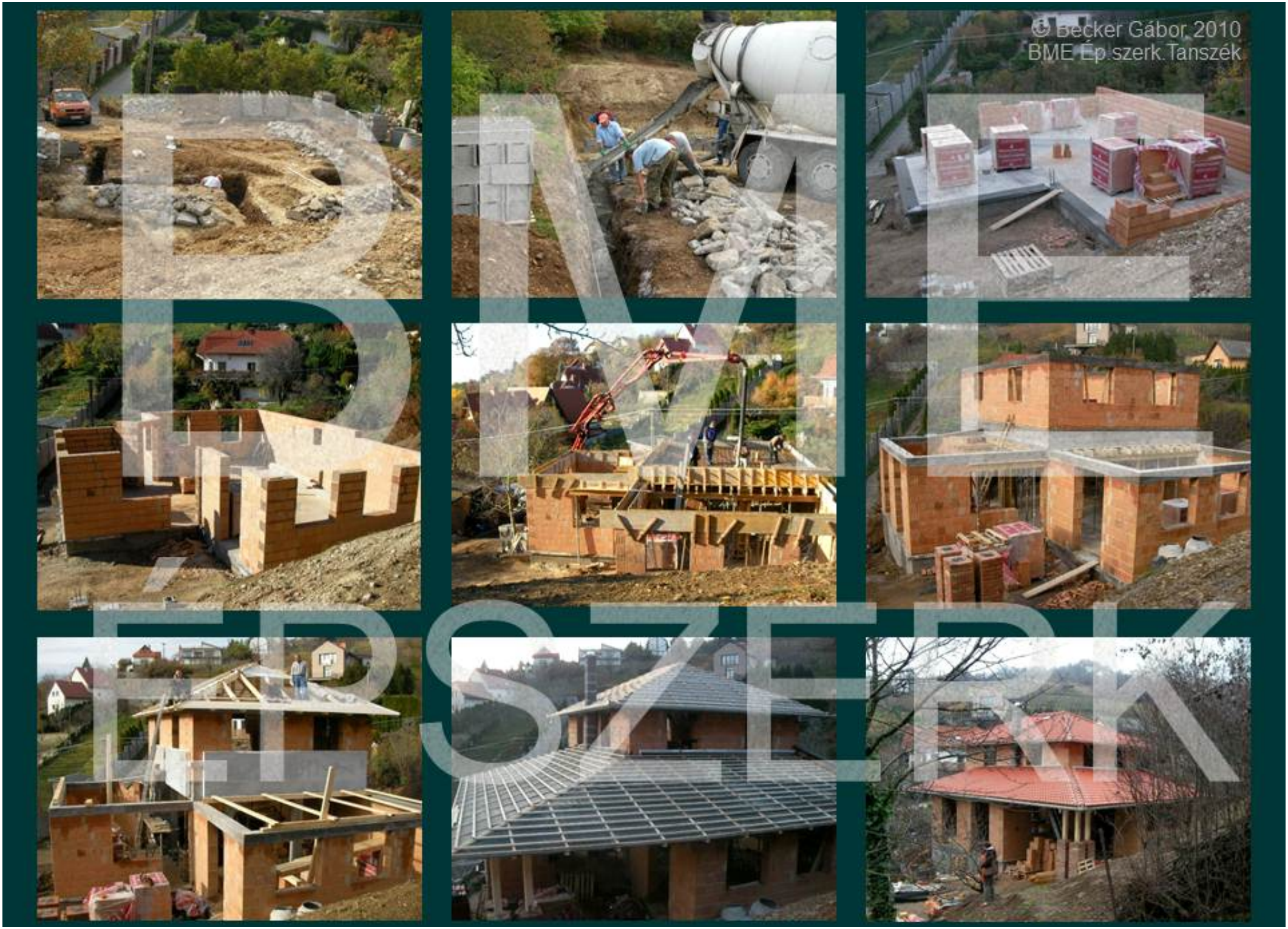
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Dr. Becker Gábor

