ukpassivhaus conference2013

Comfort *and* control?

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What this talk will cover….

- BPE and comfort definitions
- Resilience
- Lancaster Co-housing case study
- Key recommendations

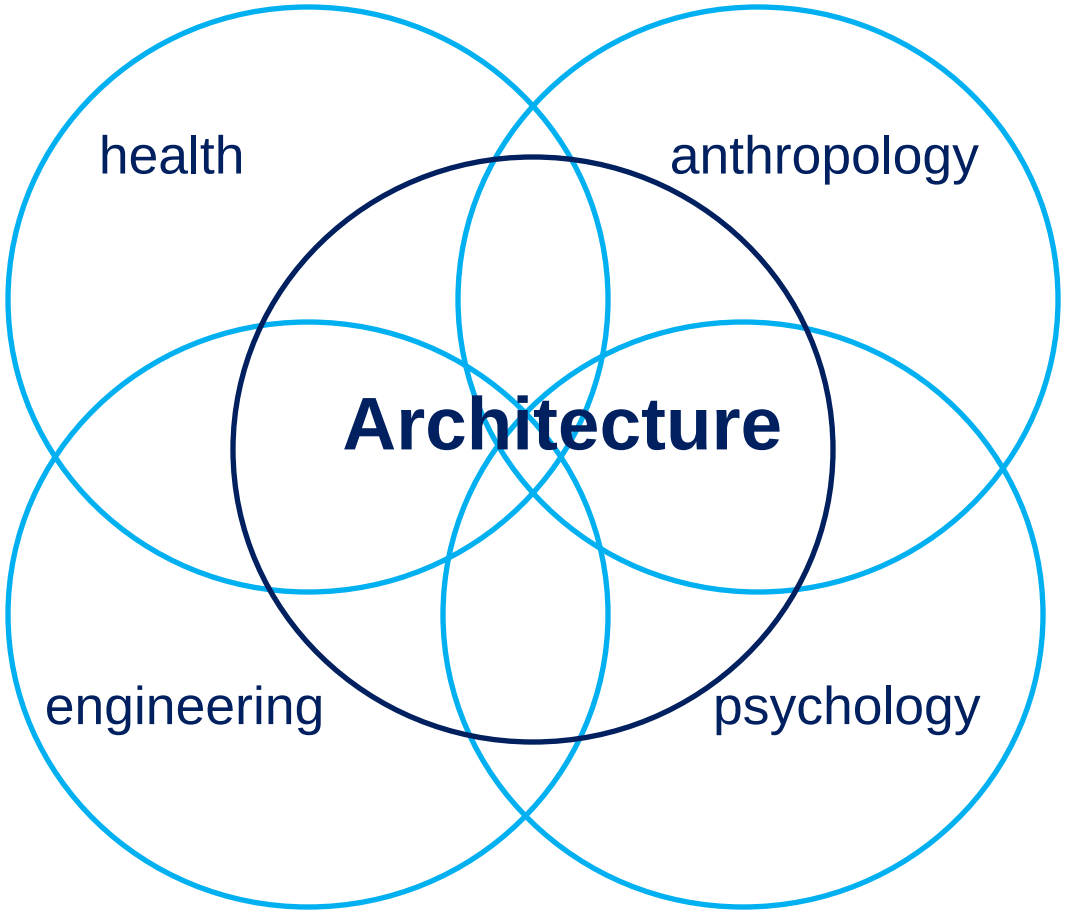
What exactly is BPE?

- BPE involves the systematic collection and evaluation of information in order to improve building performance and fitness for purpose through **benchmarking, feedback, and fine tuning**

- It encompasses all stages of a building process – **typically 1- 2 years monitoring**

- Ideally it includes **all aspects of sustainable design**, but is often reduced to just energy, carbon in use and usability in buildings

Interdisciplinary...holistic BPE



What is ‘comfort’?

- Comfort involves physical, physiological, psychological and social factors

- Comfort is the result of the dynamic interaction between people and buildings in a particular social context, **not a steady state fulfilment of physiological conditions**’
  Nicol and Roaf 2005

What is ‘ adaptive comfort’?

