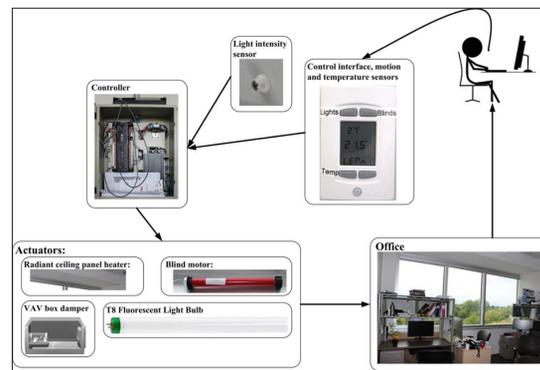
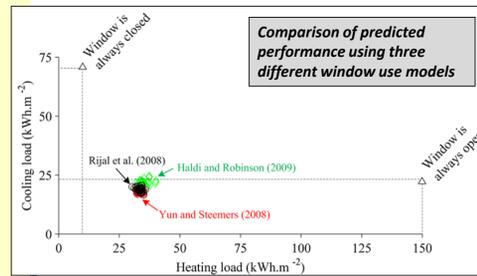


IMPLEMENTATION OF OCCUPANT BEHAVIOUR MODELS IN SIMULATION TOOLS

BURAK GUNAY

- Occupants can impact a building's performance substantially by interacting with just a few building components (e.g., windows, blinds, lights).
- Researchers have developed a number of models predicting human behaviour in buildings based on long-term field observations.
- In this study, we implemented and compared existing models predicting the occupancy and the use of operable windows, blinds, lighting, and clothing in the building performance simulation (BPS) tool EnergyPlus.
- We anticipate that incorporation of these occupant models in BPS will result in significant improvements in the design support ability of the BPS tools.



ADAPTIVE OCCUPANT-LEARNING CONTROLS

BURAK GUNAY

- The majority of the building controllers are accepted as obedient, literal, unimaginative servants maintaining fixed setpoints and schedules.
- Because of the conservative operator assumptions to keep the majority happy with a fixed setpoint/schedule regime, buildings with such building automation systems tend to consume more energy than their occupant controlled counterparts.
- A controller that can learn an occupant's recurring occupancy patterns, visual and thermal comfort preferences, and effective thermal resistance and capacitance of the office through a small number of environmental sensors is developed.
- This prototype controller is implemented in Delta Controls Lab in Canal Building and within the building performance simulation tool EnergyPlus. So far, 35% energy savings has been demonstrated.

BUILDING INFORMATION MODELLING AND SIMULATION WORKFLOWS

ALY ABDELALIM

- Software used to design, construct, and operate buildings is largely disaggregated, meaning inefficient workflows and inconsistencies.
- We are developing workflow methodologies to facilitate more efficient use of software and simulation to enhance building design and performance.



HUMAN BUILDING INTERACTION LABORATORY

PI: Dr. Liam O'Brien
Problem statement

Occupants and poorly-controlled and designed buildings contribute to vast performance uncertainty (100% or more!).

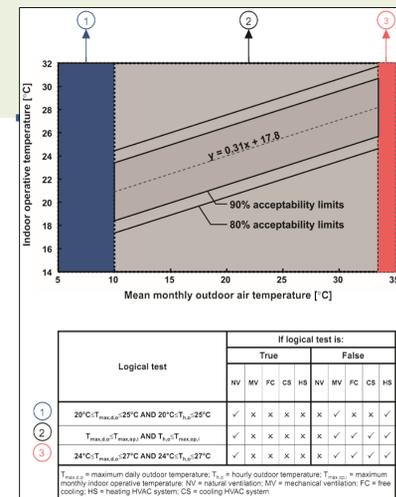
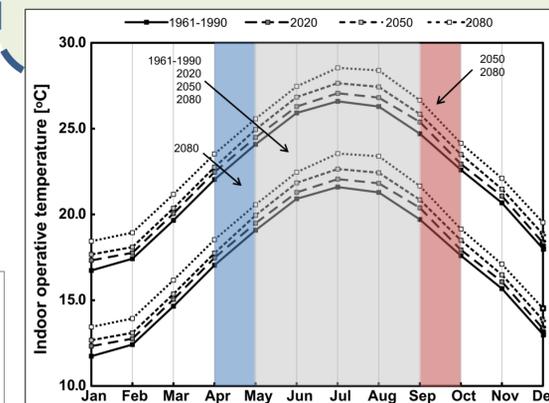
Mission statement

We are a multidisciplinary research team that is striving to better understand buildings, occupants, and the interaction between the two in order to improve building performance and indoor environments.