Introduction to Building Constructions

Comfort and General Building Requirements

www.epszerk.bme.hu

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we create an artificial environment

what do we want? eg. a family home: the function is primary

to feel fine both from a pschychological and physical standpoint

realization is architecture

architecure = scientific + artistic creation
civilization + culture

building constructions:
part of the scientific + artistic task

scientific (technical): a lasting assurance of the desired physical environment

artistic: detailing, visible structures and materials

the dual nature of Architecture

comfort and general building construction requirements

a lasting assurance of the desired physical environment:

comfort requirements

- „objective" –measureable – requirements:
  - temperature (air, radiation – sun, cold wall etc.)
  - air state (composition, humidity, air motion etc.)
  - noise (internal-external, vibrations)
  - lighting (general, work area, glare problem etc.)
  - other measurables (radiation, electrosmog, chemicals etc.)
- „subjective" –immesurable requirements or those difficult to measure:
  - beauty, frienly nature, comfortable, homey etc.
  - aesthetic appearance
  - ergonomical disposition
  - psychologically positive effects

comfort requirements

- changes in time, space and culture
- minimal survival requirements
- needs accepted by the society change in space, time, and according to the social environment

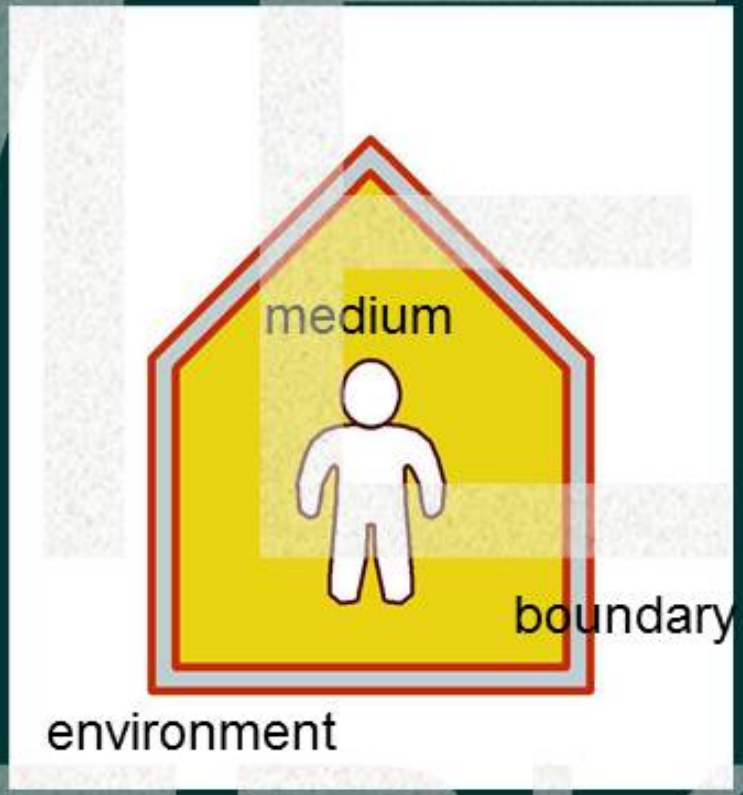
self control: compare to the simple tent - what is wrong with it?