- ‘If a change in the thermal environment occurs, such as to produce discomfort, people react in ways which tend to restore their comfort’ Nicol and Humphrey 2002

- Buildings offer an ‘adaptive opportunity’ when users can interact with the building to adapt themselves Brown and Cole, 2009

- Physical adaptation: Options given to occupants to adapt themselves. Interaction with windows, doors, blinds, heaters, fans, etc Haldi, 2008

How does this relate to climate?

- The interior comfort temperature is closely correlated with the exterior temperature in naturally ventilated buildings
- People's comfort temperatures therefore vary with climate
- There is no fixed temperature point at which people are optimally comfortable
- People can live with warmer indoor temperatures in warmer climates and cooler indoor temperatures in cooler climates –comfort range from 16-27C

What's wrong with air conditioning?

- Air conditioning modifies people's thermal perception
- It makes them less tolerant to the exterior temperatures
  Candido, de Dear et al. 2011, De Vecchi 2011
- Considers people as a static element having to live within a fixed artificial environment de Dear 2011
- People actually have a dynamic interplay with natural and artificial systems when looking for thermal comfort.

Is Passivhaus now really about air conditioning?

- Original claim for PH was no need for heating
- PH design is to ‘optimise’ all round temperature
- 200w heaters introduced into MVHR units
- Acknowledged problem of ‘dry air’ with PH, so new humidity device introduced to assist with this…

…….**Passivhaus is now air-conditioning to all intents and purposes**

What's the problem with Passivhaus notions of comfort?

- MVHR also modifies people's thermal perception
- It makes them less tolerant to the exterior temperatures
  Candido, de Dear et al. 2011, De Vecchi 2011
- PH considers people as a static element having to live within a fixed artificial environment

- Fixing an all-house **comfort temperature all year at 20C defies common sense** and wastes energy!

Does Passivhaus standard *really* control ventilation?

- Justification for energy efficiency claim is based on maintaining a very low air change rate – forever
- Lack of user control leads to unobserved system failures
- Hidden filters, ducts and mechanical features ‘dumb down’ user interaction – little interactive learning
- Confusion between when to use windows and when not

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More design issues

We need to understand the **relationship** between technologies and users – how do they influence eachother?