POTENTIAL FOR NATURAL VENTILATION THROUGH CLIMATE CHANGE

SARA GILANI

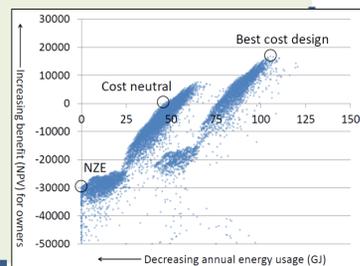
- Climate change will result in changes in heating and cooling loads in building sector.
- Low-energy design solutions are the 'future-proof' solutions. One of these low-energy design solutions is natural ventilation. It that can be incorporated into building design as a mitigation and adaptation response to climate change.
- In North America, there is little emphasis on using natural ventilation in commercial buildings due to the prevalence of air-conditioning and reliance on inexpensive energy. Furthermore, the comfort benefits of natural ventilation are not well understood.



OPTIMIZATION OF BUILDING DESIGN

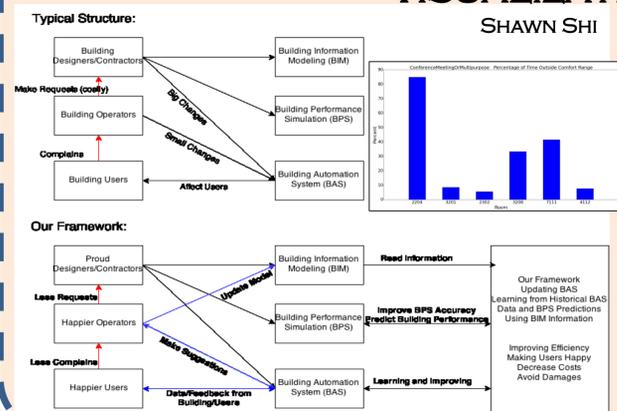
AUSTIN SELVIG

- Formal optimization coupled with building simulation is an efficient way to identify the most cost-effective set of design specification for net-zero energy buildings
- Optimization can be used to answer questions like:
 - Should there be more focus on the heating, ventilation, and air conditioning (HVAC) systems, or on the building envelope?
 - How much should be invested in energy efficiency, versus renewable energy generation?

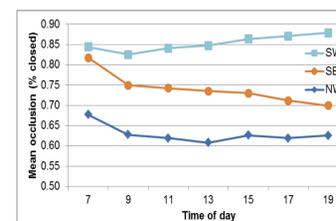
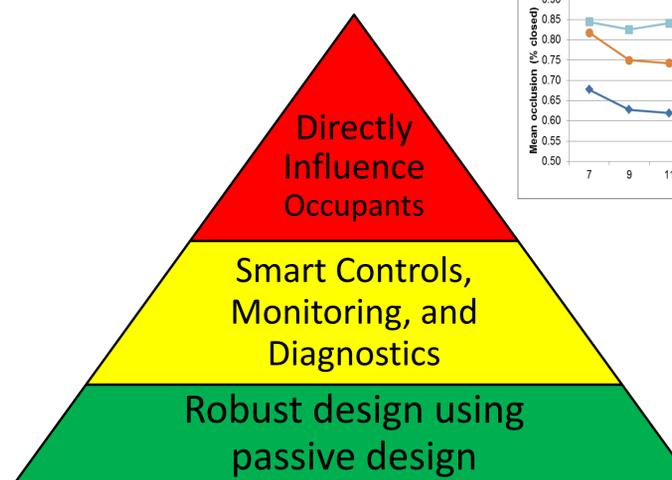


SELF-DIAGNOSING CONTROLS AND DATA VISUALIZATION

SHAWN SHI



- We are producing a framework to combine BIM with Building Performance Simulation (BPS) and Building Automation Systems (BAS) in order to improve building performance and controls.
- A major element is to develop self-diagnosing controls that learn and adapt in real-time.
- We are working with CIMS Lab to demonstrate the methodology on the Canal Building.



APARTMENT/CONDO FIELD STUDIES

BURAK GUNAY & ISIS BENNETT

- Residential buildings account for about 17% of total energy use.
- Occupants in homes can affect energy use by 200-300%.
- We have conducted multiple field studies of high-rise buildings in Ottawa, including:
 - Measuring temperature in submetered and bulkmetered apartments to compare thermostat use
 - Monitoring long term window blind use
 - Exploring comfort issues in highly-glazed condominiums

ENERGY LITERACY

LAURA SCRIMGEOUR

- Energy literacy is a barrier to energy savings in homes.
- We are using surveys to assess Canadians' understanding of energy and how their behaviour affects energy.

