APPROACH ROOM ACOUSTIC DESIGN

SOUND ENVIRONMENT IN A PRESCHOOL

- Good speech conditions
- Absorption
- Room contribution to the sound level

SOUND ENVIRONMENT IN A PRESCHOOL





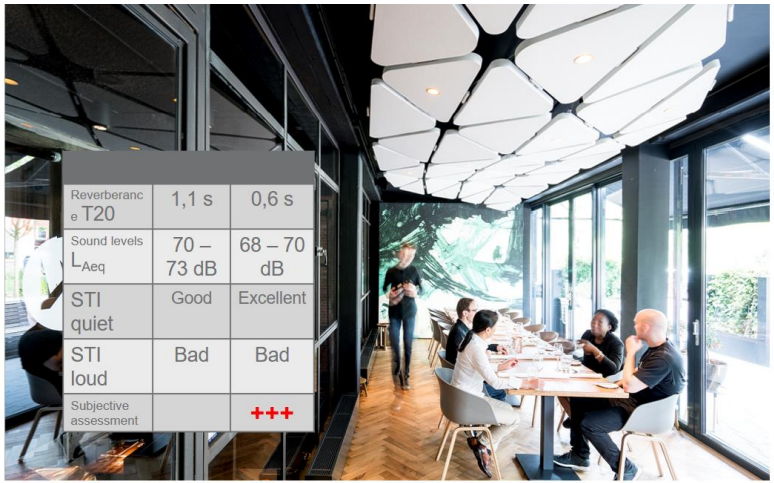
Acoustic treatment

- Screens to make rooms in the room
- Wall panels

Improvements

- Decreased sound pressure level
- Increased speech clarity
- Decreased sound strength

EXAMPLES
Restaurang Zarzo, Enidhoven



Reverberance T20	1,1 s	0,6 s
Sound levels L_{Aeq}	70 – 73 dB	68 – 70 dB
STI quiet	Good	Excellent
STI loud	Bad	Bad
Subjective assessment		+++

Ecophon SAINT-GOBAIN
A SOUND EFFECT ON PEOPLE

IF YOU WANT TO READ MORE

Noise, health and learning

- Hygge, S., 2007. *Lyssnande Lund, Rapport 5, Ljud och inlärning.* Lund: Lund University, 2007.
- Persson Waye, K., 2009. *Sound, mind and emotion.* Lund: Lund UniversitySjödin
- Sjödin, F., 2012. *Noise in the preschool Health and preventive measures,* Umeå: Umeå University, 2012.

Room acoustics

- Campell, C., Nilsson, E., Svensson, C. The same reverberation time in two identical rooms does not necessarily mean the same levels of speech clarity and sound levels when we look at impact of different ceiling and wall absorbers.
- Nilsson, E., Svensson, C., Room Acoustic Evaluation of different room types. BNAM, Reykjavik. (2008)
- Bradley, J.S., Sato, H., Picard, M., On the importance of early reflections for speech in rooms. J. Acoust. Soc. Am. 113 (6), 3233-3244 (2003)

CEILINGS

THANK YOU FOR YOUR ATTENTION

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