HUMAN FACTOR IN DESIGNING SUSTAINABLE ENVIRONMENTS

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THE PURPOSE OF DESIGN:

BEAUTY OR GUIDANCE TO SUSTAINABILITY - HOW DESIGN CAN GUIDE OR HINDER OCCUPANTS TO LIVE AND WORK IN A SUSTAINABLE WAY

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CONTENT

Design at different scales influences sustainable behaviour:

- Urban infrastructure
- Physical infrastructure
- Energy infrastructure
- Organisational infrastructure
- Social infrastructure

→ Impacts health infrastructure
→ Importance of delight and beauty in design

URBAN INFRASTRUCTURE

Good urban infrastructure can positively influence human behaviour, for example:

- Reduces car reliance through good public transport/walking and cycling connectivity
- Provide opportunities for sharing (spaces, bikes, car-sharing)
- Include other facilities nearby that can be easily reached
- Design connectivity to urban green space and leisure, supporting well-being

Obvious: if not provided, citizens cannot use it → 'nudge-architecture'

Cobe architects, Copenhagen, 20000 bikes, open space, water retention basin

URBAN INFRASTRUCTURE

- Not just new infrastructure, we need transformation of existing cities to encourage more sustainable lifestyles, e.g. Barcelona super blocks
- **Benefits:** less resource use, less pollution, less noise, opportunities for social infrastructure → healthier residents

Baseline situation

Superblocks model

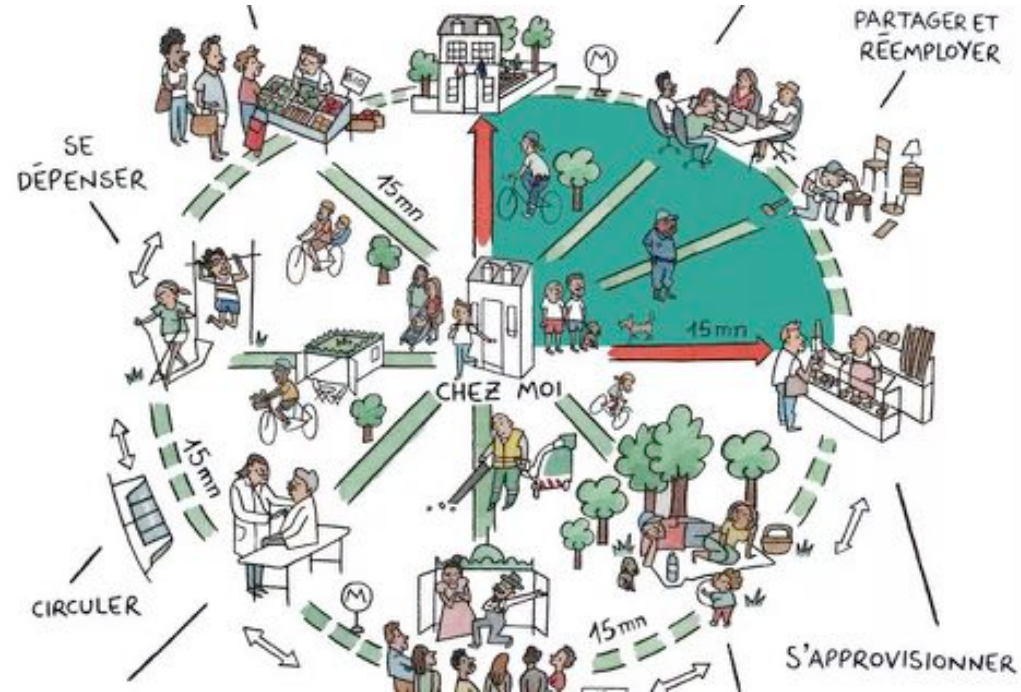
https://theconversation.com/superblocks-barcelonas-car-free-zones-could-extend-lives-and-boost-mental-health-123295

URBAN INFRASTRUCTURE

→ **Good urban infrastructue is aligned with principles of the '15 minute' city concept -** *"la ville du quart d'heure" (by foot or bike)*

