CENTRE FOR RESEARCH INTO
ENERGY DEMAND SOLUTIONS

Clothing, comfort and energy demand: A critical review

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eceee 2021 Summer Study

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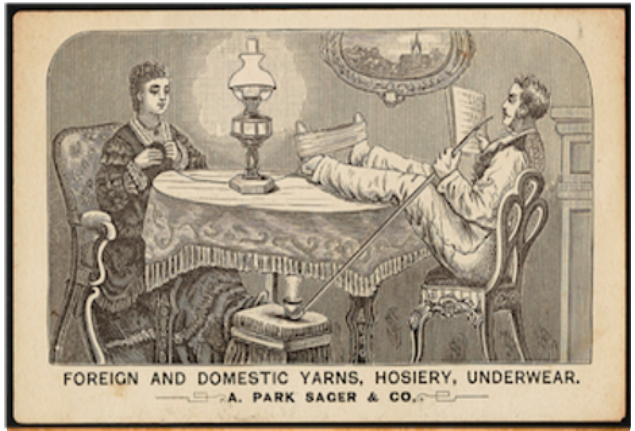
Why clothing?

- ‘Systems of clothing’ (fashions) have changed
- More casual, lighter & less insulating (Morley, 2014)



Images: Boston Public Library, Micheal Bentley

https://eprints.lancs.ac.uk/id/eprint/126967/1/2014morleyphd.pdf

Clothing: part of the energy system

- Clothing is part thermal comfort
  - More clothing insulation should mean comfort at lower temperatures
- Lower indoor winter temperatures reduce energy demand
  - 19°C > 18°C = 13% reduction in energy (Palmer, Terry & Pope, 2012)

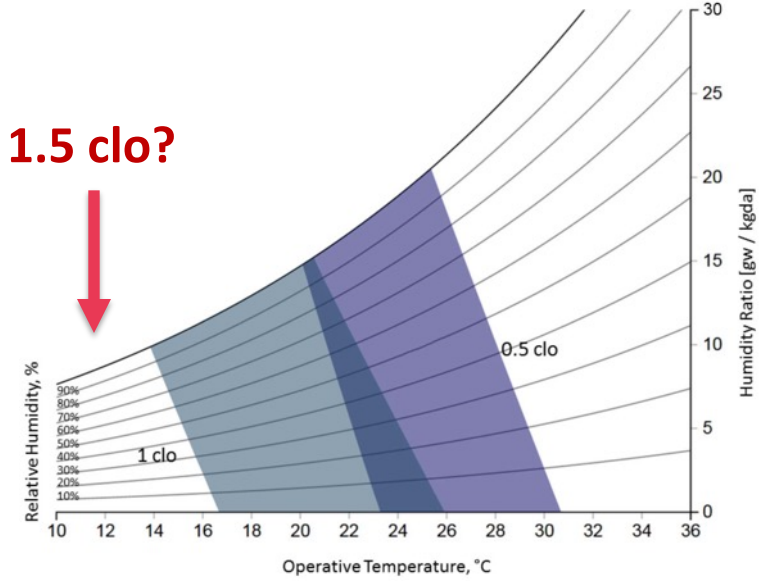
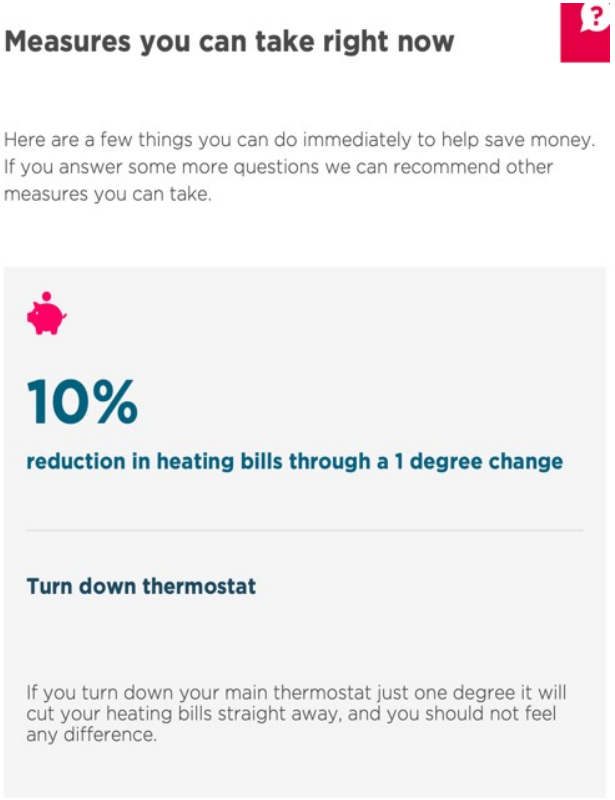


