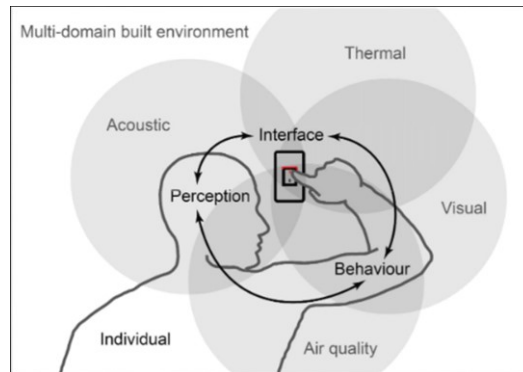


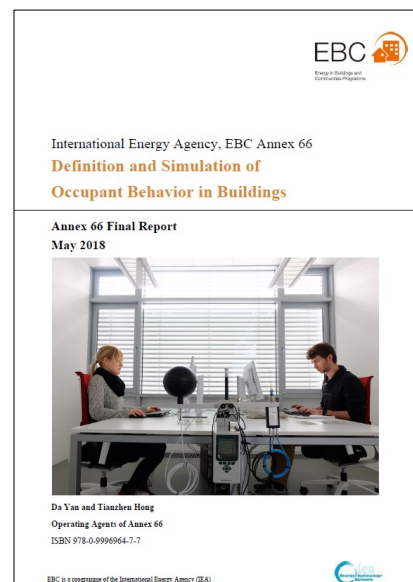
Rune Korsholm Andersen
rvan@dtu.dk

Occupant-centric building design and operation



DTU Sustain

From Annex 66: Definition and Simulation of Occupant Behavior in Buildings...



DTU Sustain

Before Annex 79: What we don't fully understand

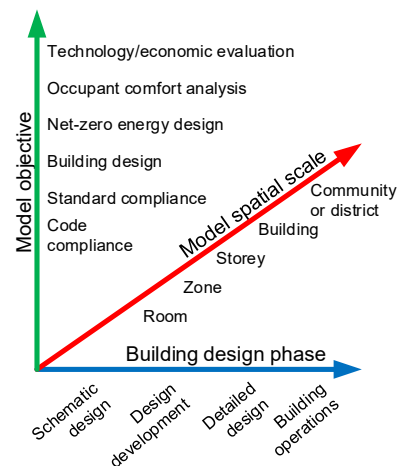
- Relationships and interdependencies between different forms of IEQ (e.g., thermal and visual comfort)
 - What form of IEQ do occupant prioritize in choosing adaptive behaviours?
 - How do forms of IEQ confound?
- What is the potential for virtual immersive environments (virtual reality)
- Effect of social context and behaviour
- How controls interface and underlying logic effects behaviour
 - How to systematically test controls
- How to systematically leverage BAS data (e.g., data mining)



DTU Sustain

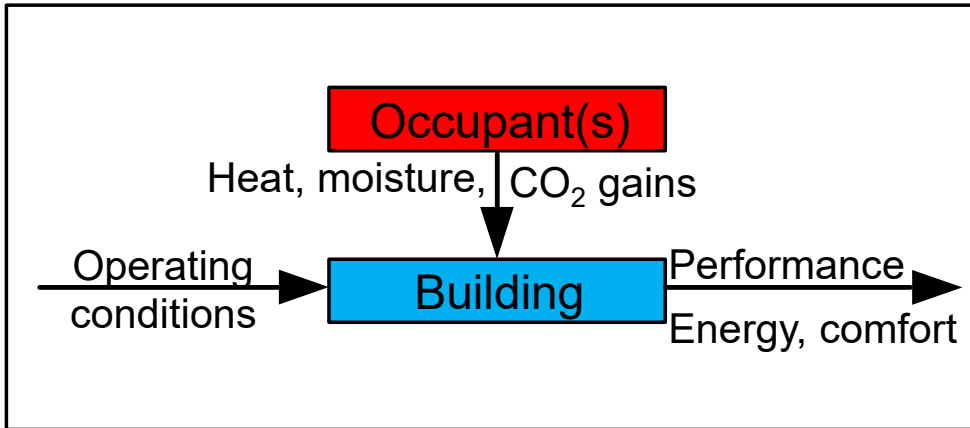
Before Annex 79: What we don't fully understand

- How to translate experimental findings to building codes
- How to translate experimental findings to common practice and products
- How occupant modelling can be used to effectively influence building design
- How much impact does occupant behaviour have across building types, climates, and against other agents (e.g., building operators)?
- How to exploit quantification of uncertainty and risk from occupants in building design
 - Robust design
 - Calculated risks
- Are current POE surveys adequate to study behaviour?

