

# EE + UD = COMFORT ?

Merging Energy Efficiency and Universal Design in Housing Renovations

## RESEARCH INFORMATION

### KEYWORDS

Energy efficiency (EE), universal design (UD), comfort, single family house, renovation, socio-technical approach, non-energy benefits,

### INTRODUCTION / CONTEXT

#### Context:

As part of the drive for greater sustainability in the building stock, public policy and societal objectives aim for higher numbers of housing renovations that accommodate lifelong living and significantly increase energy efficiency (Figure 1).

#### Research problem:

Despite much research on both UD and EE, these two fields are treated separately in literature and practice. However, this is a missed opportunity to create synergies and offer more complete and attractive renovation concepts (Figure 2).

### QUESTION / GOAL

#### Objective:

To increase the adoption of Universal Design and Energy Efficiency measures in housing renovations by investigating the possible synergies of a joint execution of UD and EE measures during renovation.

#### Central Research Question:

(How) can comfort be used to synergetically merge UD and EE measures in order to increase adoption of both for housing renovations?

### HYPOTHESIS / METHODOLOGY

**Hypothesis:** Comfort can be a unifier for EE and UD (Figure 3).

#### Method:

**Literature review** – Since there were no studies found that analyze EE and UD in tandem, they were individually considered with over 60 publications reviewed on adoption of EE measures, with focus on housing renovation and behaviour, and over 35 publications on UD.

**Survey** - A questionnaire was administered at the Universal Design Lab in Hasselt, Belgium in May-June 2015. The purpose was to get a feeling of people's attitude towards EE, UD and combination of the two.

**Workshop** – A workshop was carried out with participants at Include2015 conference in September 2015, London, England. It was designed in two phases: 1) completing in a group of 6 the terms and categories associated with "renovating their home with a focus on comfort"; 2) followed by a discussion with the whole workshop group of 36.

## RESULTS

### Literature:

The wealth of studies on the adoption incentives and barriers for EE is lacking in the field of UD. The few that focus on this topic (Goodman et al., 2006, Dong 2004) treat it from the perspective of professionals, rather than users. In EE users are often the subject and are treated as a rational consumer. However there is a trend towards identifying non-energy motivators using socio-technical approach (Aune 2007 and 2012, Bartieu et al. 2006 and 2014, Gram-Hanssen 2014, Mills & Rosenfeld 1996) and behavioural sciences (Dugan & Connolly 2013, Wolve & Hedrick 2012).

**Survey:** N=62. men=12, women=50, professionals=33, private=15, students=14 (Figure 4).

Comfort comes up as a significant, although not the most important, motivation for both EE and UD. Here comfort was not defined explicitly, but is implicitly separated from usability and flexibility. If a notion of comfort that includes both usability and flexibility is adopted, then comfort becomes the largest factor by far in motivating UD renovations. In addition, there was higher resistance to adoption of EE (18) and UD (17) measures individually than to adoption of their combination (10).

**Workshop:** N=36, 6 groups of 6 participants, 90 minutes (Figure 5 & 6).

Over the 6 groups made up of different UD professionals (designers, policy makers, researchers etc.) the concept of "comfort" at home consistently brought up the topics that are the focus of UD as well as EE renovations. These included "indoor climate", "accessibility", "usability", "lighting", "flexibility" etc. It is interesting to point out that these were often mentioned under "softer" themes such as "sensory", "atmosphere", and "social".

