

Exploring the tools and methods to evaluate influence of social groups on individual occupant behavior with impact on energy use

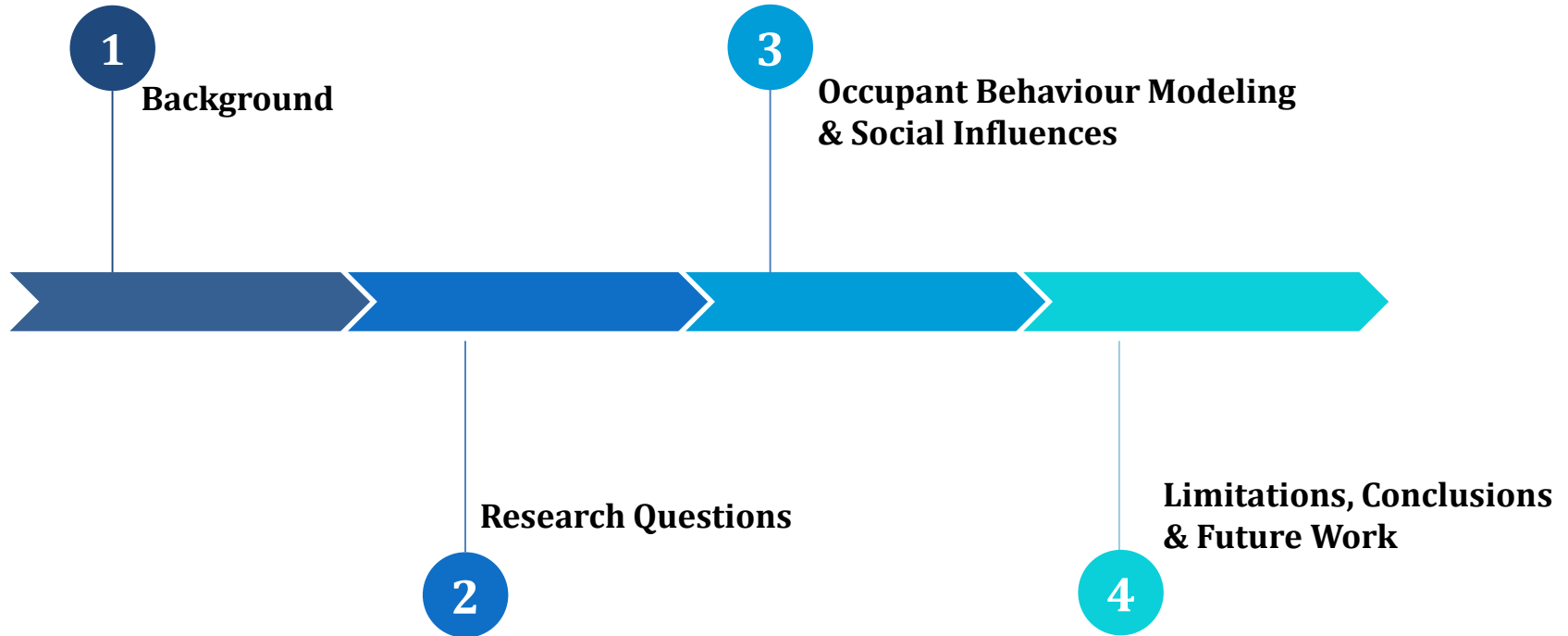
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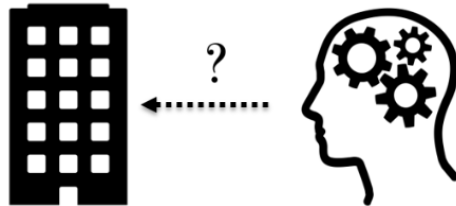
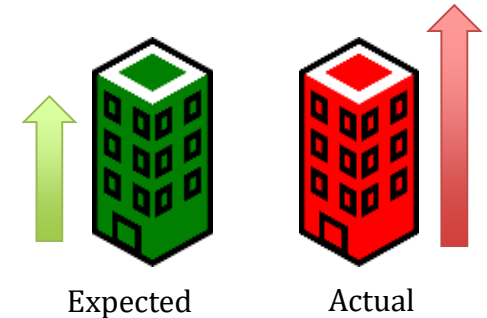
Session 12: Methods and tools for performance prediction
Nordic ZEB+ 2019, 06-07.11.2019