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Habits….and bad habits

…..protect against information overload

Jackson2005

Habits bypass values and motivation

-highly dependent on the usability of controls

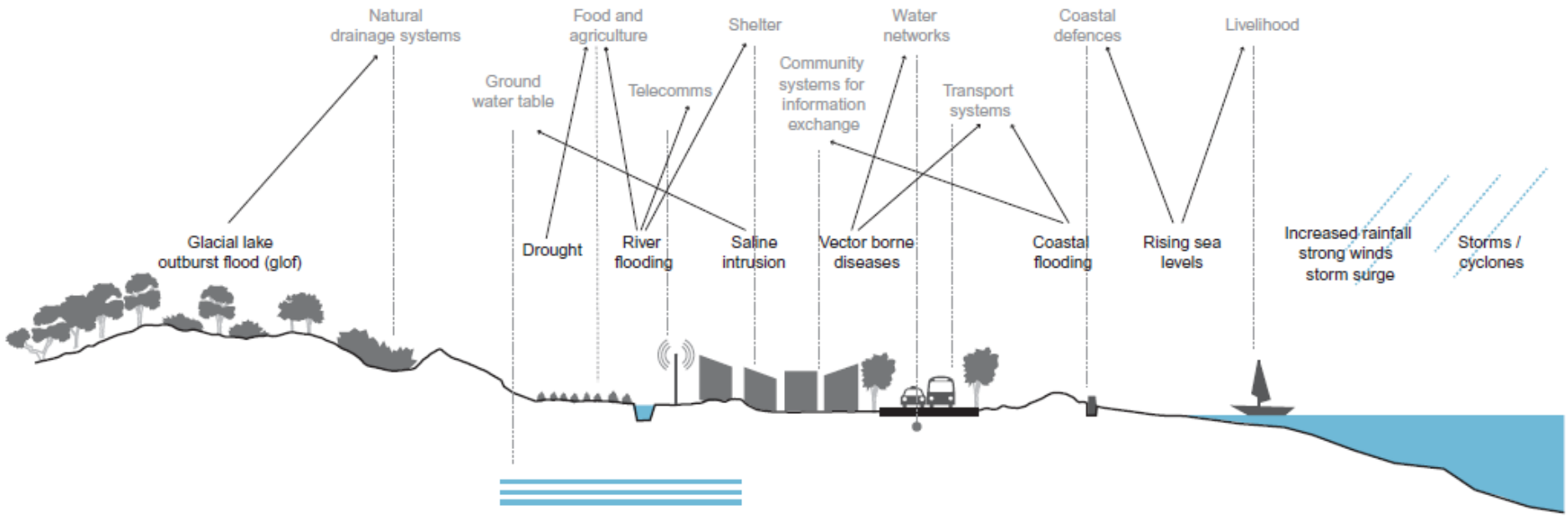
Climate change extremes

- Worst floods every in UK 2007
- Warmest weather on record in UK 2011
- Power cuts, overheating in homes…

What is resilience?

"The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions"

UNISDR, Terminology on Disaster Risk Reduction, 2009



What are properties of resilience?

Redundancy

- the opposite of optimal – dealing with wider tolerances
- more than one way to serve same function

Robustness

- able to absorb shocks, sudden changes and restore equilibrium
- again – not optimal – overdesigned for strength

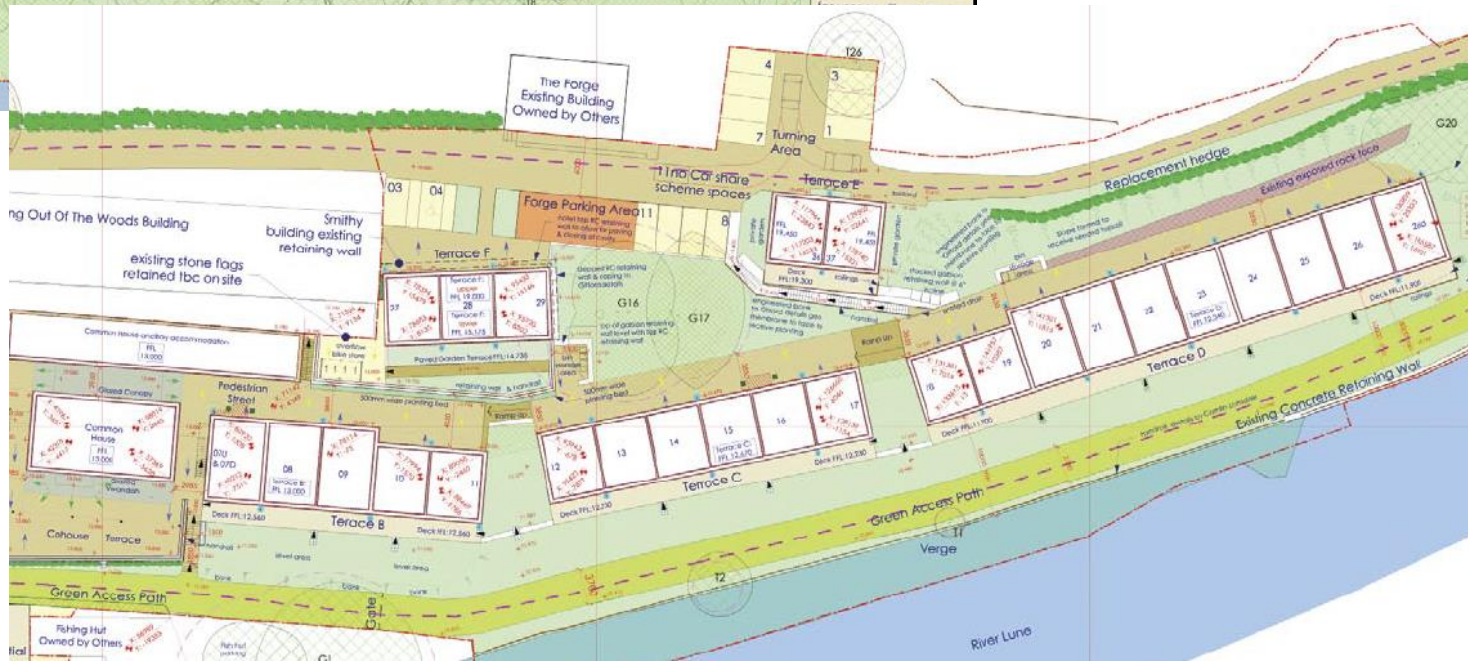
How resilient is Passivhaus?