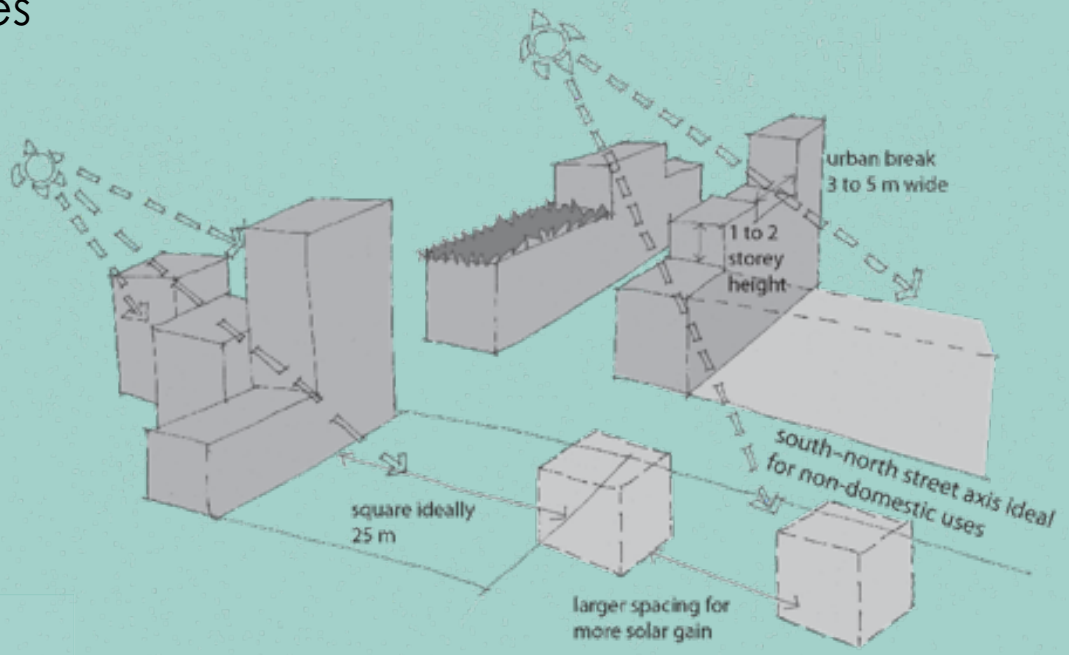
- Everything nearby the home
- Helps provide **social infrastructure**

→ **danger that used by developers to overly densify for economic gains, and without balancing housing with other functions to support residents**



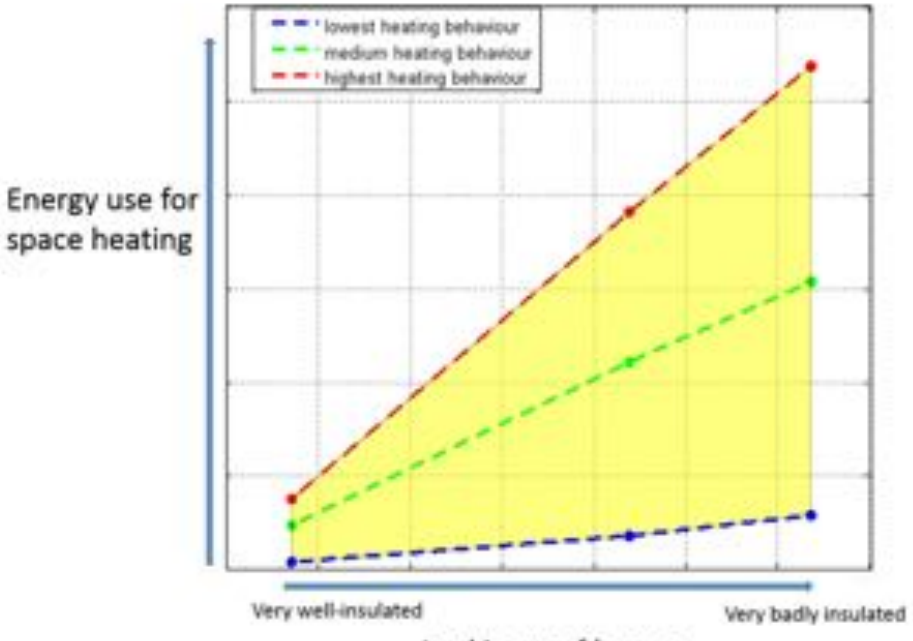
URBAN INFRASTRUCTURE

- A well designed urban environment also makes it easier for architects to optimise the creation of low energy developments
- This in turn makes it easier for occupants to live sustainably (as the physical infrastructure supports it). For example:
  - creating a pleasant micro-climate (i.e. reduced urban canyons, minimising urban heat island effect)
  - **Urban breaks** and living spaces facing the solar path in northern countries



PHYSICAL INFRASTRUCTURE

- Good building design can support occupants to live sustainably and make it easy for them 'without thinking'.
- For example high fabric efficiency standards are robust to different user behaviours (see graph)
- Occupants use energy in the building to be comfortable, but comfort is affected by the building
- So we need to create well insulated buildings as we can 'control' that and not resident's behaviour