scientifically

the micro environment system is

medium = the internal space of the building

boundary = the building's constructions

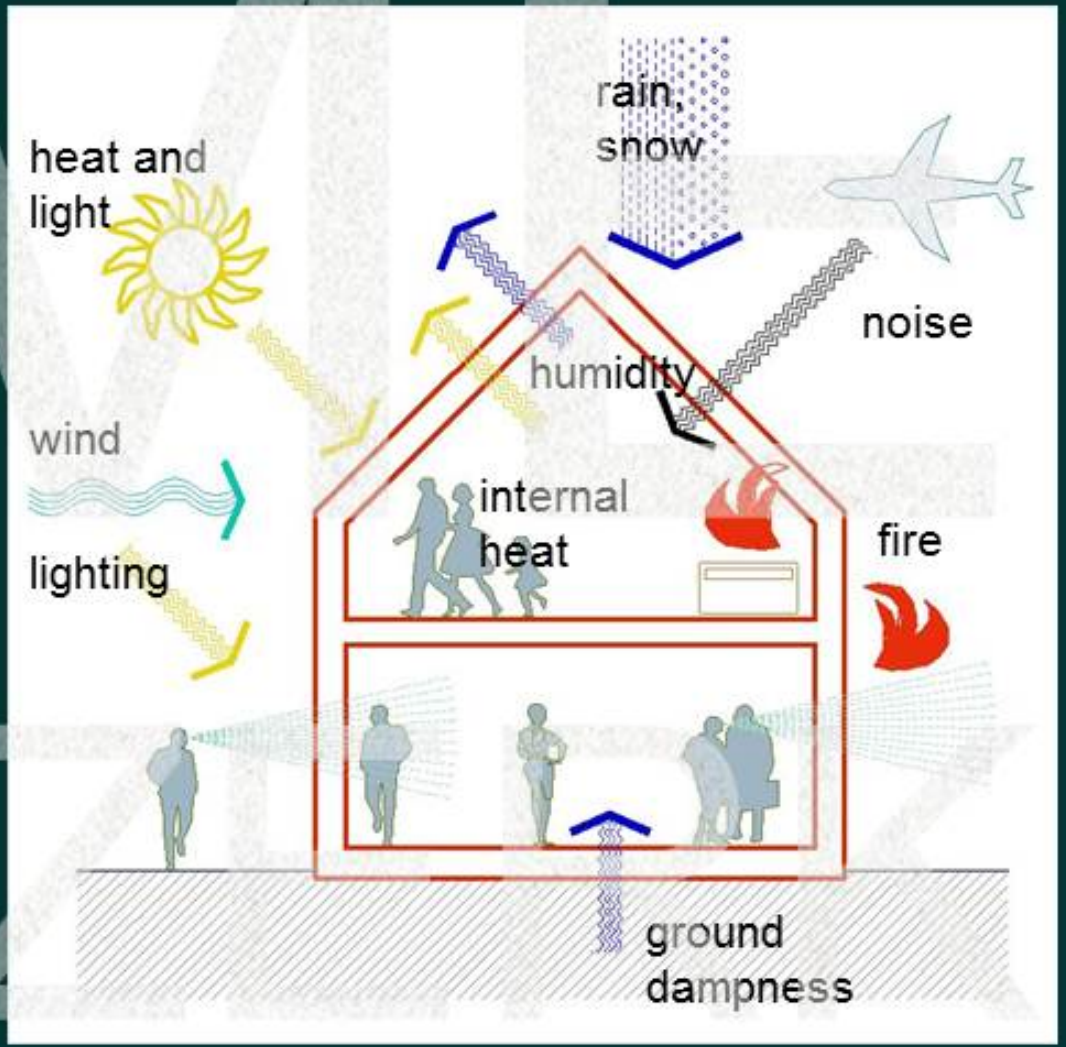


the process of structural design

effect → result → requirement → strucure ← performance

effects on the buildign

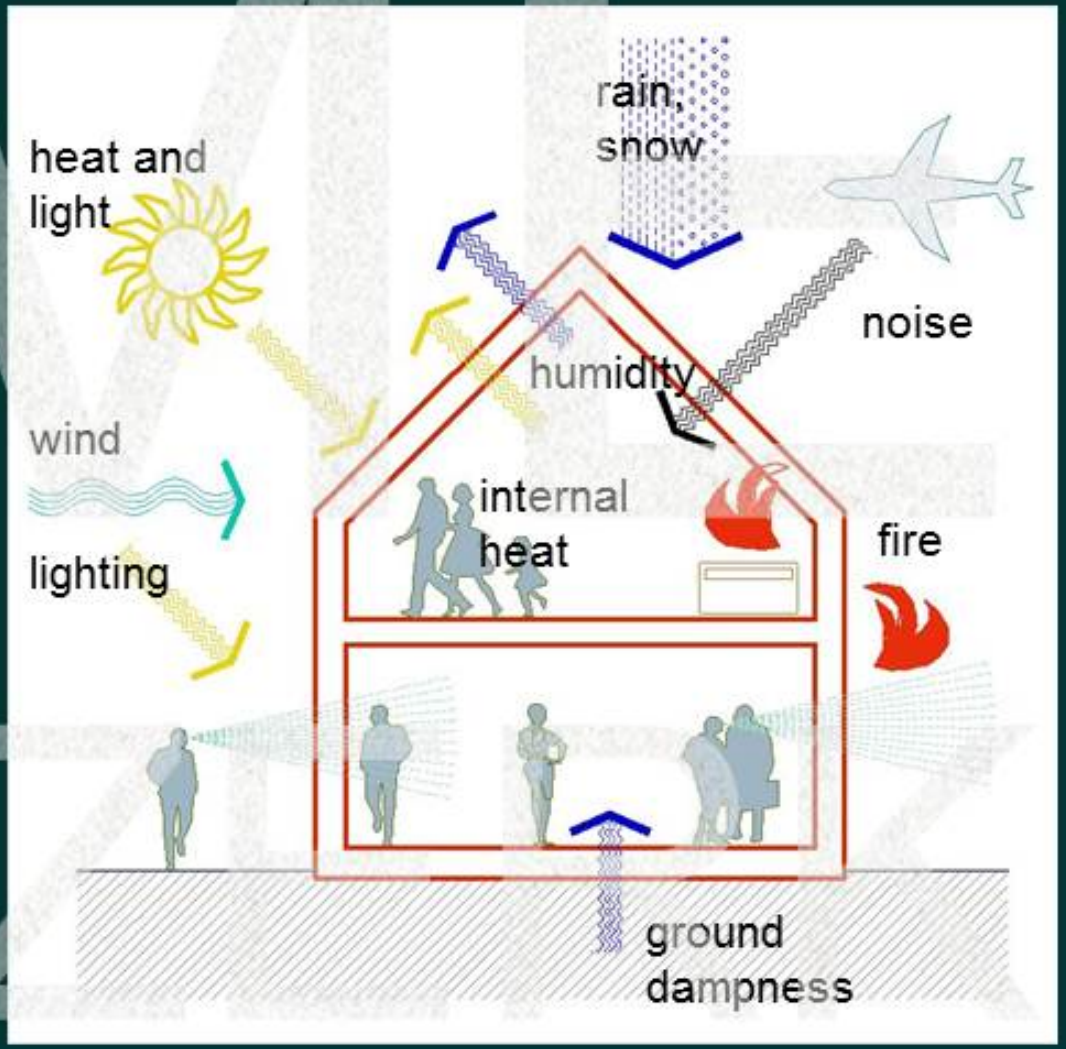
- the appropriate construction of the structures is only possible when all effects are known and considered



requirements on buildings in general

General regulation on building constructions (OTÉK)– BUILDING CODE

- stability
- fire safety
