Austrian wood designer buildings

Current research topics in the field of wood construction and interior

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Introduction

- Wood in the built environment in Austria
- Fire Safety
- Building Acoustics
- Indoor Air Quality
- Human Impression

Wood in the built environment in Austria

- Study by BOKU and pro:Holz
  - From 1998 to 2013 (within 15 years) the portion of wood constructions (with >50% wood in the load bearing construction) increased:
    - From 25% towards 43% (related to number of buildings)
    - From 14% towards 22% (related to volume)
  - In 2013 the share of wood constructions was divided in:
    - 79% residential housing
    - 12% agricultural buildings
    - 6% industrial buildings
    - 3% public buildings
- Conclusion: Good but limited market growth due to several restrictions.

Wood in the built environment in Austria

- Restrictions for further market growth:
  - Nine federal building regulations (past)
  - Harmonization of one directive (currently in progress)
  - Increasing number of building standards
  - Voluntary regulations and certifications
  - Additional building site related tender

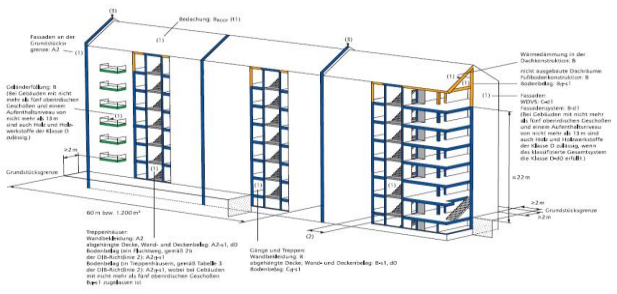
  But also
  - Missing technical solutions
  - Low knowledge of decision makers about material behaviour
  - Green-washing of “non-natural” products
  - Stronger lobbying for other building materials
  - Variable meanings and interests among experts

Fire Safety – background

- Directives of the Austrian Institute of Construction Engineering (www.oib.or.at)
  - Based on the 6 essential requirements of the Construction Products Directive (CPD)
  - Basis for the harmonisation of the 9 Austrian building codes
  - Enacted in 8 regions
  - Latest Version 03/2015 changes for timber constructions
    - Building class 5 (≤ 6 storeys) REI 90 (without A2)
    - Wooden facades
    - Sizes of fire compartments for residential buildings
  - Implementation in local regions is questionable

Fire Safety – regulations

- general requirements building class 4: left
- regulation (building class 5, ≤ 6 storeys): middle
  - OIB 2: Basic requirements REI 90
- regulation (building class 5, 7 storeys): right
  - OIB 2: Basic requirements REI 90 & A2



Contact: Martin Teibinger

Fire Safety – challenges

- Trends
  - More architectural design
  - X-lam in combination with timber frame
  - More hybrid constructions (timber, steel, concrete)
  - Prefabrication of wood-concrete composite floors
  - Wooden buildings in larger cities (e.g. Vienna)
  - Higher buildings (e.g. HoHo)
- But also
  - Low prices for social residential buildings
  - Discussions with fire brigades
  - Assure quality control