Yellow band shows different user behaviour in retrofits
Jennifer Love, https://energyandlife.wordpress.com/

PHYSICAL infrastructure

→ E.g. Passivhaus standard performs well due to high fabric standard
- Designed to reflect orientations (reduce heat loss)
- Only people are needed to heat a building (in reality a small heating system still needed)
- But! can overheat in summer without solar shading → ensure residents are thermally comfortable (if not: risk they will purchase air-conditioning → so links back to GOOD building design)

Allmann Sattler Wappner + Transsolar Germany

PHYSICAL INFRASTRUCTURE

Another example…

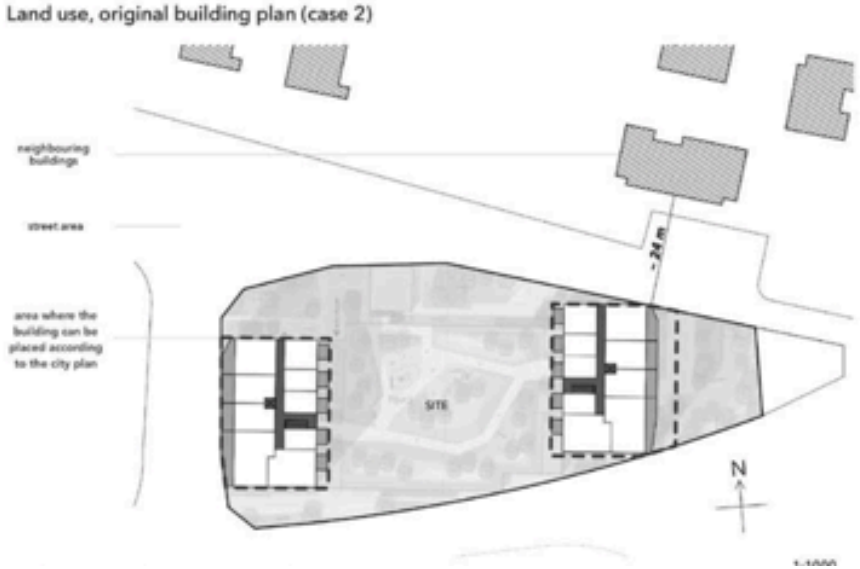
A shallow dwelling plan is also important in housing to enable sustainable lifestyles. This is because:

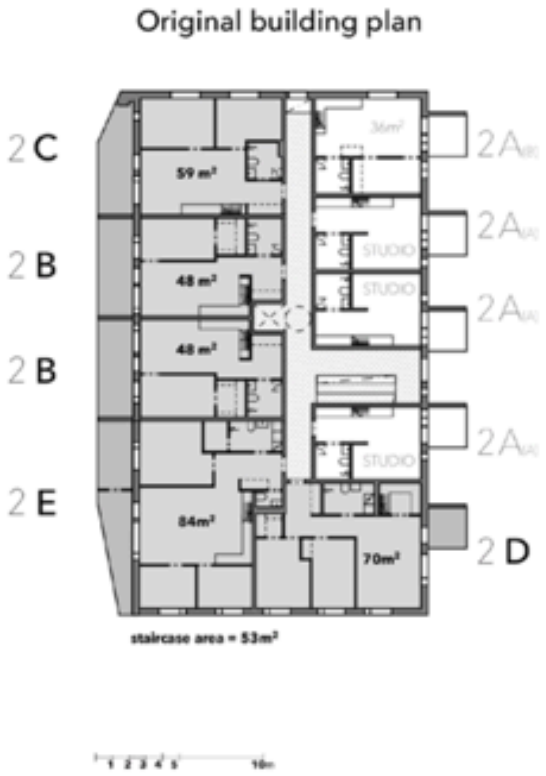
- It enables good daylighting, reducing the need for artificial light and associated energy use
- It supports more adaptable plan layouts so that residents can stay when life situations change: they invest in their community
- Less risk of summertime overheating (easier to ventilate)

→ Combined with better connections to outdoor spaces and greenery, shallow plan support occupant health and well-being (so reduced pressure on health infrastructures)

PHYSICAL INFRASTRUCTURE

Example of deep plan; highlights connection of city scale (urban infrastructure) on building depth and apartment depth (physical infrastructure) – work by Sini Saarimaa