- hygienics, health and environment protection
- security, safety during use
- noise and vibration protection
- energy consumption level: conservation, protection against overheating



stability → statics, rigidity, load bearing structural elements

stability

comfort and general building construction requirements

fire safety

- passive protection:

the adequate (life protecting: minimal escape and rescue requirements) construction of all building components

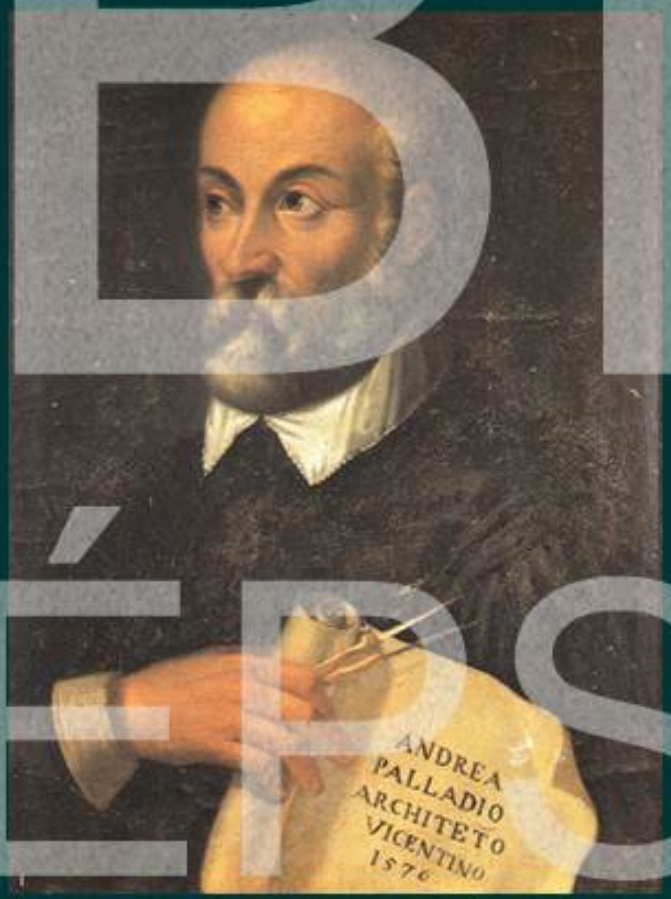
- floor plan, escape roots,
- fire zones
- the fire resistance of building components