Fig 1. Acceptable range of operative temperature and humidity ratio based on ASHRAE Standard 55. The chart was created using the Center for the Built Environment (CBE) Thermal Comfort Tool.

Kontes, Georgios D.; Giannakis, Georgios I.; Horn, Philip; Steiger, Simone; Rovas, Dimitrios V. 2017. "Using Thermostats for Indoor Climate Control in Office Buildings: The Effect on Thermal Comfort" *Energies* 10, no. 9: 1368. https://doi.org/10.3390/en10091368 (CC BY 4.0)

Turn down the thermostat?

- Energy saving advice for householders
- No broader policies to support this
- Evidence of increases in room temperature
  - Germany
  - UK
- Increases associated with improved insulation and heat pumps



UK Government-sponsored advice. March 2021
https://www.simpleenergyadvice.org.uk/energy-efficiency/reduce-bills

Comfort is socio-cultural

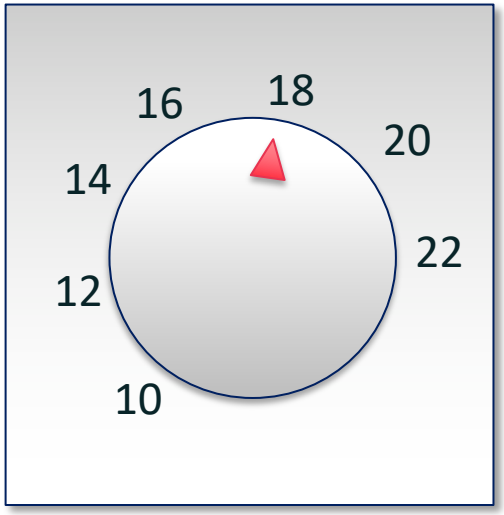
"Instead of expecting standardized conditions indoors all year round, people may become used to greater variety such that they expect to be colder than at present during the winter and warmer than at present during the summer. If this were the case, **seasonal fashions** might provide an important means of managing climatic variation. **Clothing, combined with much more elastic definition of comfort, could significantly reduce energy demand** and provide a means of accommodating global warming without adding to the problem itself. More elaborately, **new clothing technologies** could be developed to provide for insulation and environmental control, so taking the pressure off the indoor environment"

Chappells and Shove, 2005: 38

'The Fashions', November 1867. Visiting toilet, indoor toilet and costume for a little girl from eight to ten years old National Portrait Gallery London (CC BY-NC-ND 3.0)

Sufficiency and decarbonisation

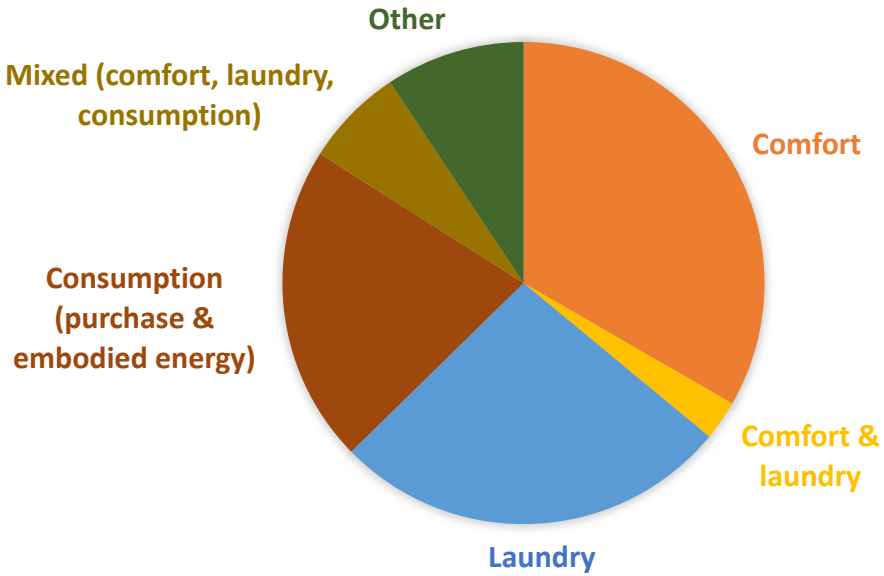
- Services: Acceptable temperatures (Darby, 2007)
- Coolbiz: policy example of 'sufficient' cooling
- Insulation: will acceptable temperatures rise?
- Heat pumps: a moment to embrace change in 'comfort concepts'?