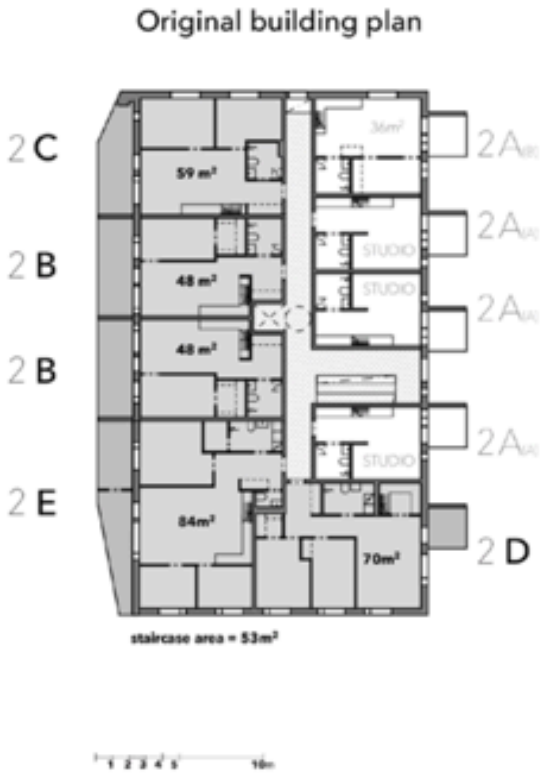


Saarimaa, S. Pelsmakers, S., (2020) Better Living Environment Today, More Adaptable Tomorrow?, Comparative analysis of Finnish apartment buildings and their adaptable scenarios, in the Finnish Journal for Urban Studies- https://journal.fi/yhdyskuntasuunnittelu/issue/view/6813/1065

PHYSICAL INFRASTRUCTURE

Typical example highlighting problems in today's Finnish housing stock:

→ Too many units that are too small (6 of 9 are 1 room or 2 room apartments)
→ Units typically have only windows on one side (i.e. single aspect)
→ Units are too deep plan so they have bad daylighting (6 meters or deeper)
→ And are in-adaptable



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PHYSICAL INFRASTRUCTURE

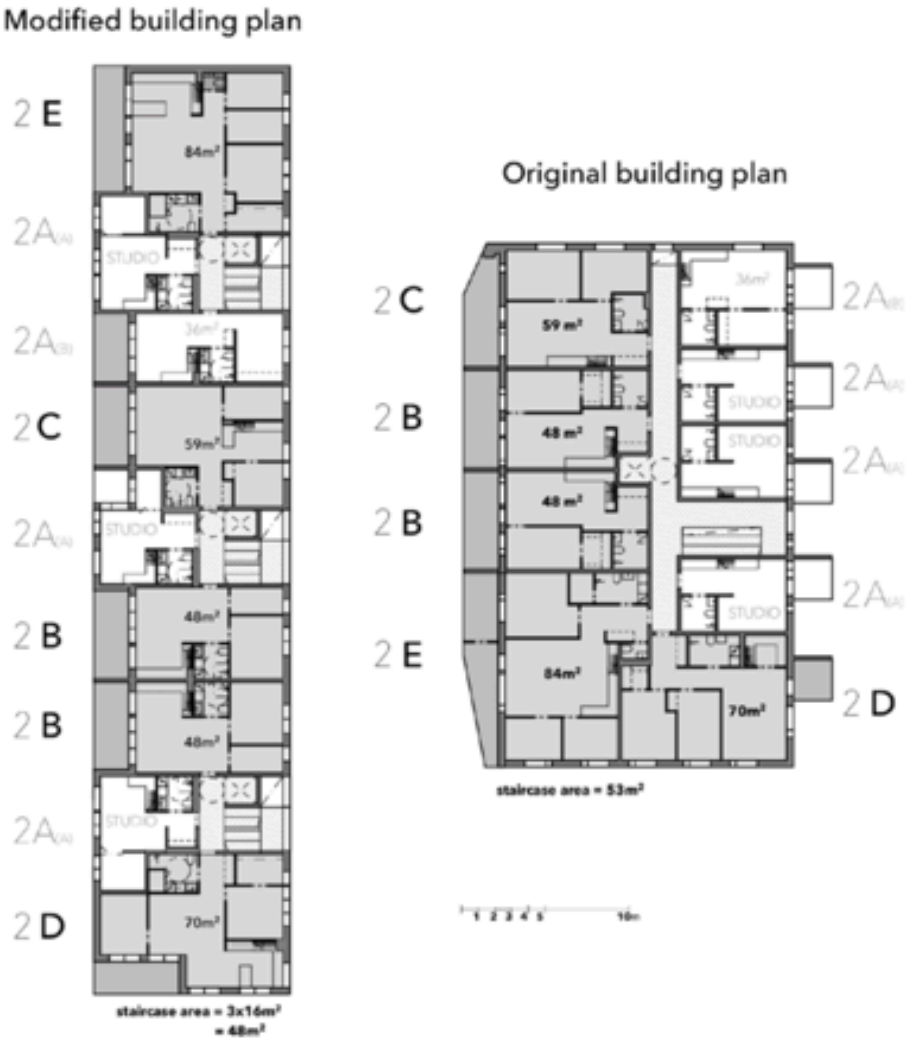
Improved design by Sini Saarimaa:

→ **requires re-design of the block:** from fat to slim!