Outline



Concerns in Building Energy Performance

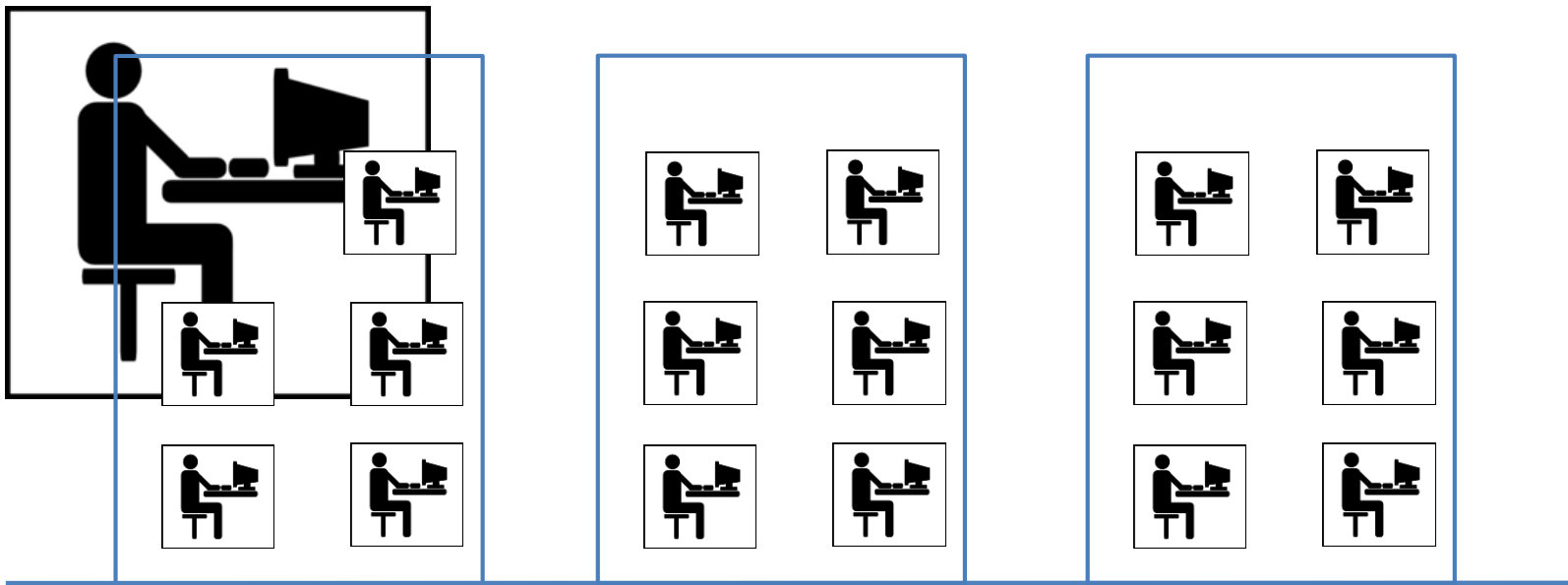
- High disparity in expected and actual performances in Low-Energy Buildings (ZEBs)[1]
- Designed for active occupant interaction
- Occupant Behavior (OB) is schedule-based or deterministic [2]