Review

1. Journal search: key terms
   - **Energy Research and Social Science**
   - **eceee Summer Study**
   - Energy Policy
   - Energy and Buildings
   - Buildings Research and Information
2. Scopus: key terms (title, abstract, keywords)
3. Snowballing

Energy Research & Social Science



Mentions ‘clothing’ and/or ’clothes’

Search: ‘clothes’, ‘clothing’ or ‘garments’

= 202 articles (2014-2021)

Sample of 75 ‘most relevant’

= 33% related to comfort

= 27% related to laundry

= 21% ‘consumption’-related

Search: ‘clothes’ OR ‘clothing’ in title, abstract or keywords

= 8 articles

= 3 related to comfort

ERSS (title, abstract, keyword)	eceee Summer Study
Sahakian et al. (2021) Challenging social norms to recraft practices: A Living Lab approach to reducing household energy use in eight European countries	Poskanzer et al. (2019) **Dressing for the anthropocene: mitigating climate change through cooler clothing**. **Poster**
Huebner et al. (2016) Saving energy with light? Experimental studies assessing the impact of colour temperature on thermal comfort'	Pagliano et al. (2009) Evaluation of building envelope retrofit techniques for reducing energy needs for space cooling
Chen et al. (2020) Culture, conformity, and carbon? A multi-country analysis of heating and cooling practices in office buildings	Sahakian et al. (2019) Challenging conventions towards energy sufficiency: ruptures in laundry and heating routines in Europe

eceee Summer Study (1993-2019)

Search: clothing/clothes
24 results over 15 years
Almost all about laundry (dyers especially)

Search: clothing/clothes/dress + heating/comfort
2-5 results (mostly dryers)
2 relevant papers
+ 1 (not returned in searches)

No *full* articles *specifically* about **clothing, comfort and energy demand** in these two major energy 'venues'

Uses / conceptualisations*

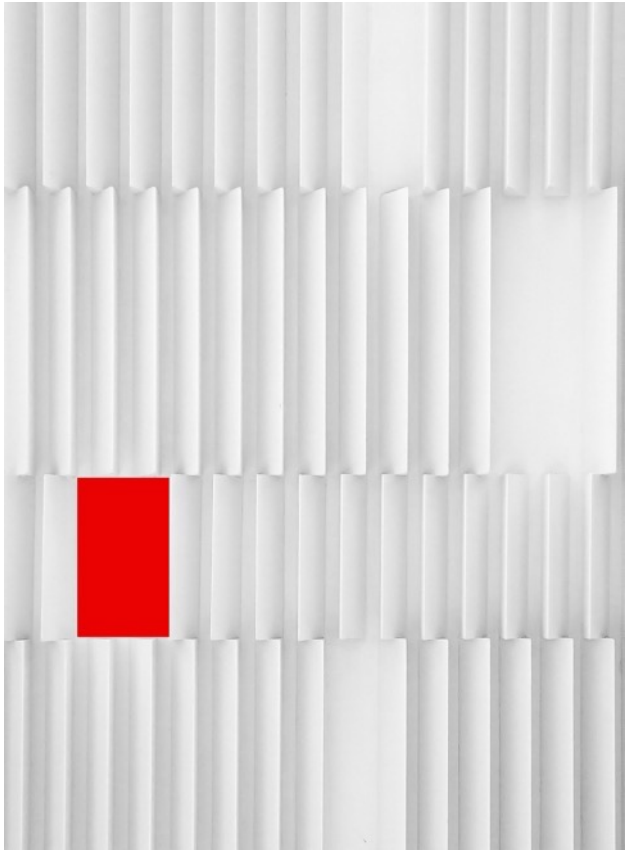
1. Clothing as adaptative response
2. Clothing as alternative to turning up the heating (or cooling)
3. Clothing as part of 'comfort cultures' and practices