→ **3 instead of one entrance**/lift and stair core; removes long corridor

→ **better daylight** with 2 orientations through **L-shaped plans** and units facing the façade directly instead of with balcony overhanging

→ **increased adaptability**



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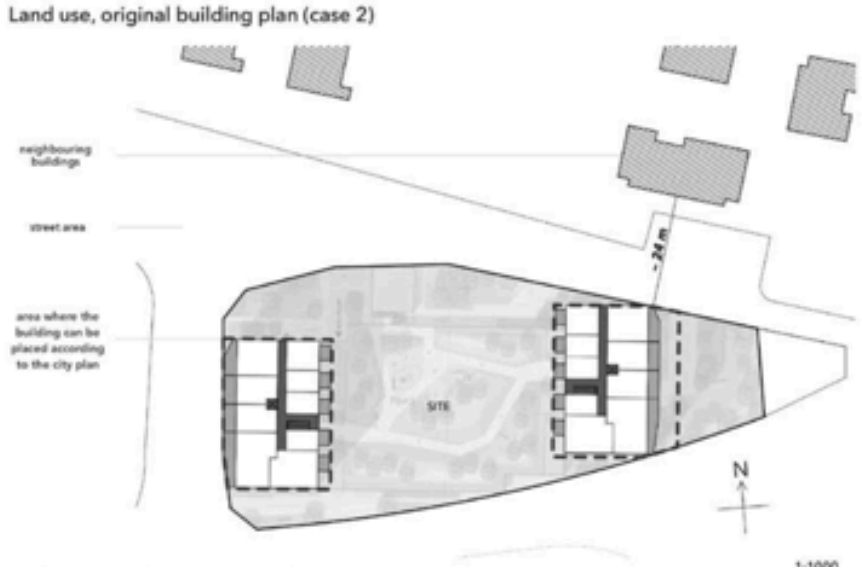
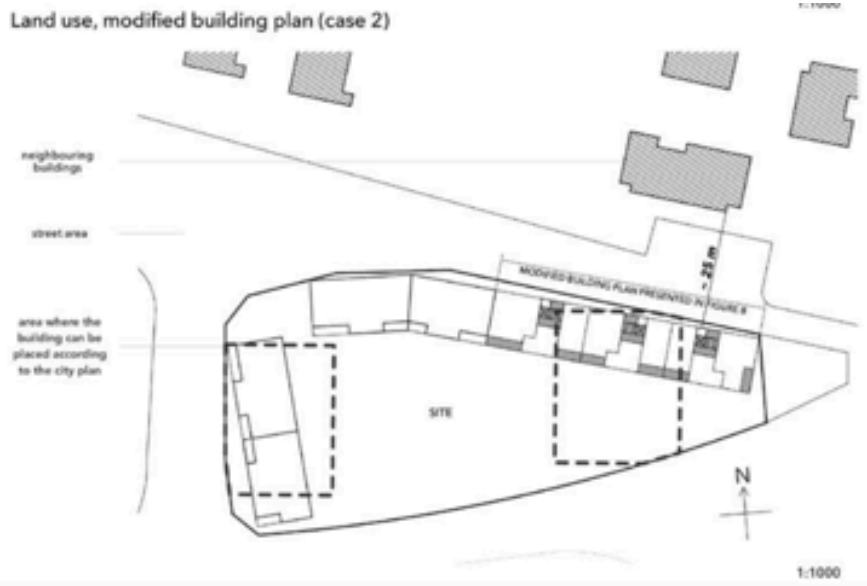
PHYSICAL INFRASTRUCTURE

→ the re-design still fits the site
→ and is much more sustainable and encourages more sustainable behaviour *(better solar gain, daylight, better quality living & adaptable so more invested in the community)*
→ **Highlights connection between urban and physical infrastructure and ability to support or hinder sustainable behaviours and lifestyles**
→ **More costly? But what is cost of NOT building better?**





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PHYSICAL INFRASTRUCTURE

We need to be careful!

- Be careful trading-off between compact form (less heat loss) and good opportunities for daylighting, compromising well-being.

