AECB 2011 Annual Conference

Evaluating usability for the design of low carbon homes

Prof. Fionn Stevenson
School of Architecture
University of Sheffield

The problem....

'95% of people opened their windows when they wanted some air.... even though MVHR was present.'

'Two thirds of residents were not able to programme their thermostats'.

Zack Gill, 2010

We need to:

Understand the user response to low carbon housing

Understand the *actual* usability in relation to design intentions

Feed into design process to improve it

The UK intentions....

‘Zero carbon housing’ (regulated emissions only...) = 70% reduction on CO2?

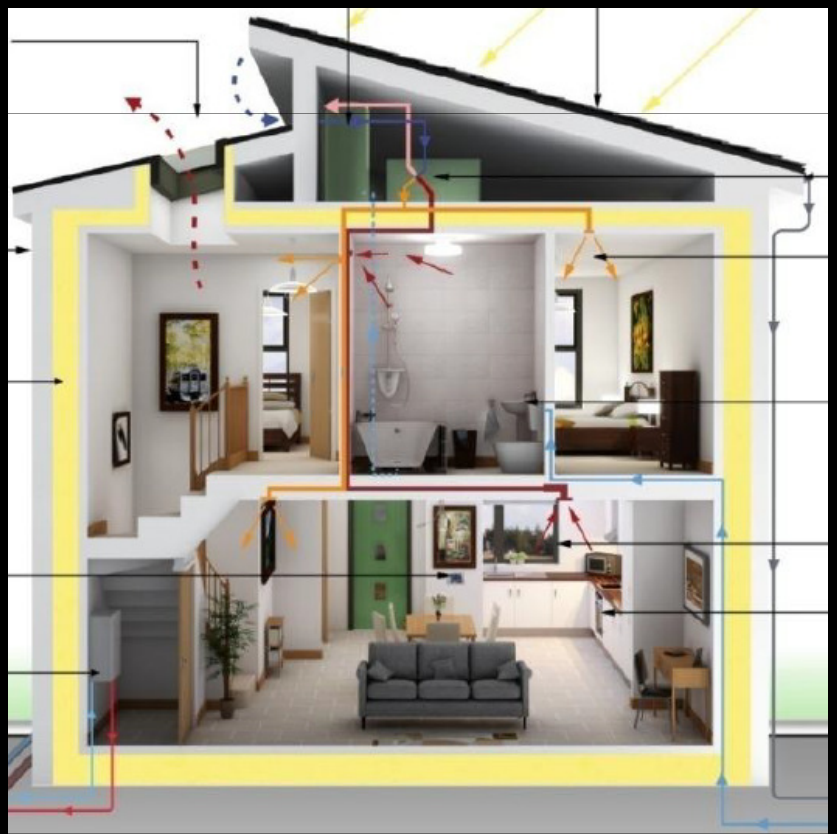
PassivHaus standard = 15kWh for heating, lighting, ventilation (120KWh overall)

‘Smart housing’

‘Integrated design’

Happy occupants....

(anbody home.....?)



Greenwatt Way
PRP architects

The UK reality.... in new homes

Overheating in homes, especially in urban areas..... unwanted heat gains

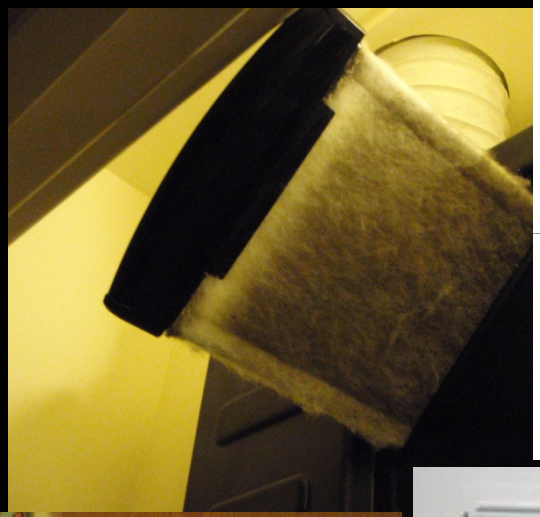
Poor cross-ventilation

Malfunctioning, unintegrated new technology

Unintelligible design ('dumb housing')

Unusable products and buildings

Unhappy occupants...



How do humans work?