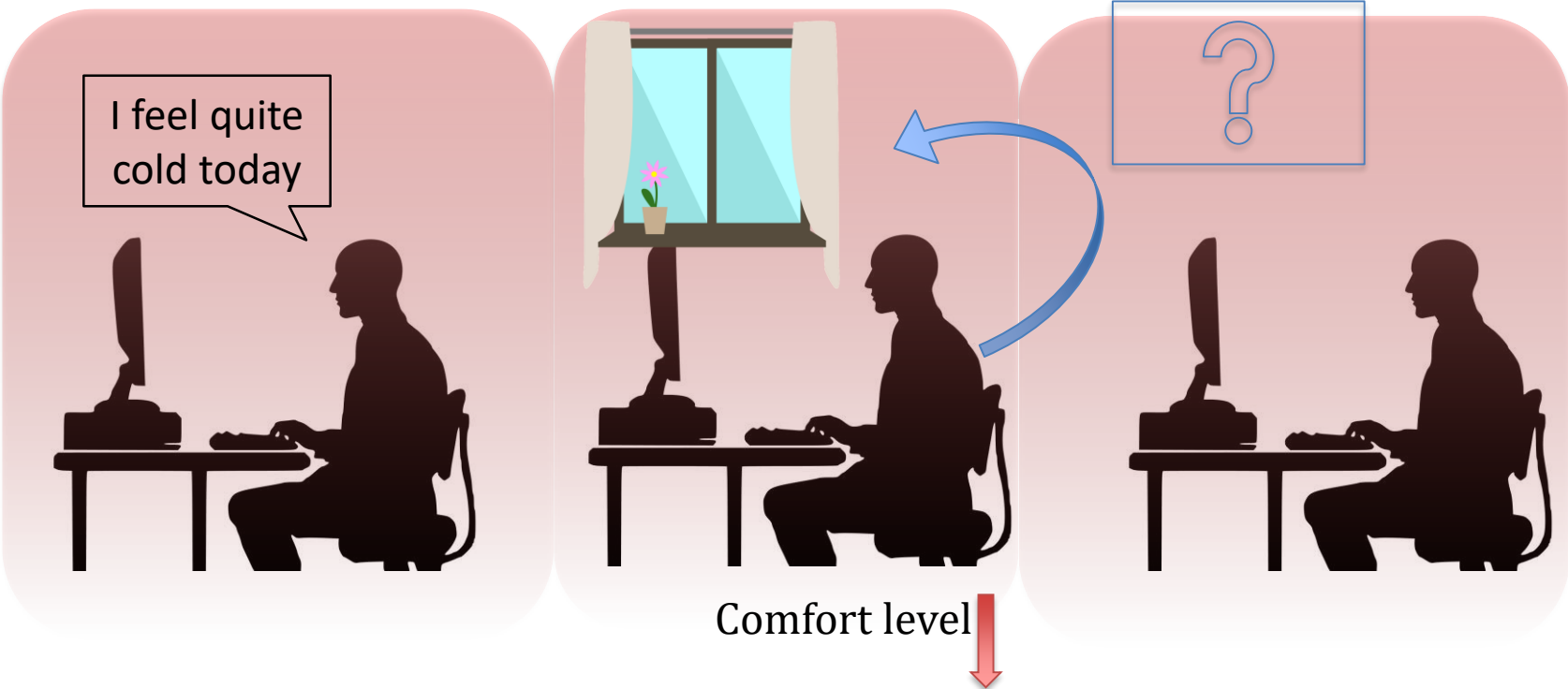
[1] Accuracy of the home energy saver energy calculation methodology.

[2] User behavior in whole building simulation.

Occupant Behavior



Occupant Behavior

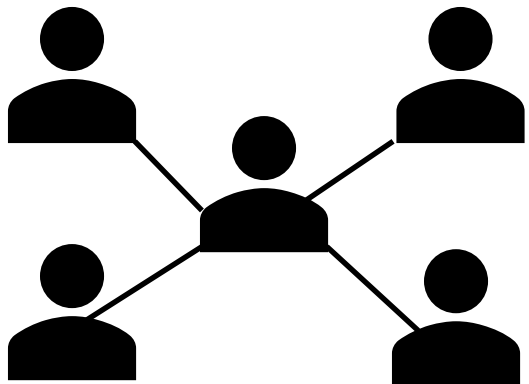


Research Questions

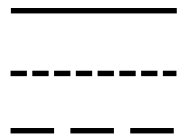
- To what extent does social influence affect energy related occupant behavior in buildings?
- **What are the tools and methodologies required to analyze this influence?**
- **What kind of datasets are needed for such an analysis?**

1. Occupant Social Groups and Networks

Measurement of social influences is often conducted through the evaluation of social groups



Size



Connection

2. Theory of Planned Behavior

Beliefs

Personal beliefs and motivations regarding the action (energy-use)

Ex: Awareness, eco-friendly attitude

Subjective Norms

Beliefs about how significant others may respond to the action

Ex: Approval/disapproval from colleagues

Perceived Behavioral Control (PBC)

Beliefs about the ease of performing the action

Ex: Accessibility of controls

Framework: General Principles

- Take into account all the driving factors
- Combine with the principles of the theory of planned behavior
- Dictate the datasets required from the framework's perspective
- Creation of a database that details the occupant's involvement and interaction with their respective networks