*From analysis of eceee papers & subset of 16 ERSS with most discussion of clothes/clothing

1. Adjusting clothing as adaptive response

Behaviour when people feel cold or hot

- "changes in clothing level, interpreted as thermal discomfort responses" (Huebner et al., 2016: 45)
- "**personal adjustments such as putting on extra clothes** are generally preferred over technological solutions such as adjusting thermostats in reaction to thermal discomfort" (in offices) (Chen et al, 2020)



2. Adjusting clothing as alternative to heating

Use of clothes *instead of* heating

- As a 'measure' of energy saving behaviour
  (Aguirre-Bielschowsky et al 2018, Walker et al 2014)

- Out of necessity - affordability/performance
  - "half of the respondents have to wear extra clothes (53.6%)" (Barnicoat and Dansen, 2015)

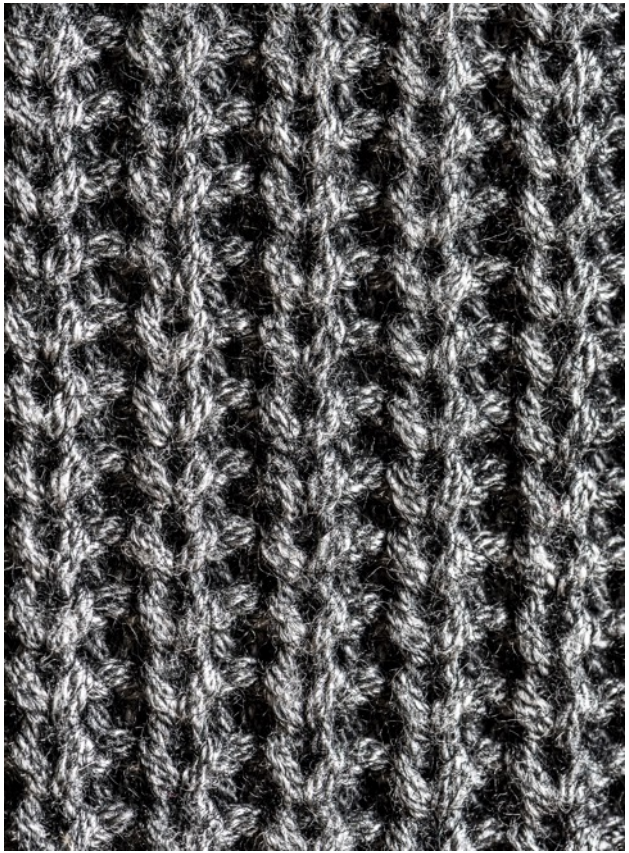
- Out of choice / by preference
  (Hampton, 2017; Hitchings et al, 2015 , Sahakian et al, 2021)

3. Clothing as culture: part of comfort (and other) practices

What people wear as culturally and historically specific

"Keeping the body warm has been the predominant practice over decades. It still represents a dominant meaning influencing practices in some regions. In Portugal, for instance, practices of keeping the body warm are still common, rather than using central heating (due to rural history of Portugal)" *Wolff et al 2017: 70*

"Clothing, the use of language and the embodiment of authority through physical competences such as posture are all important in these [office] environments" *Hampton, 2017: 4*