Contact: Martin Teibinger

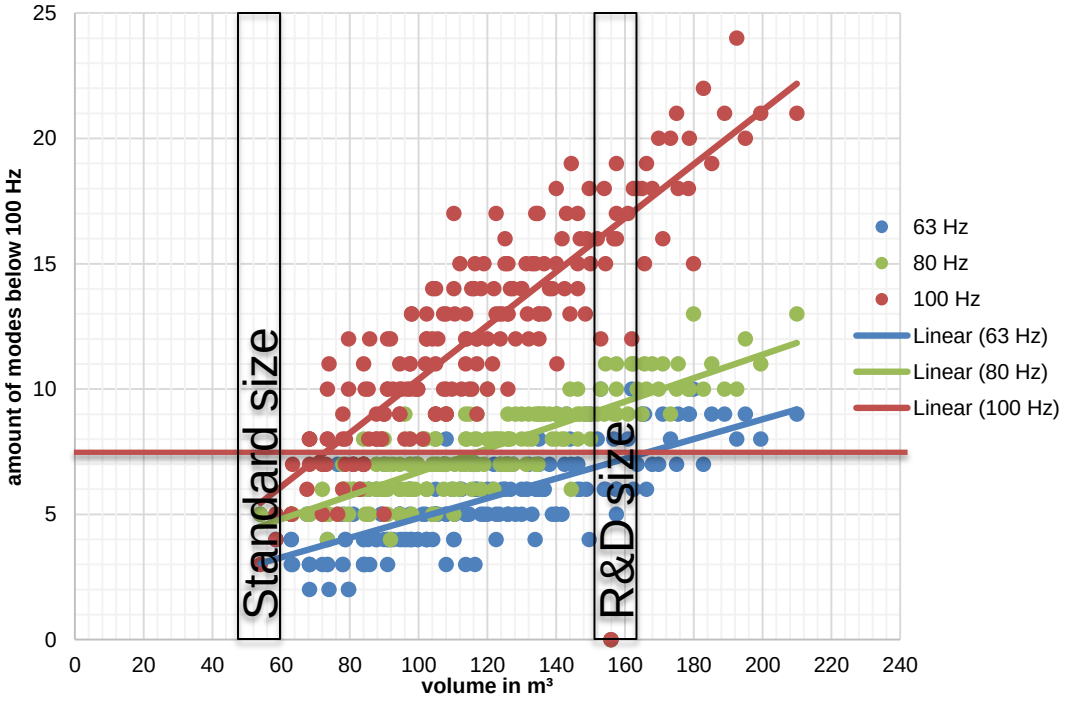
Building Acoustics - background

- Crucial parameter concerning timber application in multi-storey buildings
  - Light constructions (e.g. made of timber) show worse sound insulation compared to heavy ones (e.g. concrete) for low sound frequencies
- Engineering solutions are required for timber constructions
- Standard test facility show low repeatability in the low frequency range due to limited size
  - A novel XL-test facility was created based on FE-modelling
  - Modelling was compared with an existing standard test facility showing excellent fit

contact: Franz Dolezal

Building Acoustics – R&D

- Development of perfect test room size
- Number of modes must be optimized
- Challenge: Maximum test facility size vs. handling of test facility
- In order to measure frequencies below 100Hz adequate, ideal sending and receiving rooms must have at least a volume of appr. 150m³



Akustik Center Austria

- Facilities: transmission suites for building acoustic measurements in different sizes:
  - standard size (50 - 60 m³)
  - R&D size (137 - 153 m³)

- Applications:
  - impact sound insulation
  - airborne sound insulation
    - windows, doors, facades, walls and floors
  - improvement of impact sound insulation due to floor coverings
  - measurements in the extended frequency range
  - flanking transmission
  - free field measurements at facades