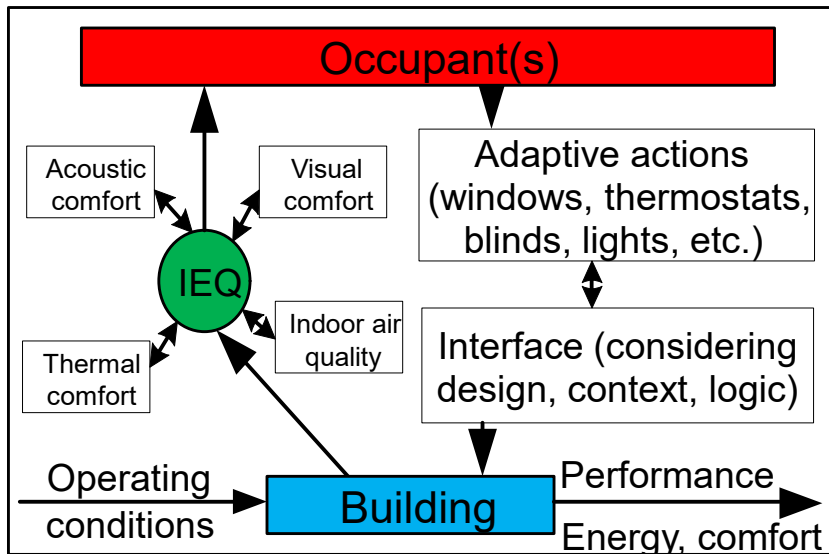


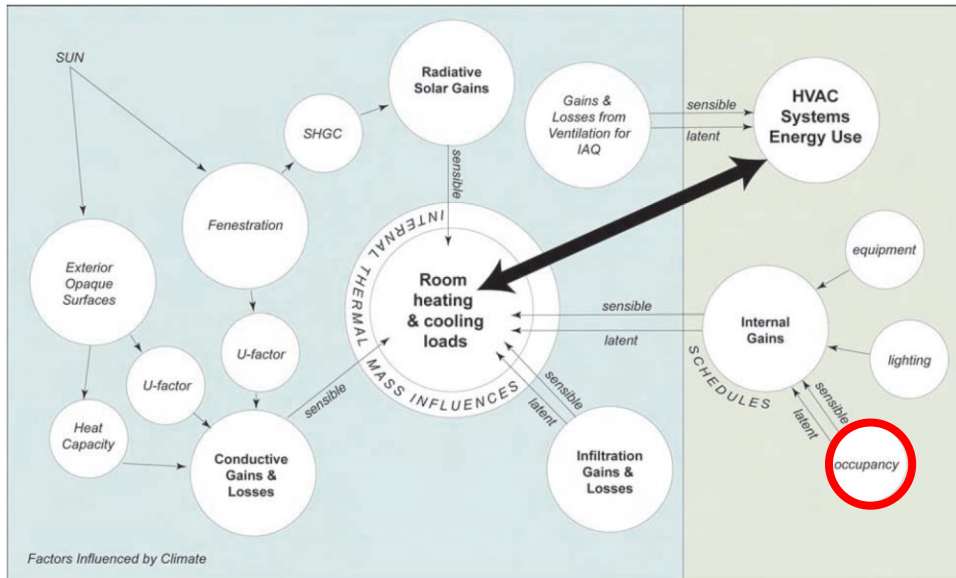
DTU Sustain

Conventional way of considering occupants during building design



Two-way interaction between occupants and buildings





Source: ASHRAE Advanced Energy Design Guide

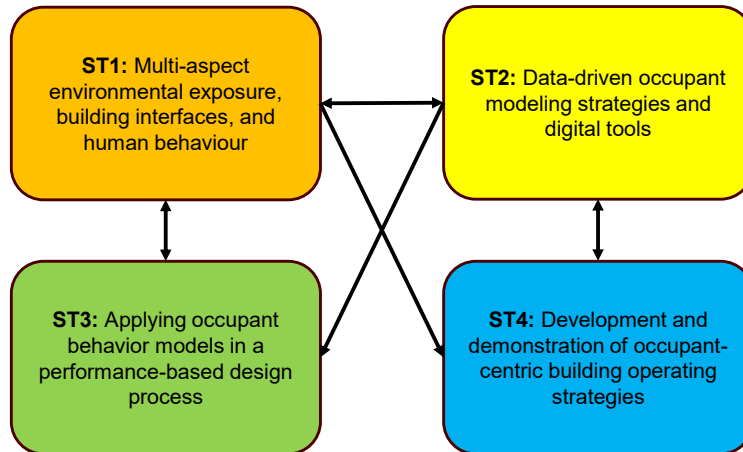
DTU Sustain

Annex 79 Management

Operating Agents: Andreas Wagner (KIT, Germany) and Liam O'Brien (Carleton University, Canada)	
Subtask leaders	
1	Ardeshir Mahdavi , TU Wien, Austria Marcel Schweiker , University Hospital RWTH Aachen, Germany Julia Day , Washington State University, USA
2	Bing Dong , Syracuse University, USA Salvatore Carlucci , The Cyprus Institute, Cyprus
3	Farhang Tahmasebi , University College London, UK Tianzhen Hong , LBNL, USA Da Yan , Tsinghua University, China
4	Burak Gunay , Carleton University, Canada Zoltan Nagy , University of Texas Austin, USA Clayton Miller , National University of Singapore, Singapore

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Organization in 4 Subtasks



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Participating countries

1	Australia	Yes
2	Austria	Yes
3	Belgium	Yes
4	Brazil	Yes
5	Canada	Yes
6	China	Yes
7	Denmark	Yes
8	France	Yes
9	Germany	Yes
10	Italy	Yes
11	Netherlands	Yes
12	Norway	Yes
13	Singapore	Yes
14	Sweden	Yes
15	Turkey	Yes
16	UK	Yes
17	USA	Yes
18	Switzerland	Yes
19	UAE	N/A
20	Hungary	N/A
21	Poland	N/A



Observers



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Annex 79: Occupant-Centric Building Design and Operation

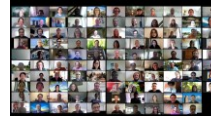


Ottawa, 10/2018

San Antonio,
03/2019



Perugia,
09/2019



Southampton, 04/2020



Odense, 09/2020



Trondheim, 04/2021



Pullman, 09/2021



London 03/2022



Singapore 09/2022



Aachen 06/2023

Objectives of Annex 79

- **Improvement of knowledge about occupants' interactions with building technologies.** Specific focus on:
 - comfort-driven actions caused by **multiple and often interdependent environmental influences** which are not yet covered by current models