- active protection

automatic fire signal systems
built-in fire extinguishing systems

hygienics, life and environment protection

Andrea Palladio (1508-1580): Four books on Architecture, second book



„One must not build in valleys enclosed by mountains: other than these buildings are hidden from view, they are invisible to the far away viewer, they also lack dignity and majesty, they are the absolute opposite of healthy disposition. Since the rainwater that collects here soak the soil which in turn evaporates vapours unjust to both mind and body, weakening the soul, the joints and nerves deteorate and also cause excessive damage in grain stores... Winds if they enter these valleys, as if entering a narrow channel, become horrific hurrucanes and if they do not enter, the air stays and becomes thick, dense and unhealthy."

hygienics, life and environment protection

must not endanger:

- poisonous gases, air pollution, other dangerous materials in the air the evaporation of such materials,
- soiled water, soil, solid and liquid waste; unwanted humidity
- dangerous radiation, electrostatical charging,
- chemical and corrosive effects,
- biological damages inhibition, overpopulation,
- unwanted noise and vibrations.

must be secured:

- ventilation, heating, natural lighting,
- protection of the spaces against dampness and condensation
- general use and drinking water,
- the secure handling of sewage and exhaust gases, waste disposal
- an adequate level of grounding and lightning protection
- an appropriate accomodation of cleaning and upkeep needs
- the individual, independent and undisturbed use of functional units

life protection, safety during use

must prevent

- slippage, falling (eg. during moving through the building),
- tripping, side-stepping (eg. due to ineffective lighting),
- falling (eg. unexpected change in height, no bars, parapet walls)
- head injury (eg. inadequate internal head space),
- collision (eg. due to inadequate lighting or reflections),
- electric shock
- explosions
- getting stuck or jammed (eg. spaces or openings that are too small).

ÉPSZERK

life protection, safety during use

comfort and general building construction requirements

protection against noise and vibrations

the subjective nature of sound: humans experience sound, but there is a dual nature of the experience

noise: sound experience that is found disturbing by humans

sound

a wave that propagates very much like waves in water

properties:

- frequency (Hz): vibrations per second

  hearing range: 16 - 16.000 (20.000) Hz

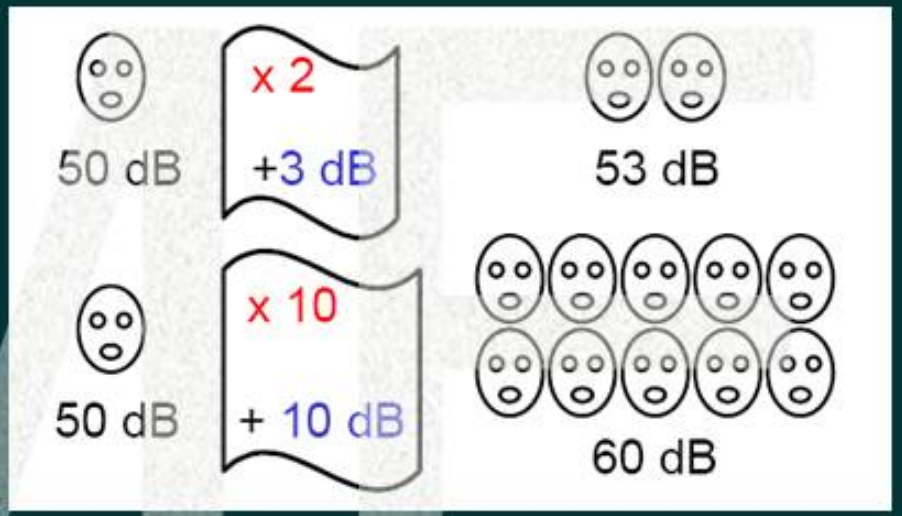
- sound pressure (p): periodic changes in the athmospheric air pressure