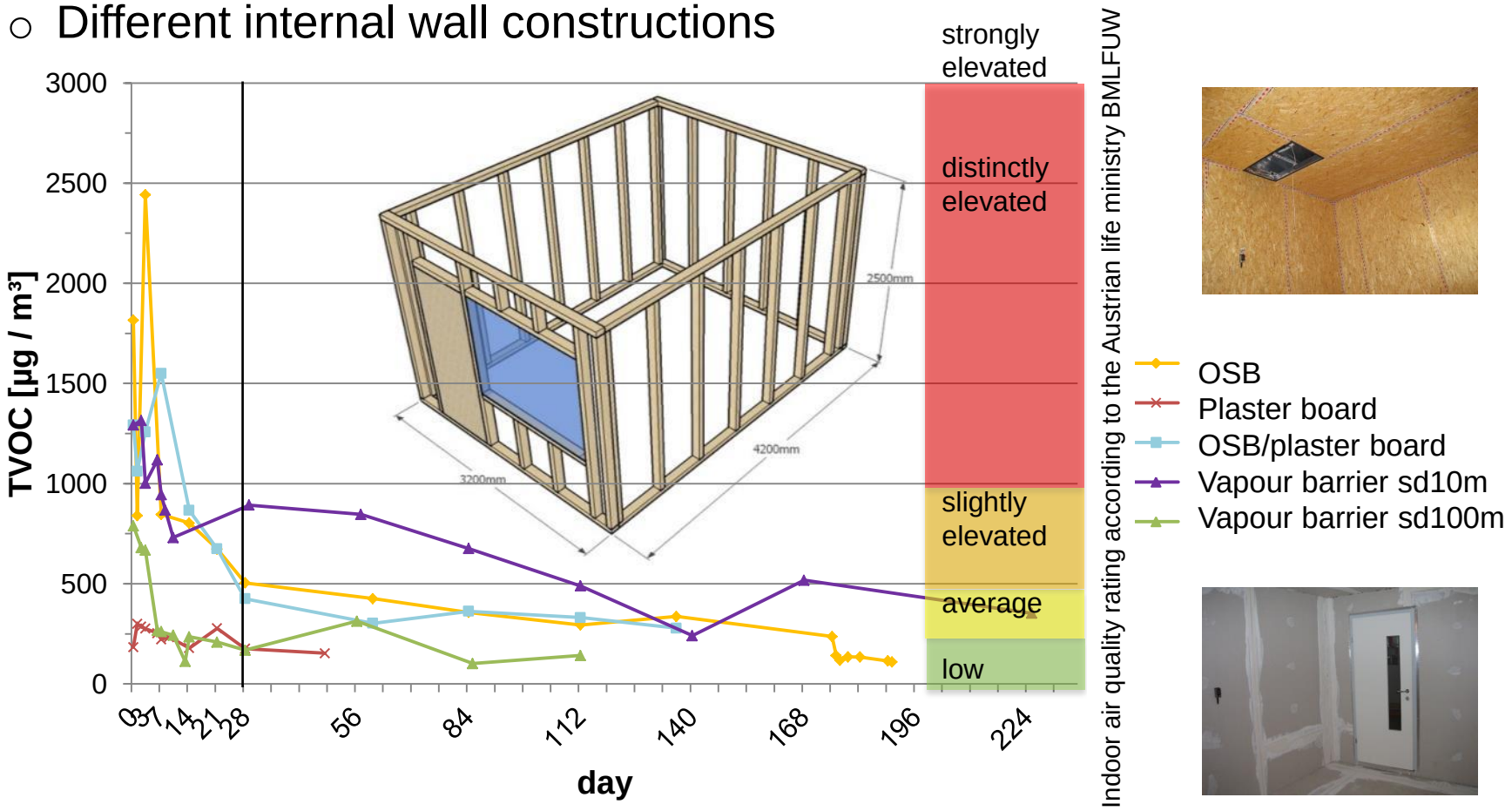
contact: Franz Dolezal

Indoor Air Quality - background

- Focus on Formaldehyde and volatile organic compounds (VOC)
- Product testing reflects emissions on day 28
- Natural products usually show further decline after day 28
- Loading of built objects (e.g. m^2/m^3) with emitting products is usually unknown
- Loading could also be accessed as “density” (e.g. kg/m^3)
- Different sources contribute to indoor air quality
  - Construction, interior, human activities, outdoor air quality, air exchange rate,…
- How to guaranty a certain Indoor Air Quality?

Indoor Air Quality – VOC

- 30m³ model room (prEN16516:2015): long-term emission
  - Different internal wall constructions