We are a product of millions of years of evolution....fine-tuned monitoring

We have primitive instincts and habits.....hunter , gatherer, farmer

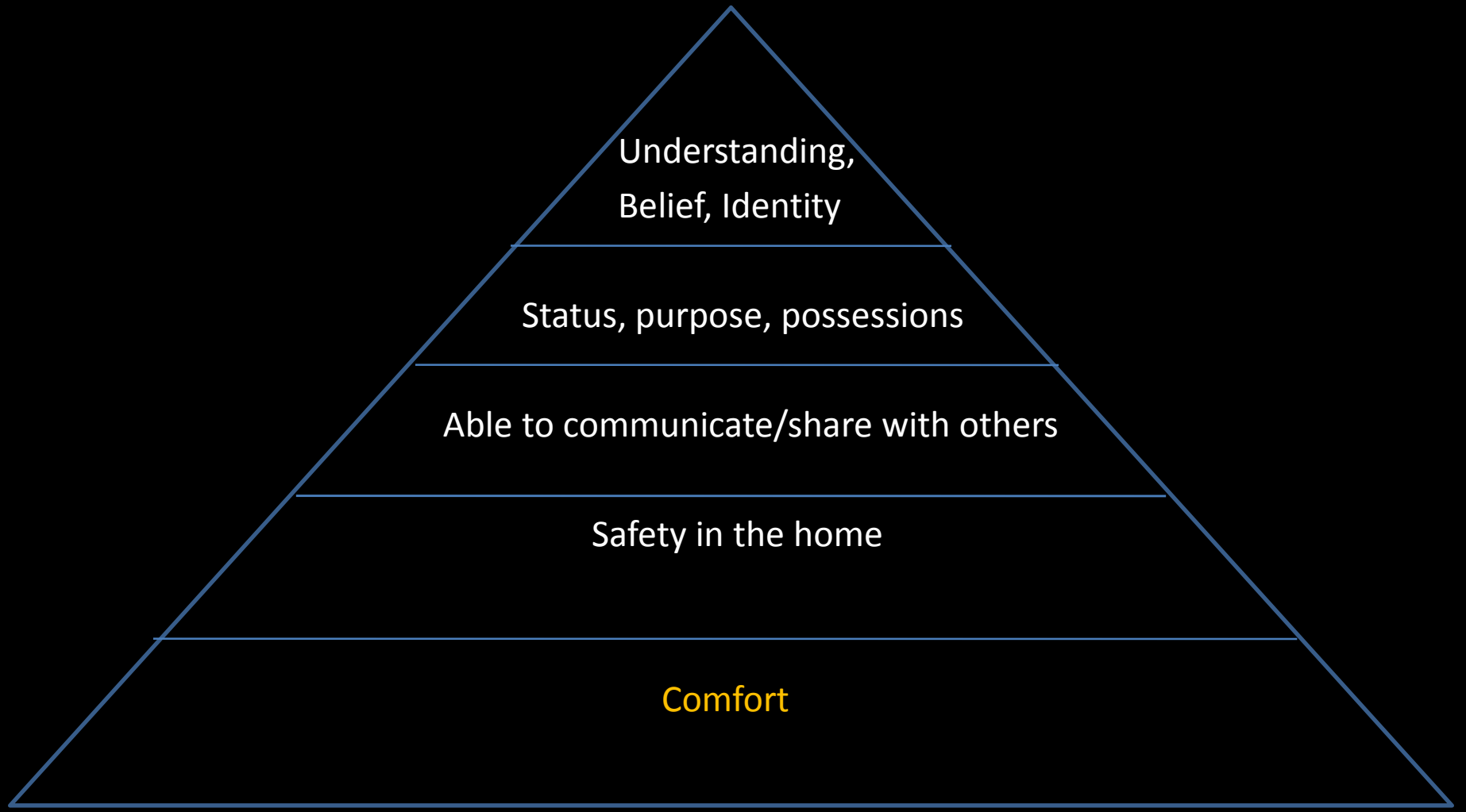
We operate through our senses and conceptual models

We are always meaning-making with whatever we have to hand

We are programmed for change, not continuity

Human needs.....Maslow's hierarchy

Needs in the home...



Affordance - design interfaces

Gibson's 'affordances' = perceived and actual properties of things, which determine how they can be used. The user knows what to do by sensing.

A chair 'affords' sitting

A window 'affords' opening

A fire 'affords' warming

A thermostat 'affords' warming?

