

Use and Operation

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Behavioural plasticity and its consequences

The “problem” with humans: Behavioural Plasticity

Plasticity, then, in the wide sense of the word, means the possession of a structure weak enough to yield to an influence, but strong enough not to yield all at once. (William James, 1890)

Yield and resist

Resistance: The power of routines

- A host of cognitive biases e.g. “confirmation bias” (Tversky/Kahnemann 1972) (common among scientists, too!)
- Folk theories e.g. about thermostats (Kempton 1986)
- Patterned routines and habits as one aspect of social practices (among scientists too!)

Plasticity: “yield, but only conditionally”

- Domestication (Berker et al. 2006): mutual adaptation of technology/building and occupant
- Social practice (Shove et al 2012): connections between skills, meanings, things as key to understand stability and change
- Example: Folk labeling (Granderson et al. 2014)

Examples for folk labels



Figure 1:

(Thermal) comfort between standardisation and adaptation

The standard model for thermal comfort

- PMV/PPD: Predicted mean vote/Predicted Percentage Dissatisfied
- based on questionnaires and experiments in a climate chamber
- takes into account: air temperature, mean radiant temperature, relative humidity, air speed, metabolic rate, and clothing insulation
- does not account for plasticity

Adaptive thermal comfort

- (NS-)EN15251: Indoor temperature adjusted according to mean daily outdoor temperatures 7-30 days before the day in question (in naturally ventilated and mixed mode buildings)
- dimensions of adaptation covered by the standard
 - Behavioral (e.g. clothes)
 - Physiological (e.g. sweat)
- dimensions not covered
 - individual differences
 - gender
 - culture (e.g. which clothes are deemed appropriate)

Some findings

- Factors influencing yield and resistance in Norwegian households
 - deeply ingrained cultural values (“good and warm homes”, puritan asceticism)
 - family interaction (e.g. teenagers)
 - interaction with life in other buildings (e.g. work places)
- Domestication of Powerhouse Kjørbo as success factor
 - extended testing and adaptation in the early occupancy period
 - occupant complaints as rather imprecise but important “sensors”

The all-important middle-men

Standard approach

- Good technology just works - bad technology needs constant care
- Administration, maintenance, operation as low status work
- Delegate low status work to machines

Our approach

- The shock of the old (Edgerton 2006)
 - Things break down, become outdated, gain a second, third, fourth life or are abandoned quickly
 - High performance machines/buildings that depend on too many specific external and internal conditions are prone to break-down
- Some findings
 - teaching how to use advanced buildings is not a one-time job
 - good facilities managers know their buildings **and** their occupants

Concluding remarks

Ongoing research activities

- Living lab
- Evaluation of ZEB pilots
- Implementation of zero emission buildings (PhD Ann Kristin Kvellheim)

Closing the performance gap while catering for high comfort expectations

“Behind the back” (= not needing end-users’ collusion) energy efficiency is always preferable, but

- has to be verified
- occupants’ tolerance levels **can** be de/increased
 - errors decrease tolerance
 - the **possibility** (not necessarily the enactment) of plasticity increases tolerance
- from “what is acceptable” to “how can acceptance be made more likely”
- Even better: Creating opportunities for mutual adaptation that is beneficial to the goal
- Facilities management as mediator between technology and use