- Developers use the excuse of ever smaller units (more 'ecological') to build at higher densities for more profit – and reduce opportunities for sustainable living as density alone is not enough.

- Trying to change occupant behaviour only makes sense if there is evidence it is not bad building or services design that is responsible for unsustainable consumption or behaviour.

- Often we blame occupants for high energy use, while it is not their fault and the building is not well designed or commissioned for the user – POE and BPE are crucial (Post Occupancy Evaluation & Building Performance Evaluation).

→ *See next example*

ENERGY INFRASTRUCTURE

Careful design of efficient and clean energy infrastructure is needed, and when we forget about '**human factors**' things go wrong…

Example: Strata Tower, London – 3 micro-wind turbines

- Expensive (approx. 1,5 million € for supplying 8% of predicted energy needs)
- BUT! Switched off at night due to noise and vibrations when residents complained

→ **Not a lot of electricity production**

→ **it is NOT the residents fault, but design issues to blame;** does NOT work in most urban areas (windspeeds are too low and inconsistent)

ORGANISATIONAL INFRASTRUCTURE

Estate and city management can support and enhance sustainable lifestyles, or hinder it. For example:

- Easy to recycle with clear collection points and times
- Easy to grow food and compost if appropriate facilities are provided
- Easy to look after and monitor, e.g. ventilation filter cleaning etc.

KEY:

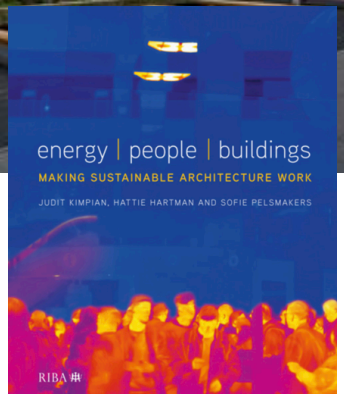
1. Involve stakeholders before/after: understand and act on what they want and need, including facilities managers!
2. Easy to use controls!
3. User manuals for occupants
4. New tenants require new re-commissioning of systems to suit their lifestyle or working practices and needs
5. Undertake POE and BPE (Post Occupancy Evaluation & Building Performance Evaluation)

ORGANISATIONAL INFRASTRUCTURE

Loxford school – AHR architects, Judit Kimpian

An example of facilities management impact on occupant behaviour and energy use

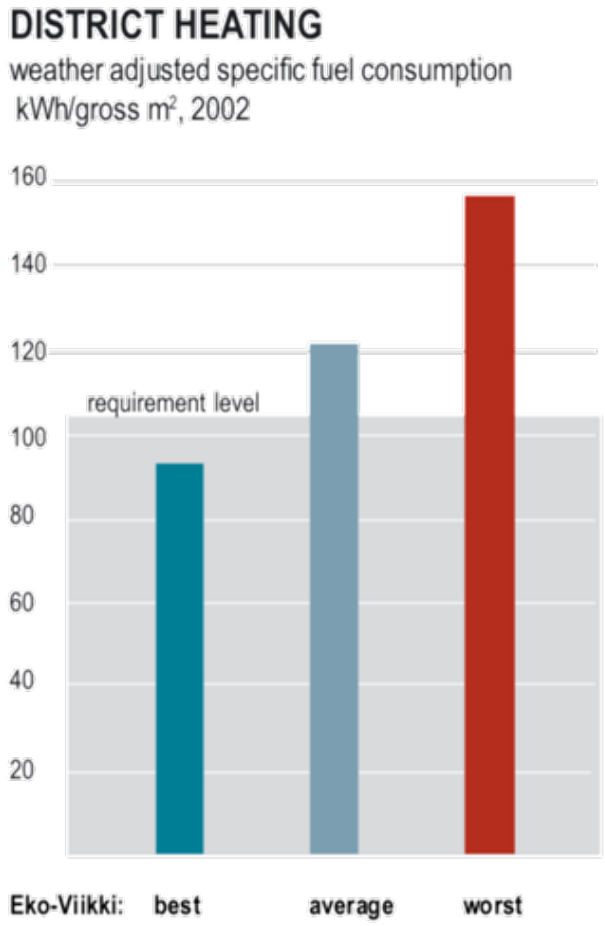
→Fire-doors open onto a large foyer area
→doors could not be opened from the outside, occupants propped open the doors as a short cut between different parts of the school
→cold air in/heatloss
→offset by higher heating because people were cold in the foyer, increasing energy use and costs
→ heat could not be delivered by the ground source heatpumps as too high demand so used fossil fuel boilers instead (and CO_2 emission reductions not achieved)
→We only know this because the architects monitored performance post-completion!
→Facilities managers were informed and it was resolved by a simple latch for the door to be openable from outside!