Issues to consider:

- Fabric – windows, airtightness
- Services – ventilation system
- Energy – supply, source
- People – community, learning

Lancaster co-housing case study

Lancaster housing layout



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Lancaster POE study 2012-2013

1. Handover and Initial occupancy only – 36 units

2. Focus on qualitative aspects

3. Separate study of energy performance – co-heating test

4. Usability analysis, questionnaire, interviews with design team and occupants, observation, drawing analysis

Procedural challenges

Time pressure on phased handover due to financial constraints

Lack of co-ordination on some construction tasks finishing and starting

Some **supply chain issues** due to high standards needed…..

windows more responsive than filters to change.

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MVHR access and controls

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Location of MVHR controls

- On/off MVHR switch under sink cupboard
- Gets knocked on and off by stuff being stored there

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Windows and patio doors

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Heating and hot water controls

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Location of heating controls

- Location of heating controller in 3 bed house difficult to access
- No light in this cupboard either

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BUS survey

36 out of 36 responded – 100%

Benchmarks based on 2011
Dataset of 15 housing studies

BUS survey has been developed over several decades – highly refined

Key aim is to identify comfort and control perceptions

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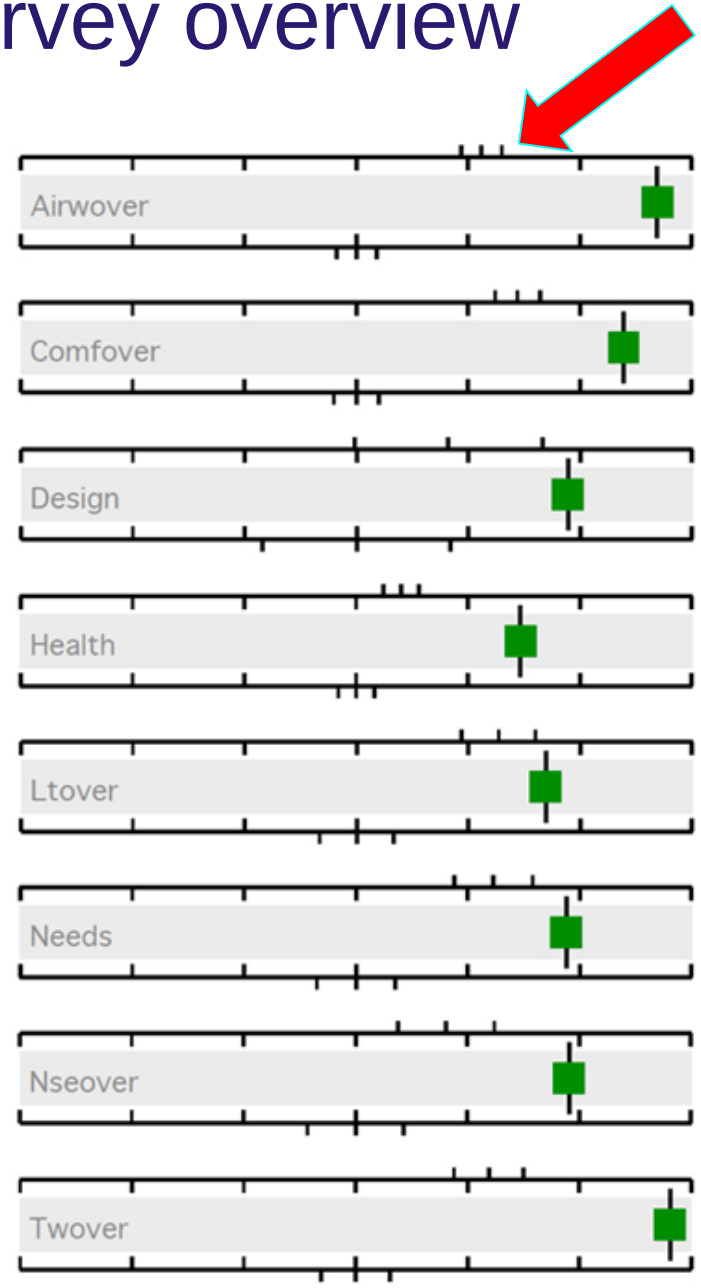
BUS survey overview