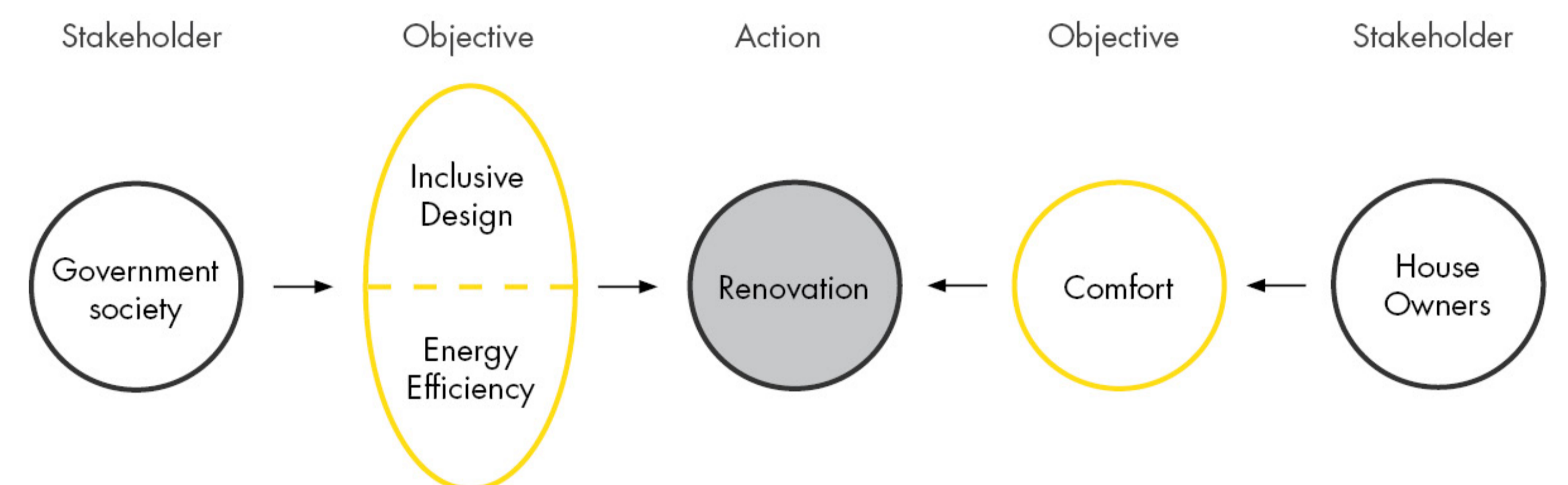
## CONCLUSION

The already established topics within EE (such as thermal comfort, humidity and air quality etc.) and UD (accessibility, usability, adaptability etc.) fall neatly within the physiological aspects of comfort. In this sense comfort can be seen as an umbrella concept that includes both UD and EE and also happens to be a key motivator for people that undertake house renovations.

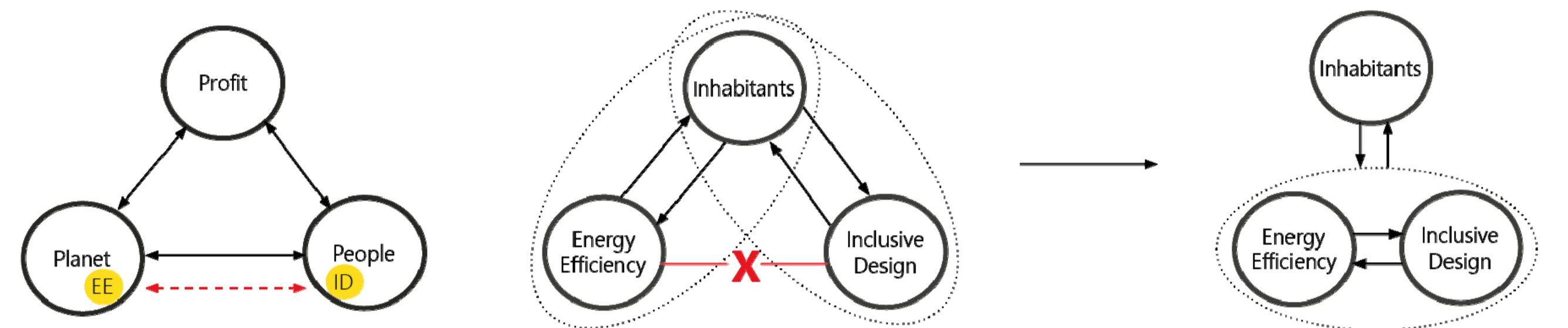
## CONTACT

Ermal Kapedani  
Email: [ermal.kapedani@uhasselt.be](mailto:ermal.kapedani@uhasselt.be)  
Tel: +32(0)11 29 21 69