ORGANISATIONAL INFRASTRUCTURE

→ Sustainability is not achieved 'on paper' only: we need to go back and check that our designs and interventions work, fix things and learn from them!

→ **Not just about energy/carbon, but user satisfaction, IEQ and the 'human factor' too**



Klinenberg, Eric. (1999). "Denaturalizing disaster: a social autopsy of the 1995 Chicago heat wave. Theory and Society, vol. 28, no. 2, 1999, pp. 239–295. JSTOR, www.jstor.org/stable/3108472.

SOCIAL INFRASTRUCTURE

- → Spaces and places can support community encounters, e.g. a lively pedestrian environment, well-maintained parks, and local commercial services, community spaces at urban and building scale, creating a 'social infrastructure' that supports residents
- → Can encourage people to get together and support each other
- → Reduces isolation, important for people who live alone and the elderly
- → **Research showed that the characteristics of the built environment are of considerable importance to human health and well-being.** (Klinenberg)
- → Can reduce mortality (Klinenberg)

SOCIAL INFRASTRUCTURE

Example: Helen & Hard, Vindmøllebakken co-housing in Norway; 40 units, collaboratively developed

SOCIAL INFRASTRUCTURE

Example: Helen & Hard, Vindmøllebakken co-housing in Norway; 40 units, collaboratively developed

HEALTH INFRASTRUCTURE

All of this has an impact on sustainable lifestyles, which in turn impacts health infrastructure.

→ Good health and well-being = not just the absence of disease.
→ **Also social justice issues and an equitable carbon neutral transition**
→ **Inequalities exacerbate health impacts in society**
→ **Our designs can support or hinder that**
→ **Overcrowding:** evidence of increased COVID-19 infection & death (USA, UK, Singapore). In Finland, 20% of people live in overcrowded conditions.

Cramped housing has helped fuel spread of Covid in England – study

Overcrowding, which makes it harder to self-isolate, may have increased death rate in poorer areas

Poor housing linked to high Covid-19 death rate in London borough

Inquiry says poverty and overcrowding in Brent create ideal conditions for the virus

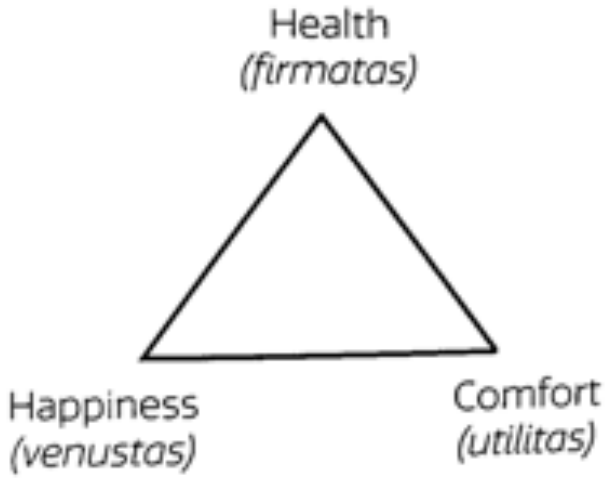
Coronavirus – latest updates
See all our coronavirus coverage

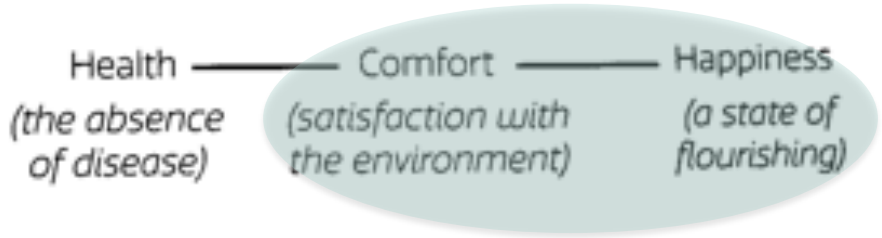
The Health Foundation, (2020), Emerging evidence on COVID-19's impact on health and health inequalities linked to housing, https://www.health.org.uk/news-and-comment/blogs/emerging-evidence-on-covid-19s-impact-on-health-and-health-inequalities

Khansa Ahmad et al, (2020) Association of poor housing conditions with COVID-19 incidence and mortality across US
counties, PlosOne https://doi.org/10.1371/journal.pone.0241327

HEALTH INFRASTRUCTURE

→ Good health and well-being = absence of disease + comfort + flourishing





Nick Baker and Koen Steemers (2019), Healthy Homes, Designing with light and air for sustainability and wellbeing, Riba Publishing