  0,000002 Pa hearing threshold
  20 Pa pain threshold

logarithmic scale:

hearing	0 dB
pain	140 dB
quiate forest	20 dB
library	40 dB
medium traffic road	90 dB
take off noise of a jet	120 dB

1 dB + 1 dB = not 2 dB!



if noise is reduced by:

- 1 dB – not noticed
- 3 dB - noticable
- 5 dB - considerable
- 10 dB – we feel that the noise is halved

dispersion speed in:		
	vacuum	0 m/s
	air	340 m/s
	water	1.430 m/s
	ice	1.400 m/s
	concrete	5.000 m/s
	corkwood	500 m/s
	rubber	40 m/s

noise level effects in buildings

residential: resting is disturbed
workspace: learing, communication and work are disturbed, performance is reduced and the problem solving capacity is hindered

at a noisy work area the chances of an accident is higher, people make more mistakes in a noisy environment

in the vicinity of high power machinery workers will experience temporary or long lasting hearing damage

the result of noise loads

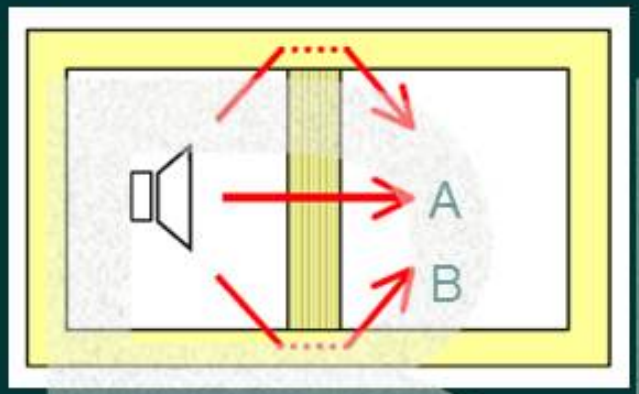
comfort and general building construction requirements – noise, vibrations




noise effects → requirements

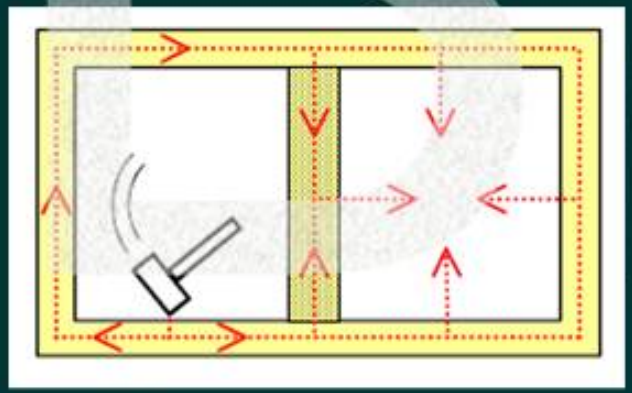
acoustic tasks of the architect – main areas of noise reduction:

- residential: the assurance of conditions needed for undisturbed resting and recreation
- public function: spaces must be designed so that the particular function should be performed without noise disturbance (library, conference, movie theater, theater, concert hall etc.) and effective communication is allowed
- industrial environment hearing damages must be prevented
- in the environment protected natural area and designated recreational spaces (including buildings) must be noise protected

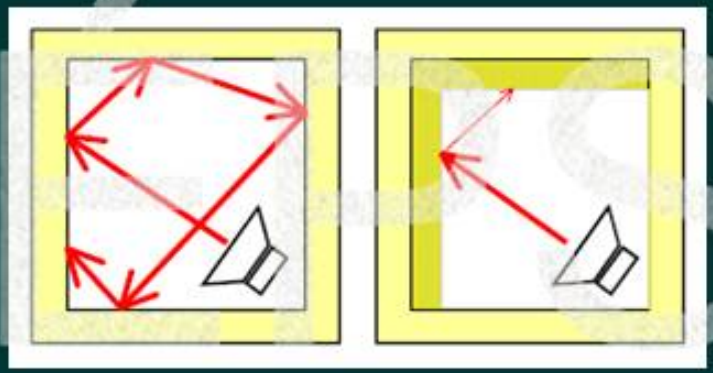


A: direct structural sound transmission
B: indirect sound transmission through connecting structures