An MVHR 'affords' ventilation ?

Key control touchpoints in the home

Heating heating source, programmer, VDU,switches, dials, valves, radiators, pipework

Ventilation windows, doors, handles, hinges, trickle vents, ventilation units, switches, dials, VDU, filters, ducts

Lighting switches, VDU, light bulbs, shading, control panels, cabling

Water taps, plugs, showers, baths, drainpipes, pipework

A jungle or field with a view?

Moving on from affordance to learning

Affordance is ‘What you see is what you get’ (WYSIWYG) – physical

Humans work conceptually also, and through time – we learn how to use things

Products and buildings have emergent properties which create a relationship with the user

Maximum usability is when emergent properties reveal themselves easily
e.g. one thing leads to another – exploring a door handle....

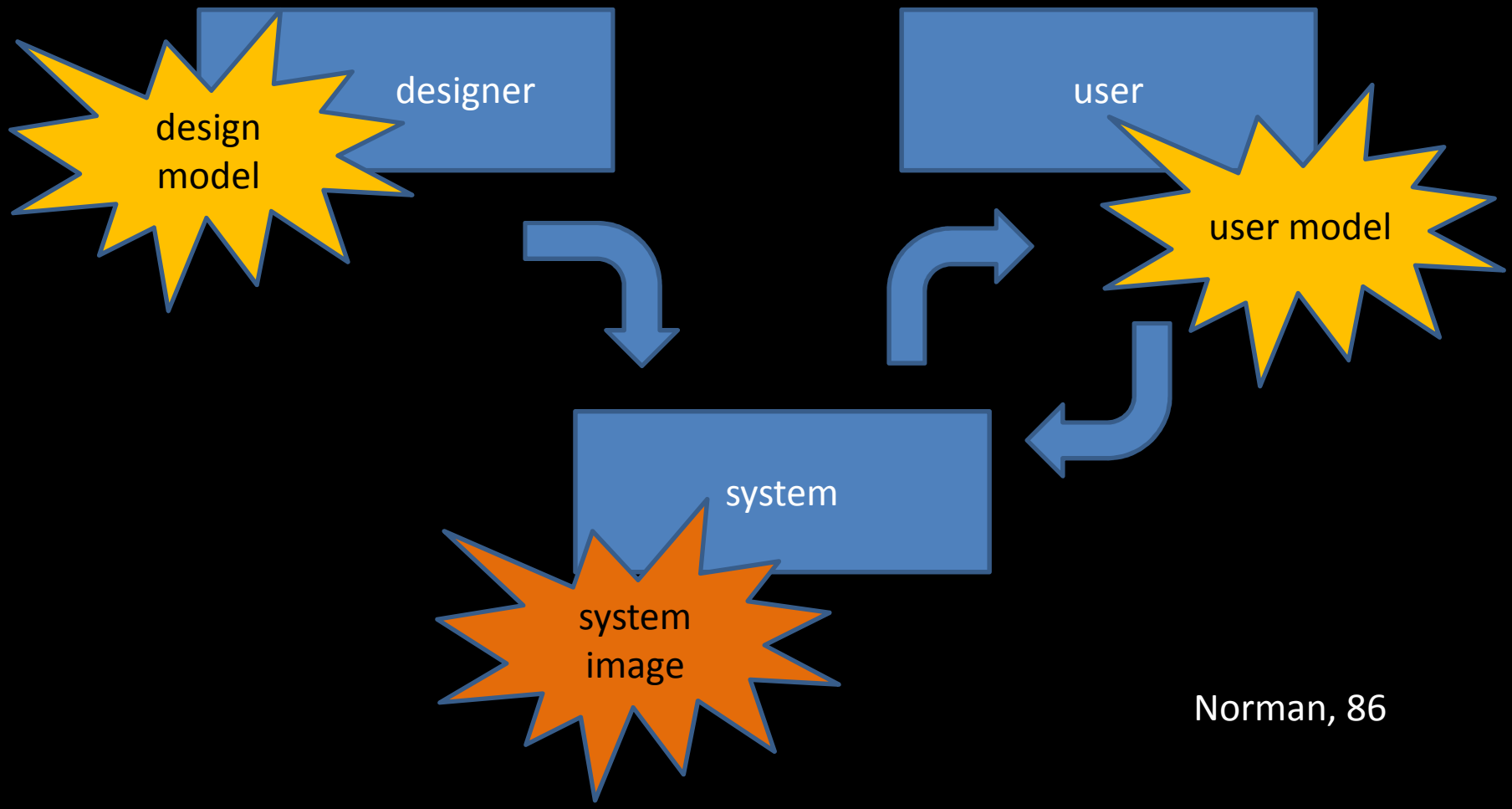
Conceptual model of how things work

Our concept of how things work and their meaning is based on:

past experience
habit
instinct
sense
memory
logic
culture
physical context
feedback

We try to ‘make sense ‘ of controls with whatever faulty information we have.....
not always logical!