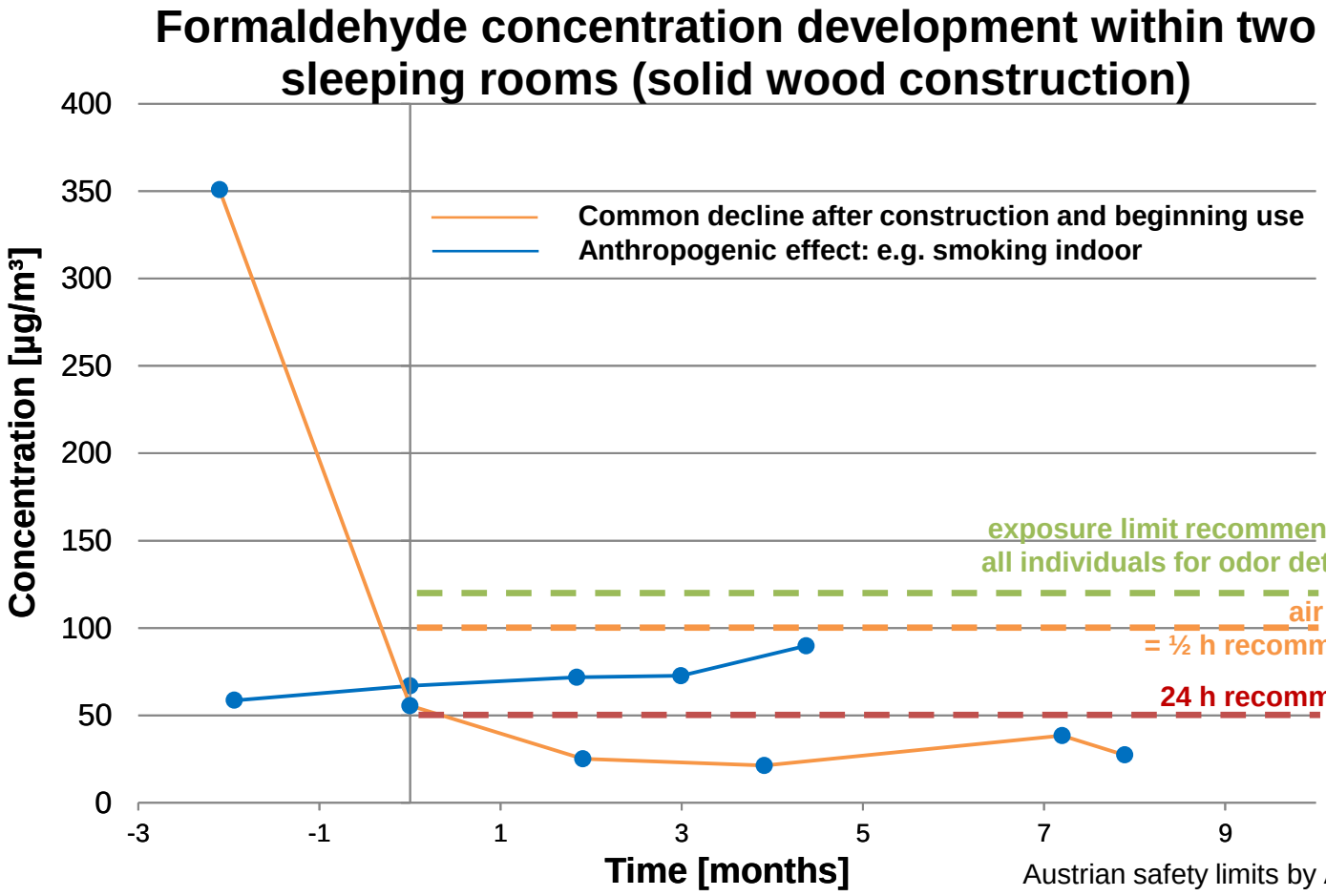


http://www.holzforschung.at/fileadmin/Content-Pool/Fotos_HFA/HFA-TiMBER/Timber_4WEB.pdf