airborne noise insulation



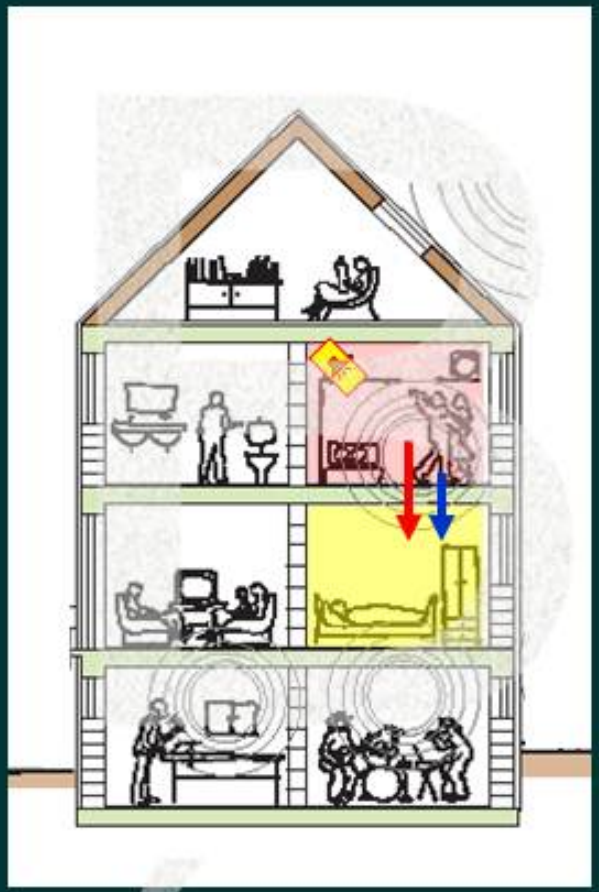
structure borne noise (knocking) insulation



sound absorbtion (echo prevention)

effects and requiremetns – noise insulation

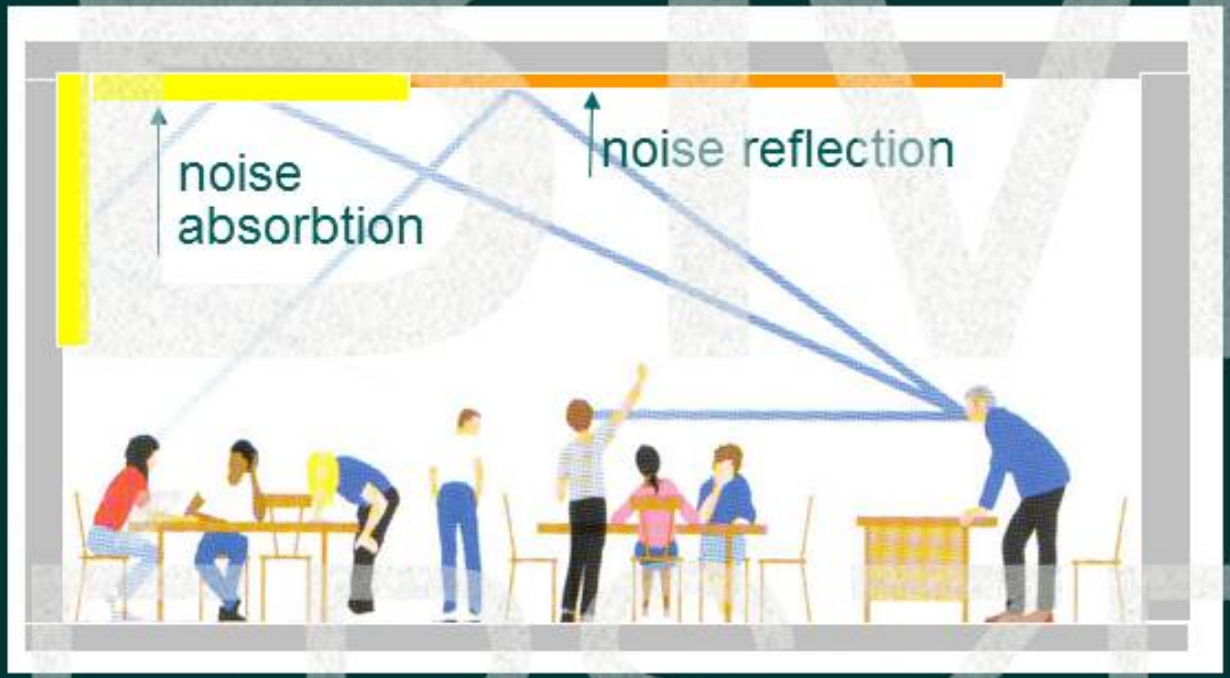
comfort and general building construction requirements – noise, vibrations