Conceptual congruency in design



Norman, 86

Usable design – make it visible

Make the invisible, visible – heating, ventilation, lighting – any control factor

Feedback to show current status

Single controls with single functions

Non-arbitrary controls

Use sound with touch and vision

This is generally what a car has – why?

Matter of life or death design...thoughtful.

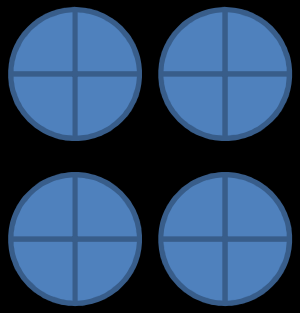
Usable design – sound and touch

Usable design –mapping

Mapping = relationship between two things e.g. controls and results in world

Natural mapping = immediate understanding from culture, biology, perception

Mapping problems = cognitive dissonance ('does not compute, not logical counterintuitive..') – no direct spatial relationship



Usable design – work with constraints

Make it easy for the user – limit the number of options available

Physical constraints – easier if visible

Meaning constraints – keep the design language simple

Cultural constraints – recognise these for user and context

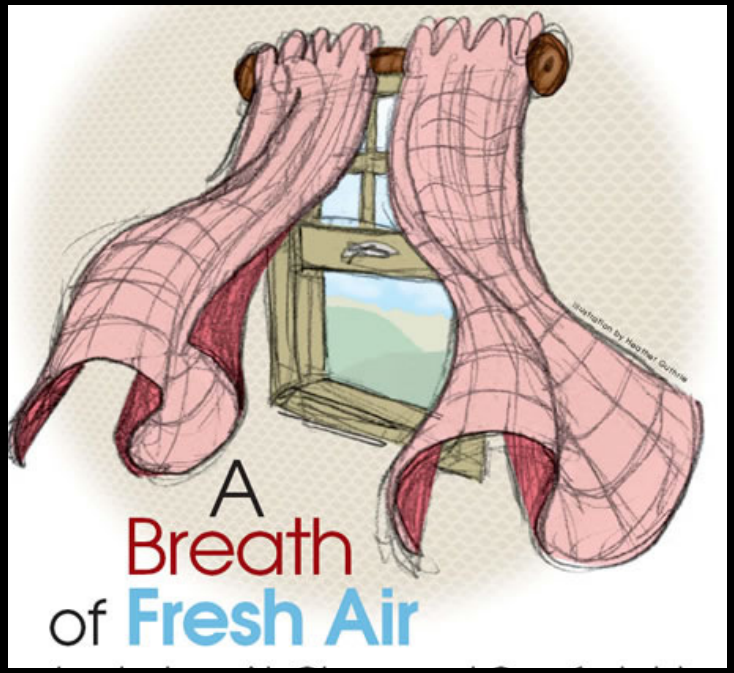
Logical constraints – simple relationship between object, function and location