Indoor Air Quality – Formaldehyde

- Different safety limits: e.g. 120 – 50 µg/m³

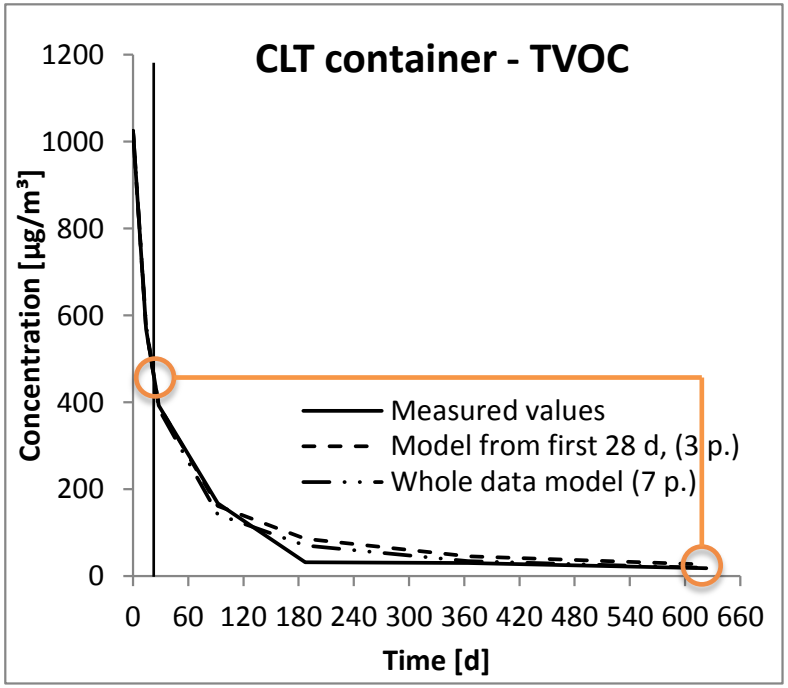
http://www.wood2new.org/

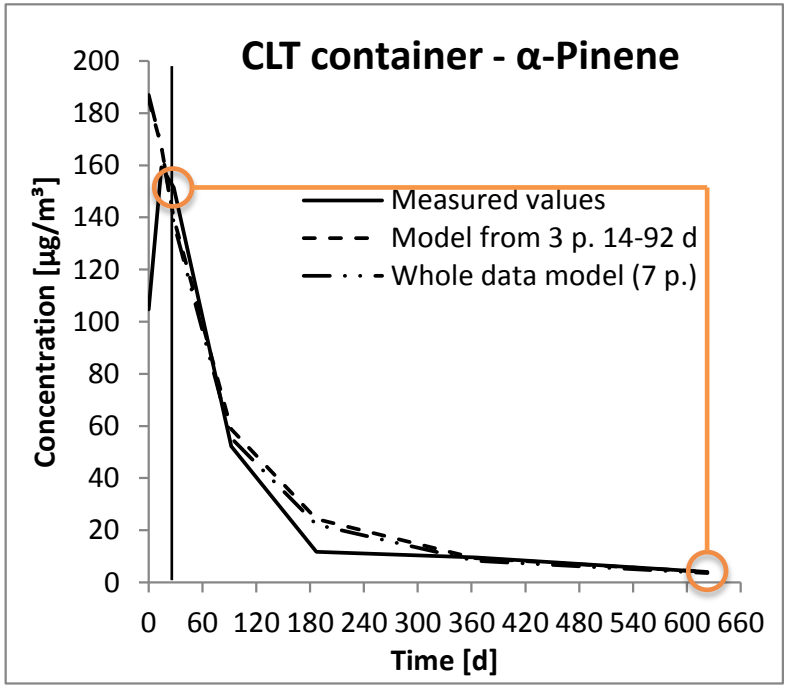


Austrian safety limits by Austrian life ministry BMLFUW

Indoor Air Quality – Modelling

- Modelling of long-term emissions following the EN 717-1 method (nonlinear regression algorithm)
  - Model seams suitable
  - Hidden safety margins up to the factor 20!