Subjective Norms

- Mapping the network grid around the occupant
- Social rank/status
- Connections

Extent of these influences on energy-related behaviors

Framework: Required Datasets

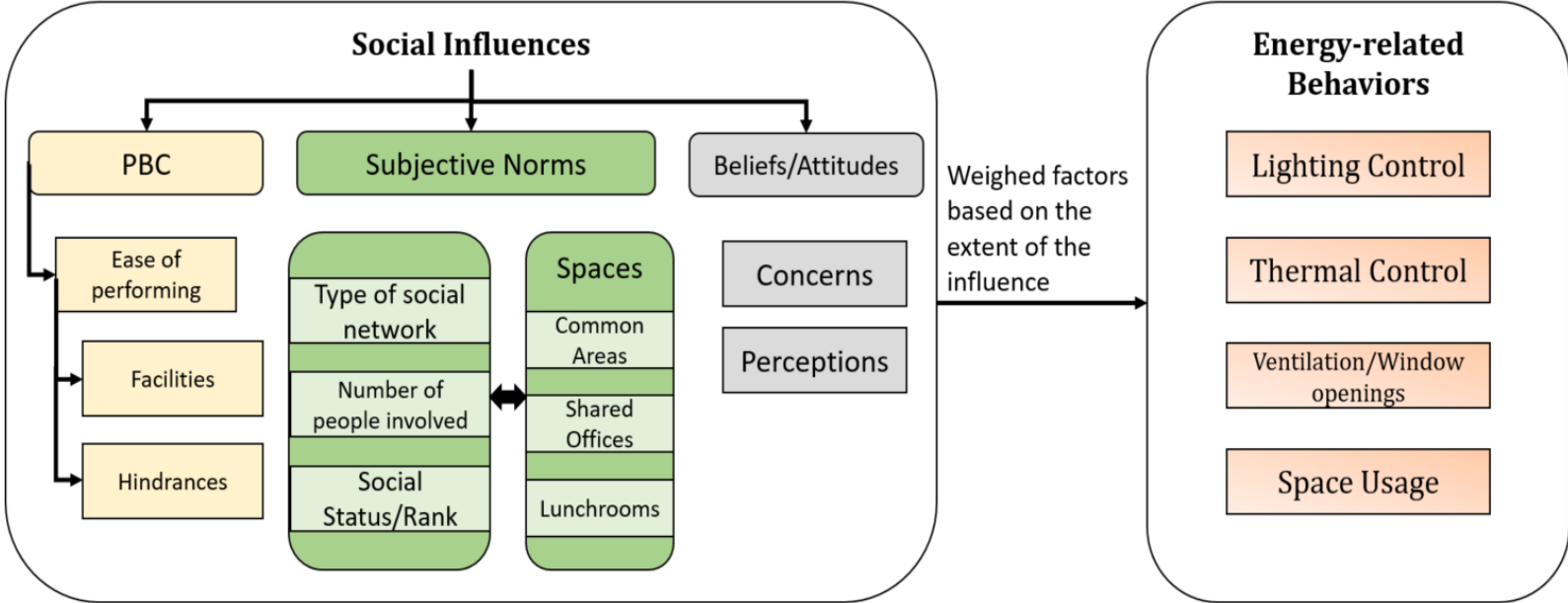



Fig.1 Schematic of datasets required.

Framework: Survey Methodology

- A growing trend in adapting survey methodology to explore the nuances in OB
- Surveys still remain the most effective method for measuring variables that cannot be monitored or observed directly
- Quantitative survey methods may not be sufficient  Combine with qualitative Interviews

Future Work (and Applications)

- Creation of survey based on the structure (contains the following sections):
 - Information of the office and energy facilities (PBC)
 - Energy concerns and awareness (Beliefs/Motivations)
 - Susceptibility
 - Social network
 - Social Heirarchy
- Improving OB models during Building Performance Simulation
- Energy-saving recommendations during Post Occupancy Evaluation

} (Subjective Norms)