benchmarks



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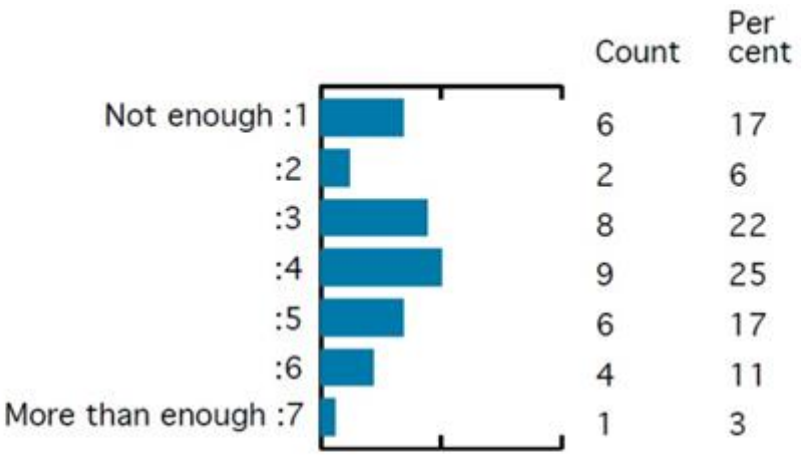
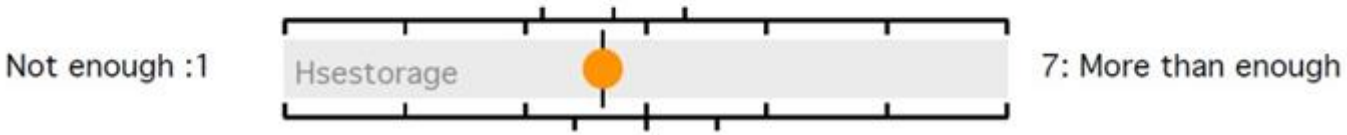
Air in winter in detail

- Air is perceived as dry by 81%
- Air is perceived as still by 91%
- Unclear whether this is good or bad thing!
- Dry conditions are a concern
- **People usually prefer some air movement**

Storage provision – resilient?

- 45% of respondents feel their provision is less than adequate
- Residents thinking of creative ways to get around this





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Common house with shared kitchen, shop and dining area

Changes in behaviour due to shared facilities = robustness

Residents are:

- using a shared laundry
- eating meals together, socialising
- parents using the children's room
- storing bikes and outdoor equipment
- using the co-op food store
- using the car club on a regular basis
- using the guest rooms on an occasional basis
- holding community events
- sharing outdoor space.

- Beneficial aspects identified were: socialising, looking after children and sharing resources.

Lifestyle changes = resilience

- Nearly everyone has changed their lifestyle
- now eating less meat or more vegan meals
- food accounts for around a third of all carbon emissions in the UK
- Increase in physical activity –walking and cycling
- project is helping to reduce carbon dioxide emissions in a number of innovative ways
- Slow internet speed – some looking forward to Mill opening to redress work/life balance

Is Passivhaus based on an out of date paradigm?

- Passivhaus is based on an **optimised** mechanical model
- No inherent system learning between user and building
- No resilience built into the standard
- Takes no account of climate change modelling
- Passivhaus demands *passive*, not active response
- Passivhaus fundamentally separates people from their natural environment – no adaptive comfort model

What way forward for comfort and control?

- Fabric first with robust detailing
- MEV, not MVHR
- Responsive controls with visible feedback to user
- Usable windows and natural ventilators with fine control
- Natural cross-ventilation strategies

What way forward for Passivhaus?

- Adopt a new paradigm for modelling based on resilience, temperature ranges, robustness and probability rather than optimisation
- Think about the long term durability of fabric detailing for airtightness – mechanical joints better than glues and tapes
- Weigh up overall cost of embodied carbon for MVHR
- Consider alternative heating to electric, especially in cities, using green fuels (Less is More, 2012)

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Thank you – any questions?

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