Usable design – feedback

Make feedback visible to tell user what is going on

Provide accurate, embodied , feedback

Provide more feedback, less features



Things that go wrong with usability

Too many features –too much information

Smaller and faster is not always better

Over automation

Humans are irrational - Users blame themselves or wrong cause

Durable design increases usability

Avoid perfection – make design scratchable

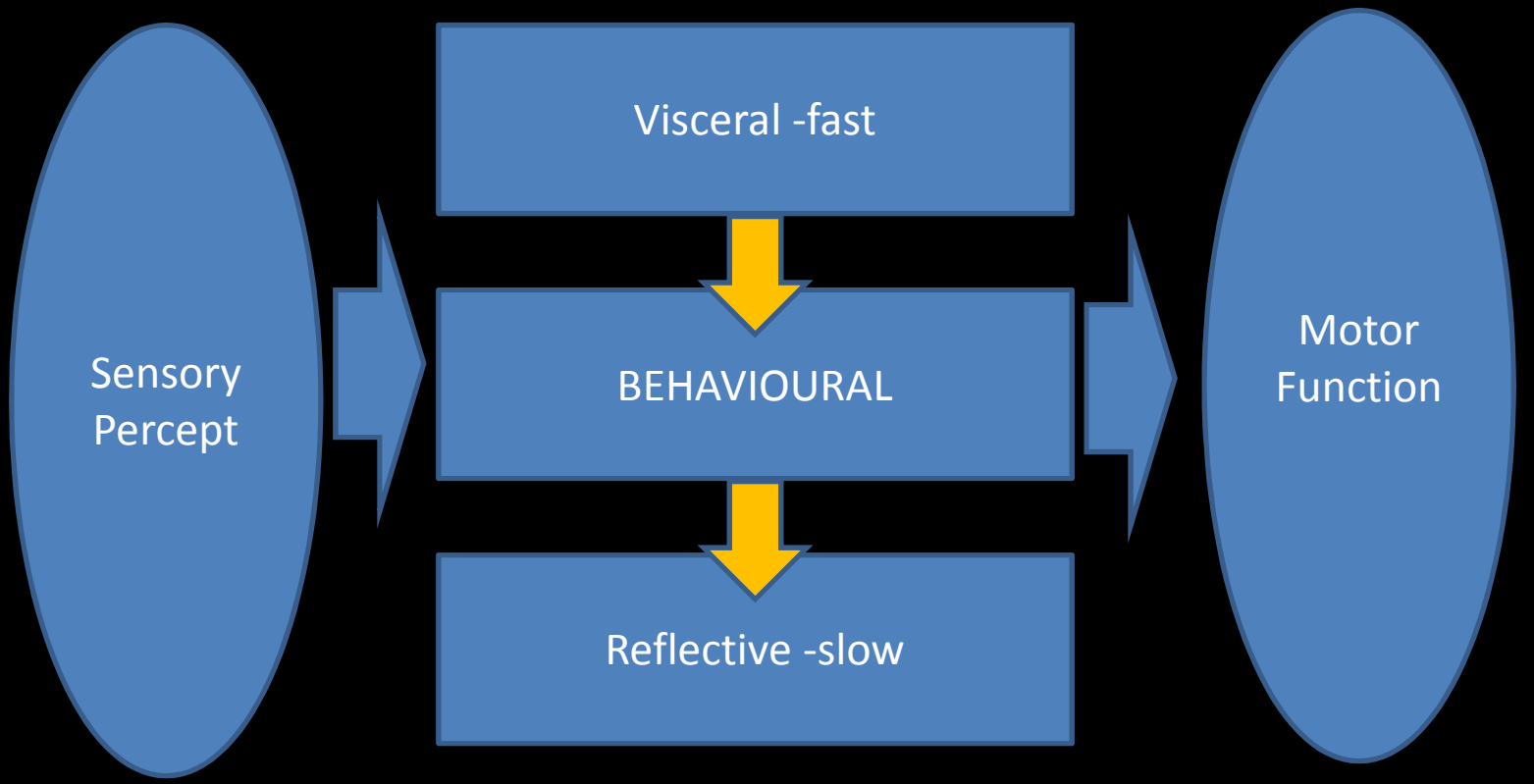
Make design ‘cherishable’

Increase the meaning through memory

Avoid waste –embody habit over time

Design for discovery not ‘cover up’

Emotional design increases usability



Norman, 2004

Evaluating usability – the criteria

Clarity of purpose

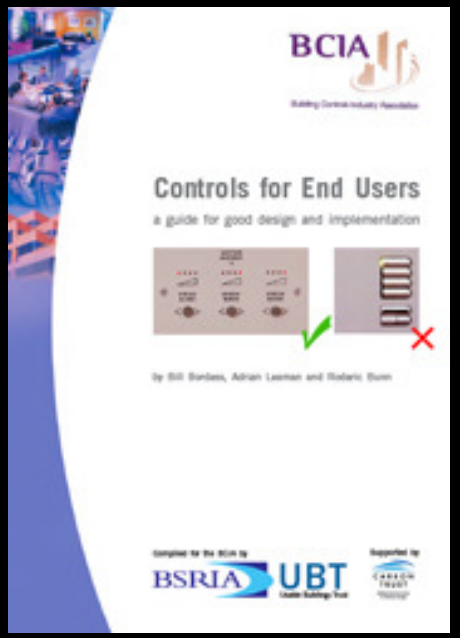
Intuitive design

Labelling

Ease of use

Feedback

Degree of fine control



'Controls for end users'
Bordass, Leaman and Bunn

Evaluating usability in BPE

sink taps

Description and location:

Usability criteria	**Poor**	**Excellent**
Clarity of purpose		
Intuitive switching		
Labelling and annotation		
Ease of use		
Indication of system response		
Degree of fine control		

Comments
There are no indications of movement for hot or cold water ot labelling. This is a highly non-intuitive piece of equipment, although the movement is good.