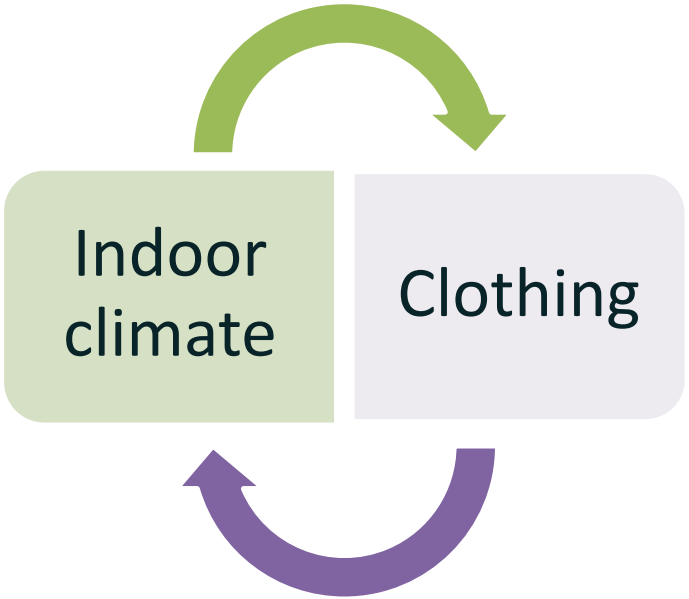
Clothing: Adjustment & adaptation?

1. Adjustments… in a given context

But ‘clothing’ is more than **‘more or less’**

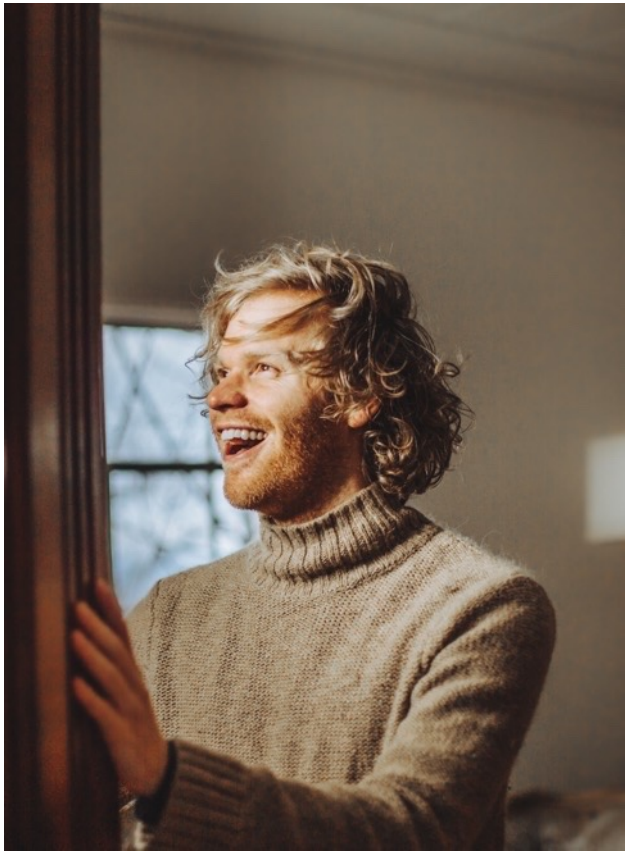
2. Adaptation implies
   - Modification (from a prior version)
   - Better fit to environmental conditions (i.e. climate)

But indoor **climates** are also ***adapted to*** **clothing**



Findings: ERSS subset

1. For some, wearing 'extra' clothing itself uncomfortable
   - "*Having to* wear (extra) clothes" often *defines* uncomfortable conditions
2. For others, warm clothes are welcome & normal
3. For those in fuel poverty, warm clothing can represent stigma and/or normal ways of keeping warm



Bringing 'clothing' into fashion?

Engineering / comfort science
Textiles & clothing innovation; links between clo & comfort in practice e.g. diff social groups; clo surveys; 'potential' for changes

Clothing methods

Case studies
Thick jumper day; organisational policies; policy interventions and narratives; cool homes

Fashion
Sustainable fashion; provision and marketing of warmer clothes; histories and trends; office & home

Experimental
Designerly & co-design approaches: what works?

Ethnographies
Wardrobe studies; seasonality; interaction with new heat services (e.g. heat pumps)

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Please get in touch

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