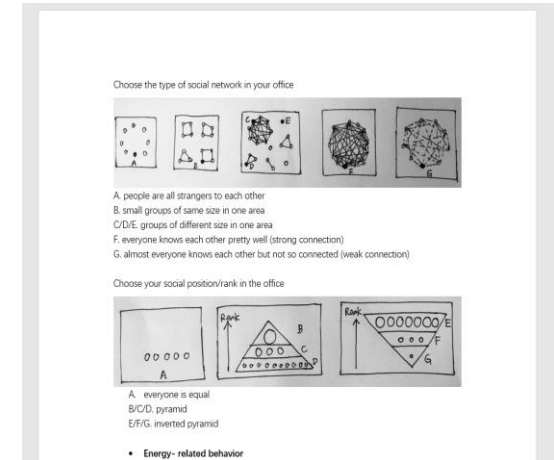
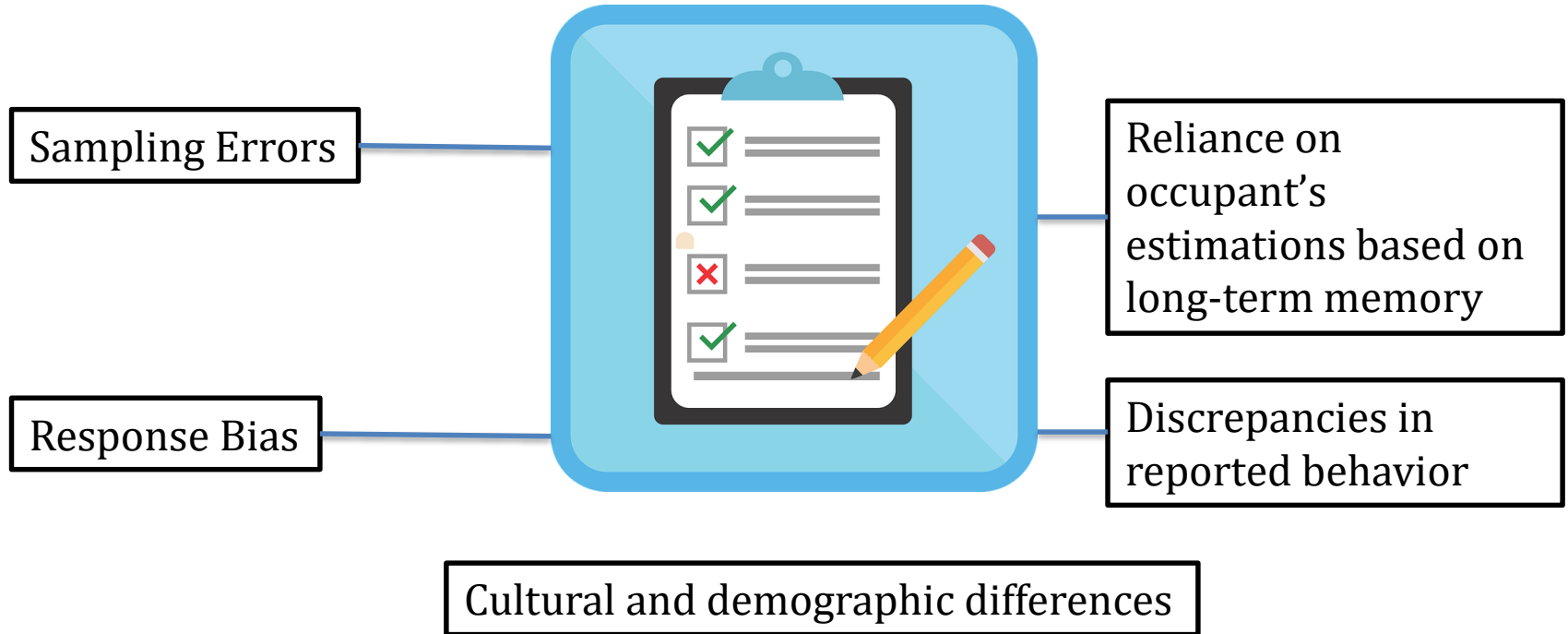


Fig.2 Survey design

Limitations



Conclusions

- Energy research literature → Definitive insights about the impact of social influences on occupant behavior
- Theory of planned behaviour → Effective tool to quantify these influences
- This paper brings out the necessity of considering these factors in conjunction with the energy-use behaviors to obtain a better approach to OB modeling.
- The guidelines and types of datasets outlined in this paper were used to construct questionnaires to gather the required data

Thank you for your attention!