Translating usability evaluation into design

Clarity of purpose – is it clear what my design is for? Any ambiguity?

Intuitive design - does it map well from intention to interpretation and movement?

Labelling - is it as 'visible' as it can be, using all senses?

Ease of use – does it do what it is supposed to do easily for the user?

Feedback – does it show what it is doing and what is going on?

Degree of fine control - does it give a good range of control for the user?

Translating usability evaluation into process enhancement

Good solutions to design problems are not always product-based –
they can be process-based:

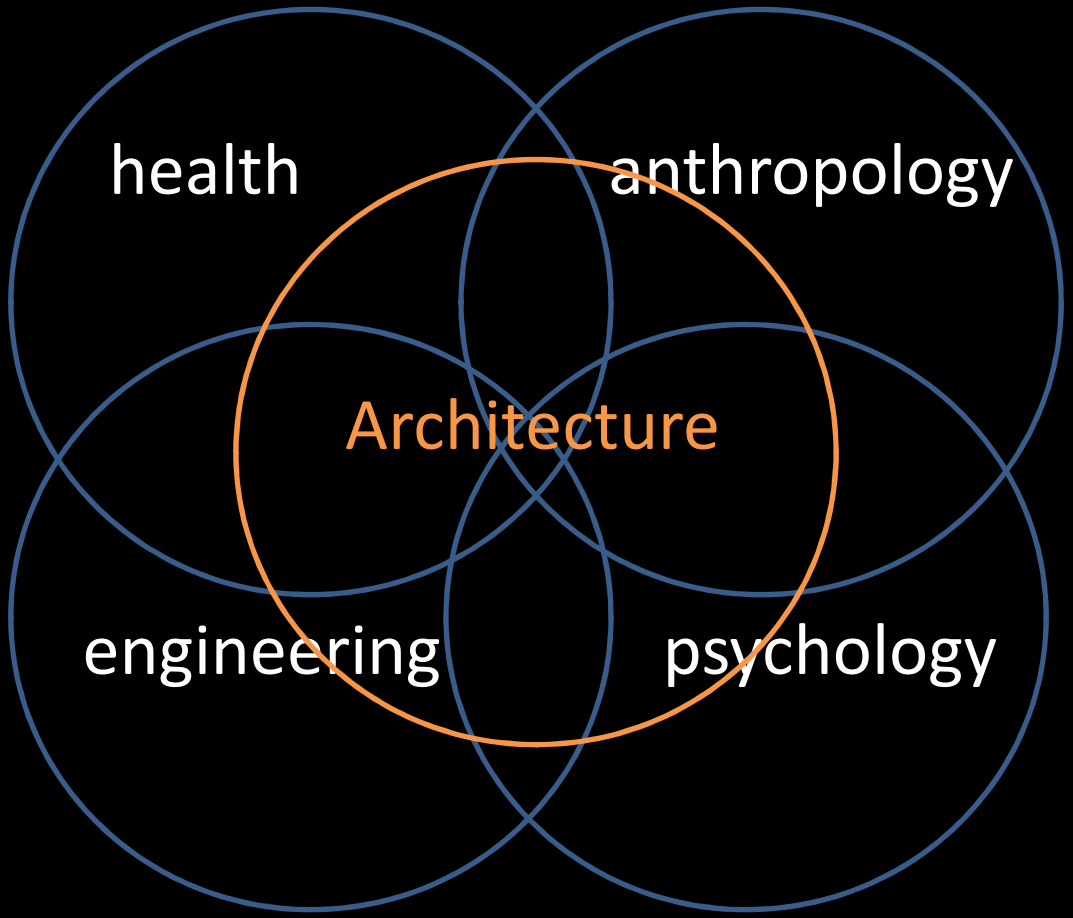
Dirty MVHR filters? – change indicator or SEND REMINDERS/FILTERS