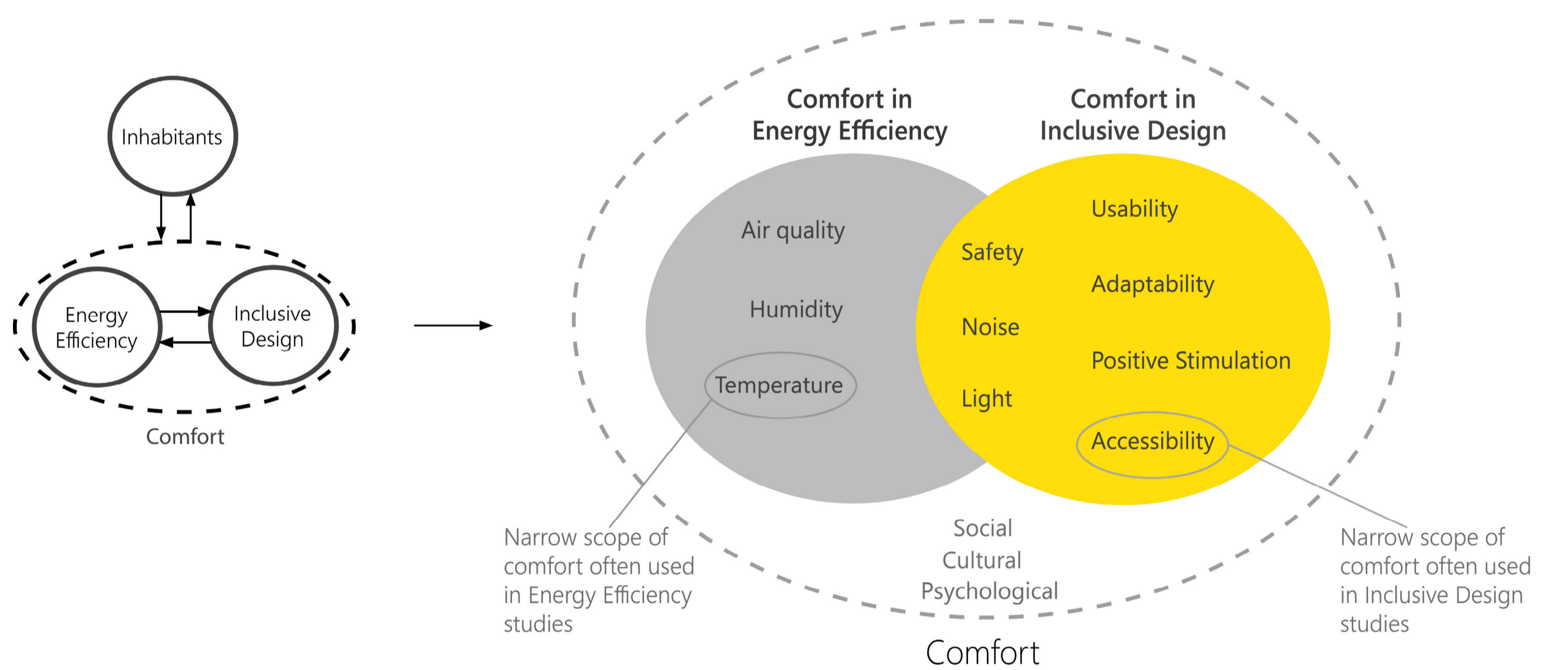
► Ermal Kapedani, Shana Bonneux, Jasmien Herssens, Griet Verbeeck



