



OVERHEATING AND NATURAL VENTILATION

THE EFFECT OF OCCUPANT VENTILATION BEHAVIOUR ON OVERHEATING IN SUMMER

BACKGROUND

UK homes are becoming more air-tight and well insulated to reduce winter heating demand and alongside a warming climate are at increasing risk of overheating in summer. More common heatwave events could lead to an increase in excess summer deaths. A reduction in thermal comfort could encourage uptake of air-conditioning which would increase electricity demand. To improve summertime thermal comfort and prevent air-conditioning use in UK homes, a suitable ventilation and internal shading strategy needs to be devised to ensure homes stay thermally comfortable with minimum energy outlay.

Occupant behaviour directly influences internal thermal conditions during summer and more needs to be understood about precisely how and when to ventilate in terms of window opening configurations and responses to outdoor temperature.

AIMS AND OBJECTIVES

Empirically evaluate and explain the thermal and air movement effects of different ventilation behaviours in UK homes to determine and design optimum strategies for providing the most favourable summertime thermal comfort for occupants, reducing the risk of overheating and excess summer deaths.

1. Develop methods to determine air change rates and critically evaluate to identify benefits and limitations.
2. Explore airflow and air changes under different window and window covering opening scenarios.
3. Explore thermal comfort under different window and curtain opening scenarios.
4. Extrapolate findings using wider UK climate data.

BENEFITS OF THIS WORK



Identify at risk groups and tailor natural ventilation strategies to reduce overheating risk



Lessen pressure on health services during heatwaves and reduce excess summer deaths



Avoid wide scale adoption of air-conditioning which consume large amounts of electricity



Develop experimental methods to detect air change rates in domestic buildings and validate models

METHODOLOGY

Describe

Houses with characterisation of thermal and airtightness properties.

Compare

How similar are the two houses?

Review

The literature on window opening behaviours.

Design

Occupancy schedules to simulate behaviour based on literature.

Develop

Methods to quantify air change rates.

Measure

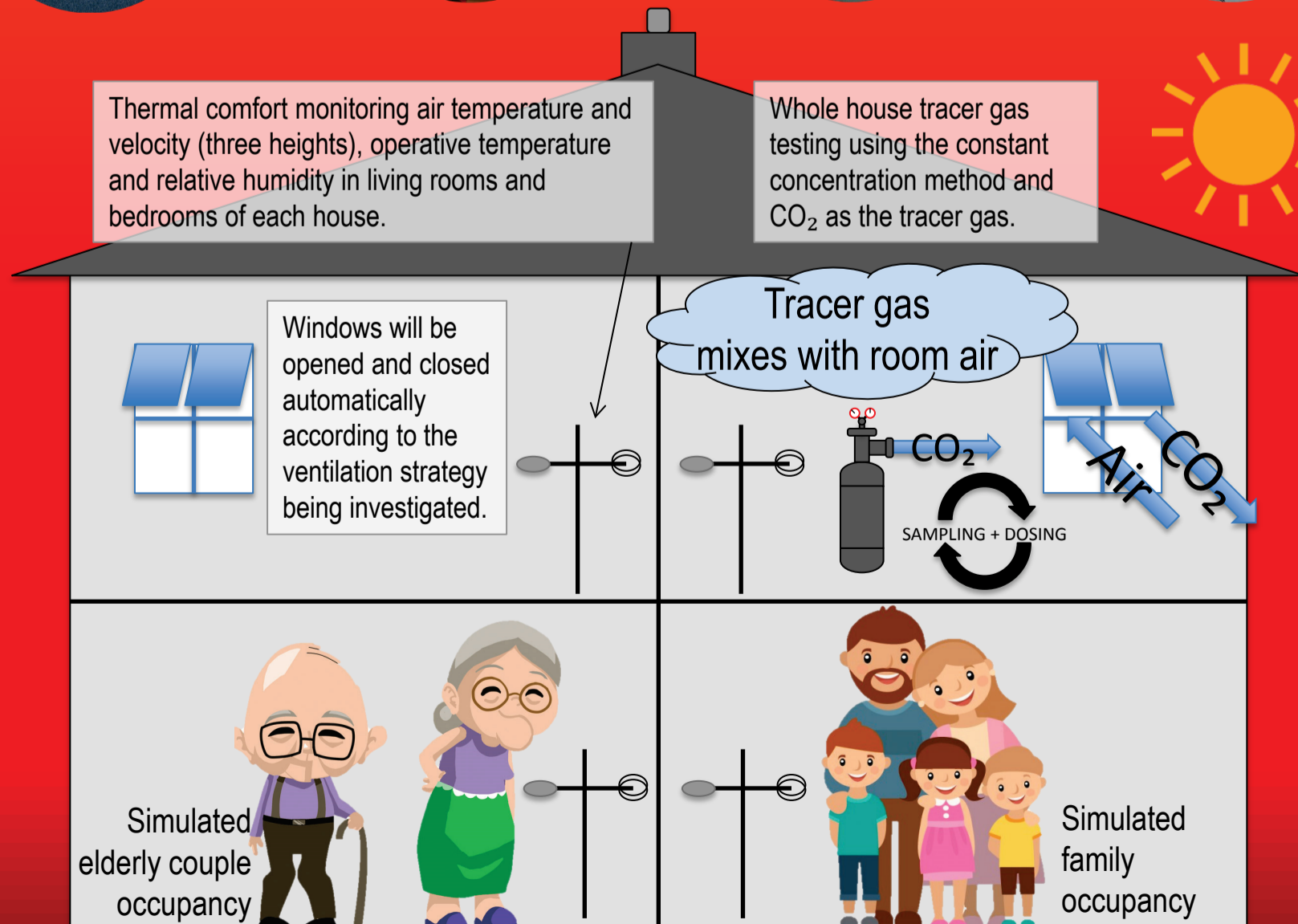
Air change rates and thermal comfort.

Extrapolate

Findings to wider UK climate and projected data.

Recommend

Optimum ventilation strategies to reduce overheating risk.



SYNTHETIC OCCUPANCY

Automated (z-wave) control of windows, doors, blinds/curtains and internal heat gains to occupancy-specific schedules.



LOUGHBOROUGH MATCHED PAIR TEST HOUSE FACILITY

Two 1930s mirrored adjoining semi-detached unoccupied test houses allow direct comparison of internal conditions under different synthetic occupancy behaviours whilst exposed to the same weather conditions.