Poor co-ordination of services/structure ?- ORGANISE CO-ORDINATION MEETINGS

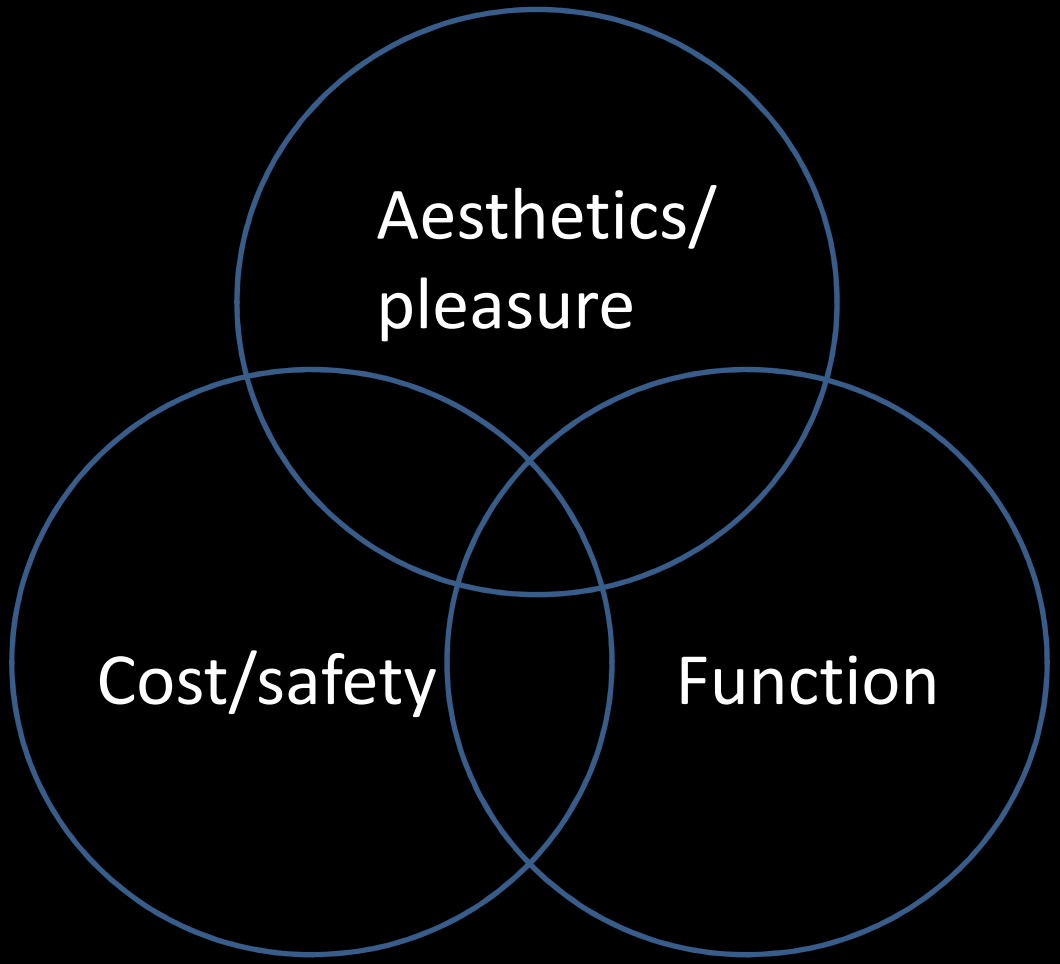
Short-life product? – ENHANCE AFTER SALES CARE, MAINTENANCE, UPGRADING

Don’t understand why it’s not working? – GET AN INTERDISCIPLINARY INSIGHT

Cross discipline.... for usable design



Striking a balance for usability....



The bigger picture.....usable design

Ergonomics and human factors need to become part of the low carbon design

Interdisciplinary design is no longer a luxury - it's essential!

Building performance evaluation feedback needs to go into brief for next building

Forget LCA - think of the usability of a building or product over time

We need to slow down our rate of use

RECYCLING IS NOT THE ANSWER (even 'upcycling') – IT'S RE-USE and USABILITY

an antidote....

‘One must still have chaos in oneself to be able to give birth to a dancing star.’

Nietzsche

Watch out for the ‘rear view mirror’ effect

We need to keep on imagining....

thank you....