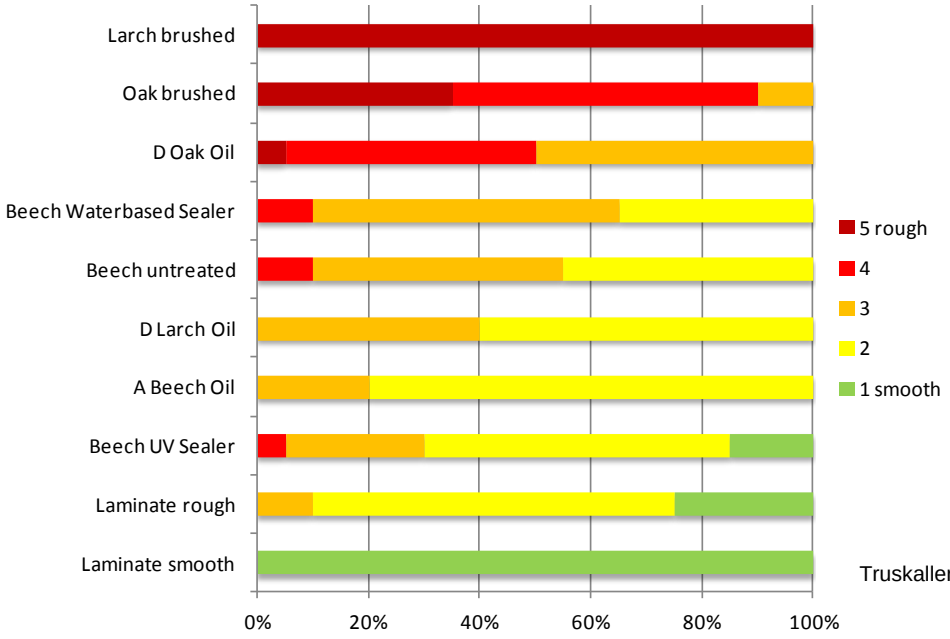


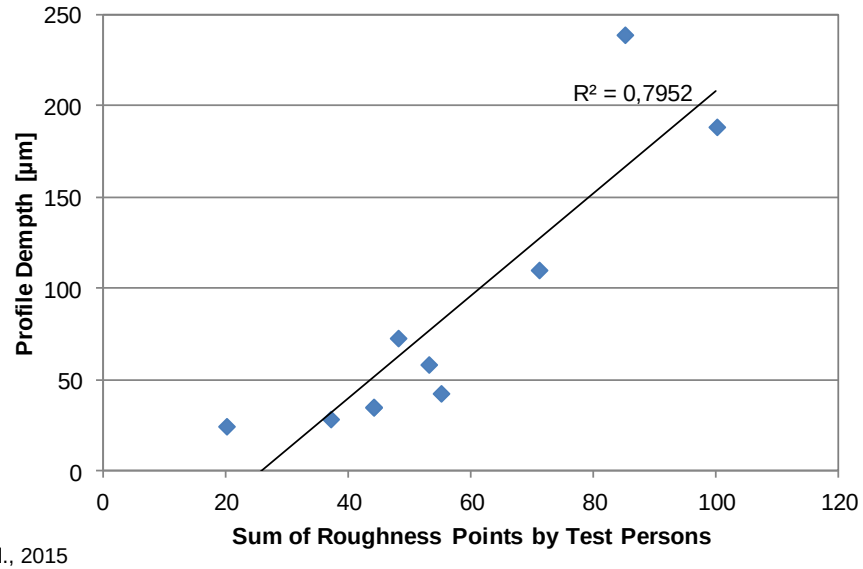


Stratev et al., 2015

Human Impression - background

- Visual, haptic, and general sensory impression lead to subjective grading of products
  → relation to surface properties
  - Example: roughness sensation vs. measurement