 - **building technologies' interfaces** in terms of their suitability for taking advantage of adaptive opportunities, and their effect on building energy consumption
- **Deployment of 'big data'** (data mining and machine learning) for the building sector based on various sources of building and occupant data as well as sensing technologies
- Sustainable **implementation of occupant behaviour models** in building practice
 - guidelines / recommendations for **standards for applying occupant behaviour models and new knowledge on occupants during building design and operation**
 - focused case studies to implement and test the new models in different design and operation phases in order to get valuable feedback

Activities in the different Subtasks

(based on actual report to ExCo)

Subtask 1: Multi-aspect environmental exposure, building interfaces, and human behaviour

10 completed activities, 8 ongoing activities

Subtask 2: Data-driven occupant modelling and digital tools

11 completed activities

Subtask 3: Applying occupant behaviour models in a performance-based design process

8 completed activities

Subtask 4: Development and demonstration of occupant-centric building operation strategies

6 completed activities, 1 (3) ongoing activities

Cross-Subtask Activities

2 completed activities, 4 ongoing activities

Revised plan for Annex Deliverables

1. Comprehensive final Annex Report, summarizing most essential activities

- The core of the report will consist of four main chapters which will give an overview of the most significant contributions of each subtask (expected to be also published as open-access journal papers).
- Cross-subtask activities will be filed in thematically closest subtask.
- Corresponding chapters and sections will be tagged for the different audiences.
- In addition, a comprehensive summary with conclusions and recommendations for future work, as well as all further relevant information about Annex 79 (participants, etc.) will be part of the final report.