IMPORTANCE OF DELIGHT & BEAUTY

Lance Hosey:

"*Aesthetic attraction is not a superficial concern — it's an environmental imperative. Beauty could save the planet*"

→ based on the premise because that what we love is what lasts and what we look after

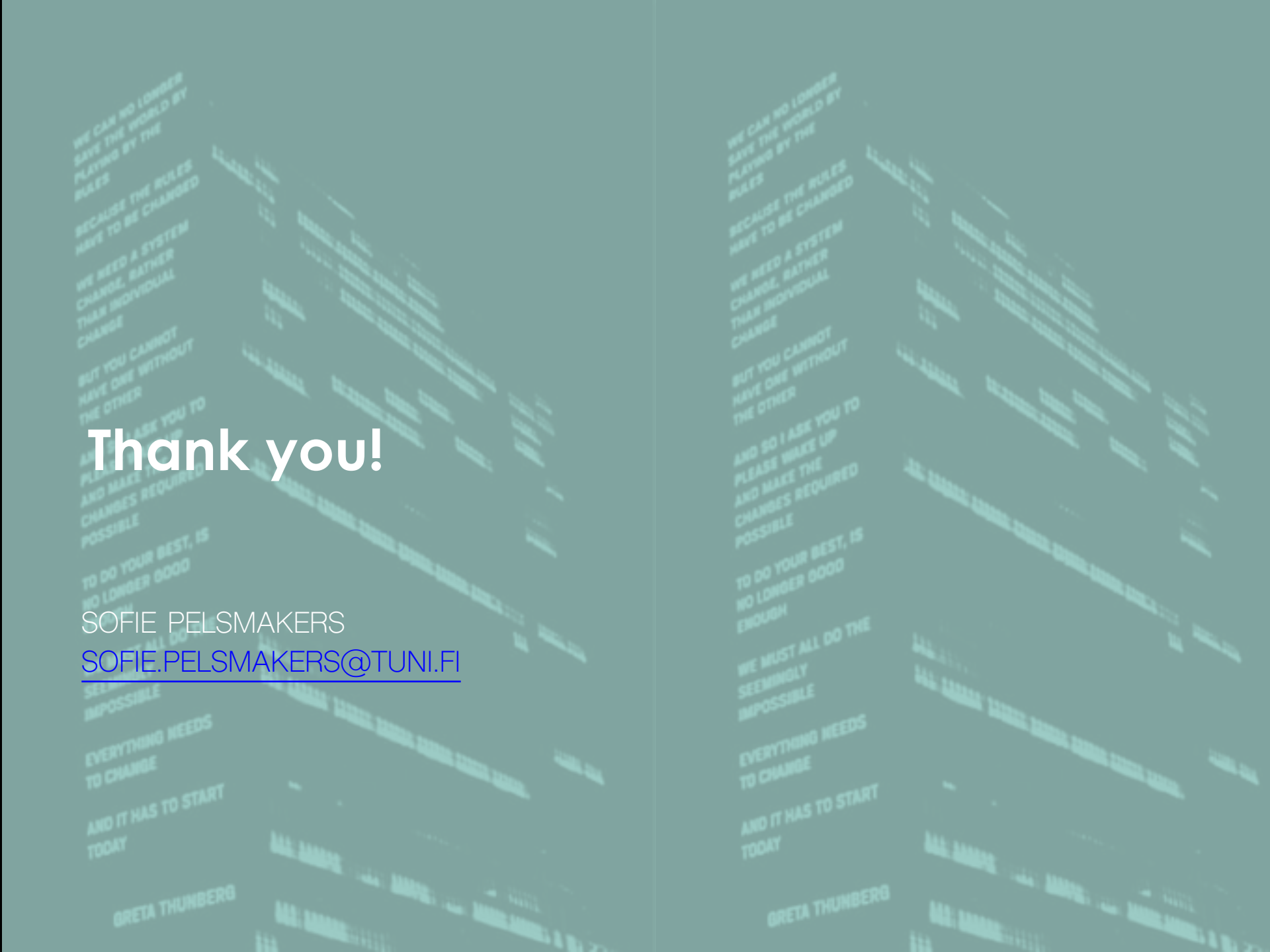
→ **About happiness and delight** and a state of flourishing

IMPORTANCE OF DELIGHT & BEAUTY

"Imagine a day when we've perfectly solved the challenges of energy, resources, and emissions, and everything we do and make is clean, harmless, and infinitely renewable.

Is that enough?"

Lance Hosey (Shape of Green)



Thank you!

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