effect		
„party” in the flat	home theater in the flat	tubing, machinery
requirement		
slab airborne noise insulation transmitted noise insulation	wall airborne noise insulation	tubing must be installed with separation and insulation (selected machinery)

acoustic tasks in the design process

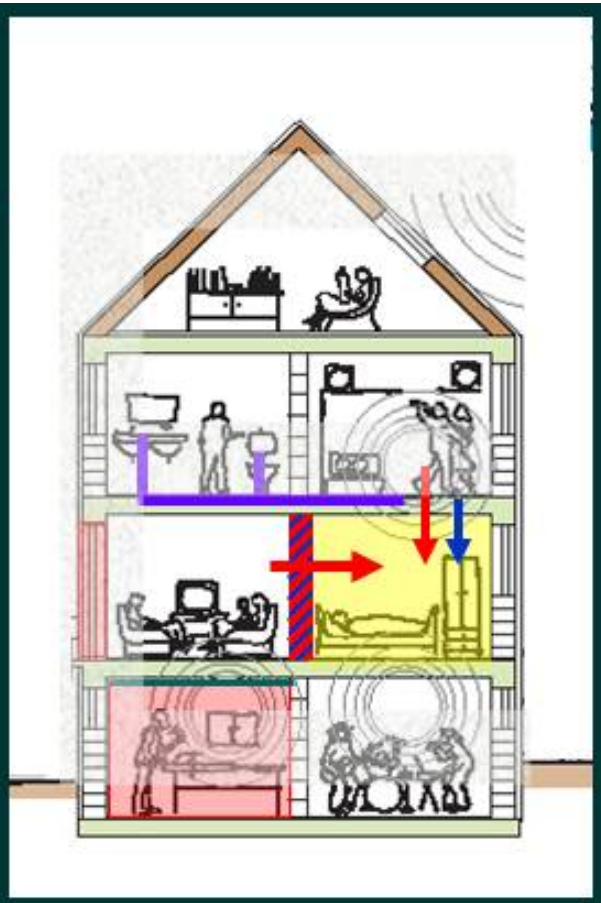
comfort and general building construction requirements – noise, vibrations



sound energy diffusion improvement in the classroom

acoustic tasks in the design process

comfort and general building construction requirements – noise, vibrations



effect: noise sources outside and inside the building
eg. neighbours in the aparment house

requirement: sound insulation and level

tasks:

- facade acqoustic scaling: windows, walls, ventilation elements etc.
- internal structure acqoustic scaling: walls, slabs, doors, stairs etc.
- internal room acqoustic scaling: education, corridor, meeting rooom, lecture hall, theater, studio: walls, slabs, surface coverings
- buidling machinery installation noise reduction

decisions and the responsibility of the architect:
structural selections will define the value of the building

acoustic tasks in the design process - summary

comfort and general building construction requirements – noise, vibrations

- we create an artificial environment – the dual nature architecture
  architecture = (technical) scientific + artistic creation
- assurng an appropriate micro-environment: comfort requirements
- the micro-environment system: humans – internal space – separation
- effects on the building
- the general requirements of buildings
  - stability – fire safety - hygienics, protection of life and health, environment protection, protection against noise and vibrations, safety of use, energy efficiency and protection against overheating
- protection against noise and vibrations
  - the nature of sound
  - the effects of noise loads in buildings
  - the acoustic tasks of the architect