2. Open-access book: Occupant-centric building design

A comprehensive book that includes fundamentals on occupant comfort, consideration of occupants and occupant behavior in design processes, occupant modelling and simulation, and case studies focused on occupant centric design.

Revised plan for Annex Deliverables

3. Best practices on occupant model documentation

Insights for transparent and thorough communication of occupant behaviour models for building simulation and controls, Summary of the work done on OB model documentation by both ST2 and ST1

4. ASHRAE Global OB Database

A centrally-coordinated database of occupancy and occupant behaviour data. (ASHRAE will be consulted on the possibility to credit the database to EBC).

5. Platform for sharing and evaluating OB models

A database with occupant behaviour models that is based partially on the ASHRAE Global OB Database.

6. Online library of case studies on OCC projects

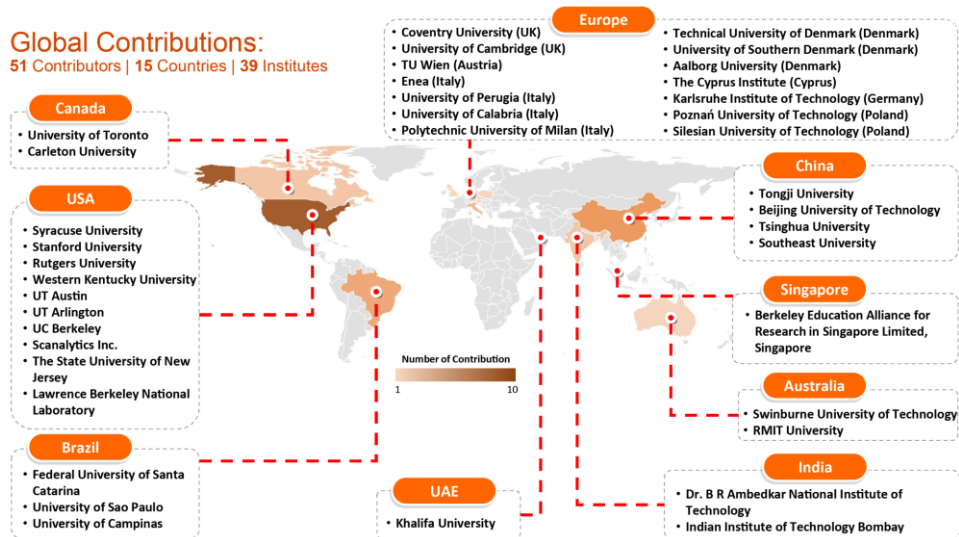
A large international collection of documented case studies of buildings or spaces that demonstrate occupant-centric controls

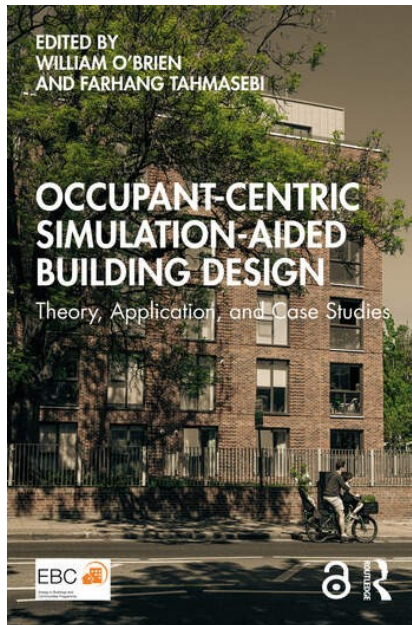


ASHRAE Global Occupant Behavior Database



Global Contributions:
51 Contributors | 15 Countries | 39 Institutes





- Open-access (free) book by ~40 authors
- Published May 30, 2023

Questions?

Thank you for your attention!