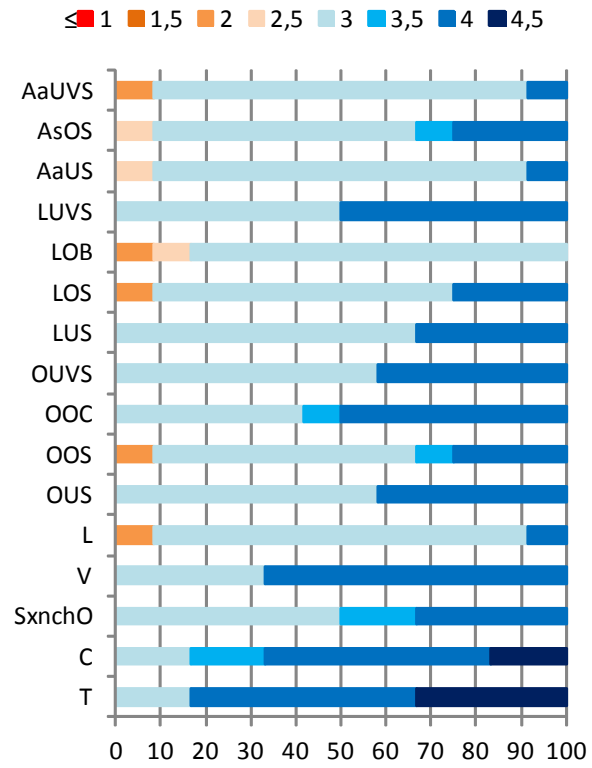
Truskaller et al., 2015

Human Impression - results

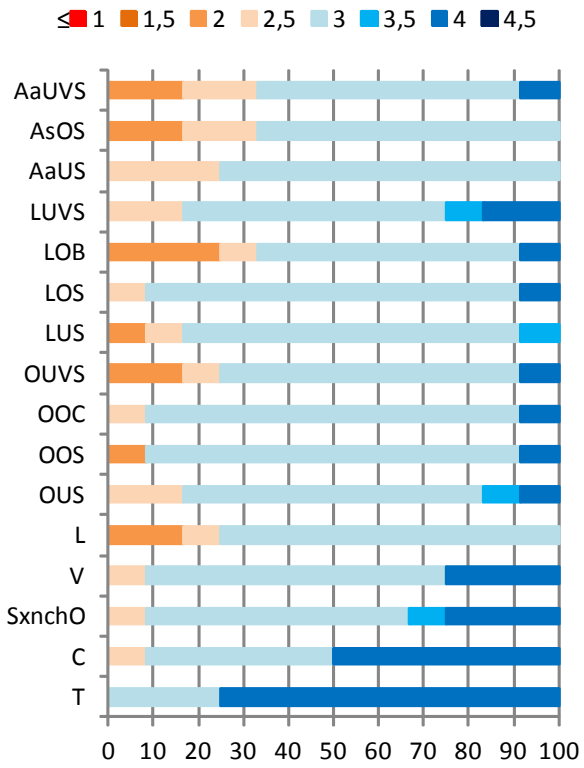
- Temperature sensation by foot – immediate