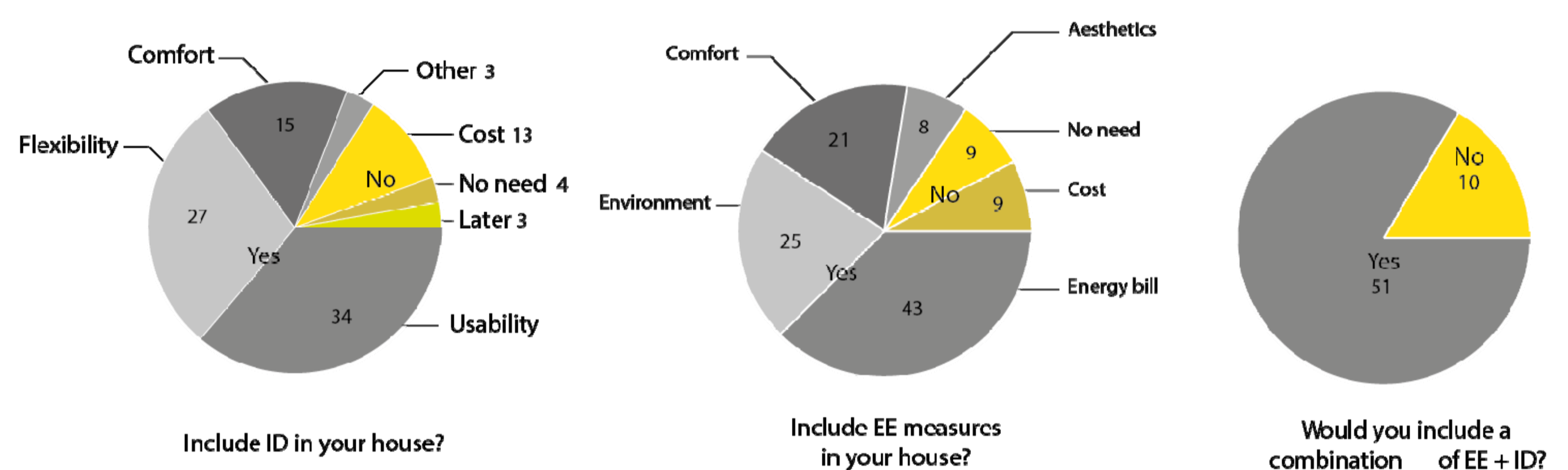
► Fig. 1: A miss-match of inhabitant and societal objectives



► Fig. 2: Theoretical context



► Fig. 3: Comfort as a unifying approach



► Fig. 4: Survey results



► Fig. 5: Include 2015 Workshop

- |                                                                                                                                                             |                                                                                                                                                      |                                                                                                                                                                     |                                                                                                                            |                                                                                                                                         |                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Group 1:</b><br>Access<br>Rest (usability/coziness)<br>Temperature<br>Sensory<br>Lighting<br>Entertainment (sociability, usability)<br>Inside-out spaces | <b>Group 2:</b><br>Built (accessibility, usability)<br>Natural (Thermal, Lighting, Sensory)<br>Proximity (urban level)<br>Social<br>Socio-functional | <b>Group 3:</b><br>Usability<br>Light<br>Personalization<br>Intimacy/pleasure<br>Accessibility<br>Fresh air<br>Atmosphere (sensory, thermal)<br>Wellbeing<br>Safety | <b>Group 4:</b><br>Adaptability<br>Personalization<br>Cleanliness<br>Sensory<br>Social<br>Sustainable (energy + materials) | <b>Group 5:</b><br>Materials<br>Temperature<br>Simplicity<br>Outdoors<br>Lighting<br>Peaceful (noise)<br>Welcoming (Social, accessible) | <b>Group 6:</b><br>Accessibility<br>Climate<br>Sensory<br>Light<br>Noise<br>Social<br>Privacy<br>Safety & Security<br>Virtuality<br>Maintenance |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|

► Fig. 6: Main themes of Comfort include UD and EE elements