Wood2New
http://www.wood2new.org/

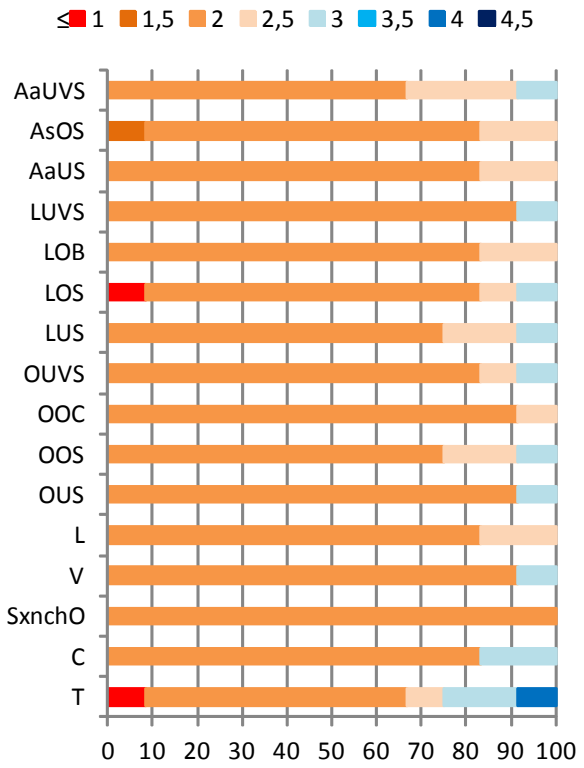
foot 18°C temperature immediately



foot 23°C temperature immediately



foot 28°C temperature immediately

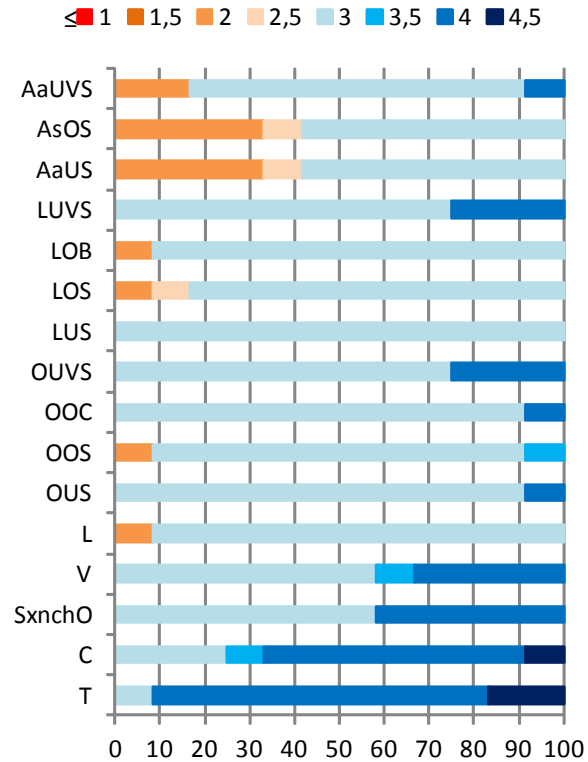


contact: Michael Truskaller

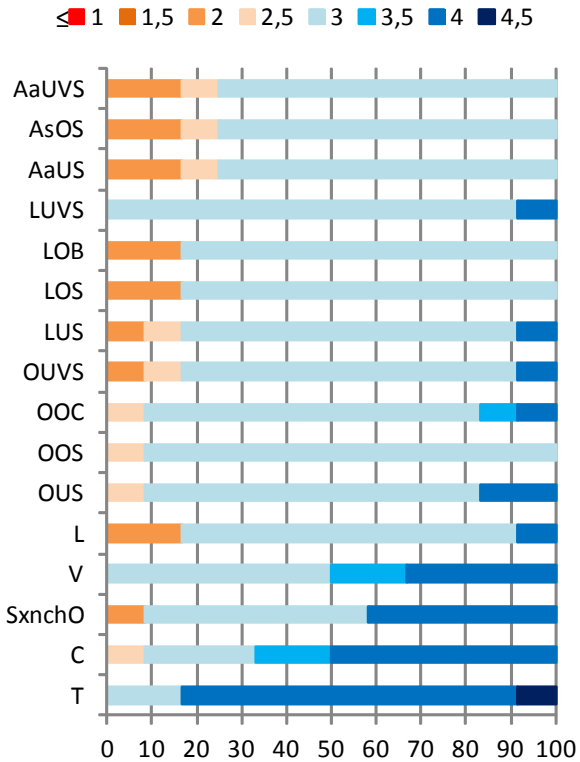
Human Impression - results

- Temperature sensation by foot – after 10 sec.

hand 18°C temperature immedeately



hand 23°C temperature immedeately



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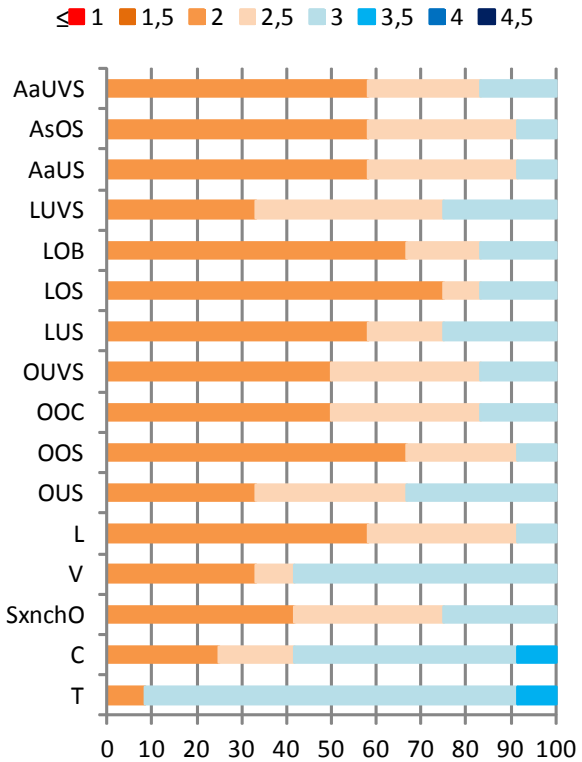

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General conclusion

- We need better understanding of
  - Materials
  - Material interaction
  - Buildings
  - Psychology
  - Human behaviour
  - Human perception
- National and international (research) activities should help finding answers to these diverse questions.

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