



Key Drivers for Residential Cooling Demand The User Perspective

Julia Mittermüller & Farzan Banihashemi

Ludwig-Maximilians-Universität Munich
Department of Sociology
j.mittermueller@lmu.de

Technical University of Munich
Institute of Energy Efficient and Sustainable
Design and Building
farzan.banihashemi@tum.de

Key Drivers for Residential Cooling Demand - The User Perspective



The Conventional Approach: Modelling Cooling Demand

Overheating Hours



Input data:

- weather data
- building geometries
- materials, windows
- air exchange rate
- shading by buildings
- ...

Cooling Demand



- treshhold 26°C
- building volume
- ...

Who Defines the Cooling Demand – Buildings or Residents?

what simulations predict it feels like



what it really feels like



The Mixed-Methods Study

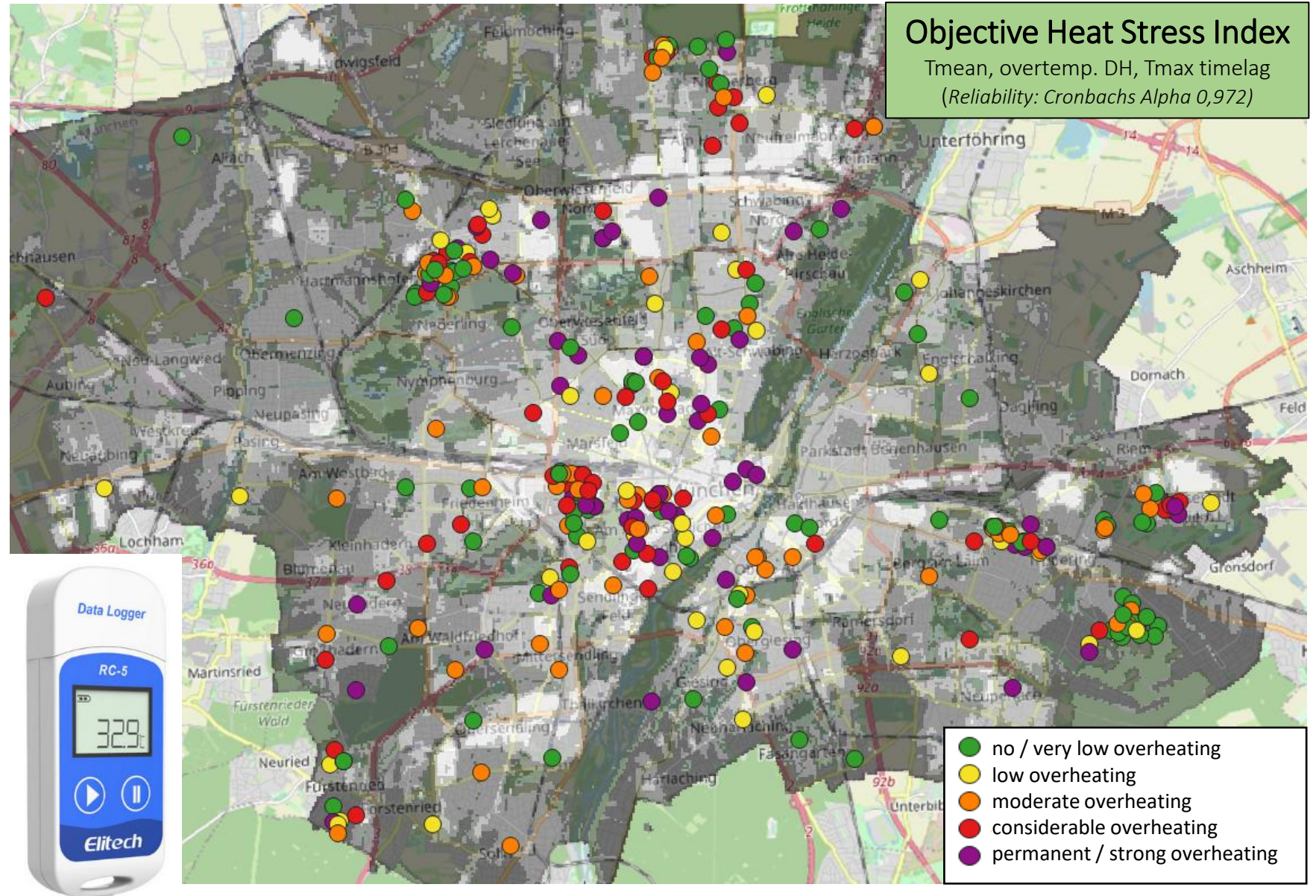
Research project „Green City of the Future“
(LMU, TUM, City of Munich, IÖW)

Diversity of

- building structures
- social structures
- microclimates

Household survey
in summer 2020 (n=731)
→ SPSS analysis, geocoding

Air temperature monitoring
in August 2020 (n=342)
→ overheating analysis
→ matched with survey data
→ SPSS analysis, geocoding



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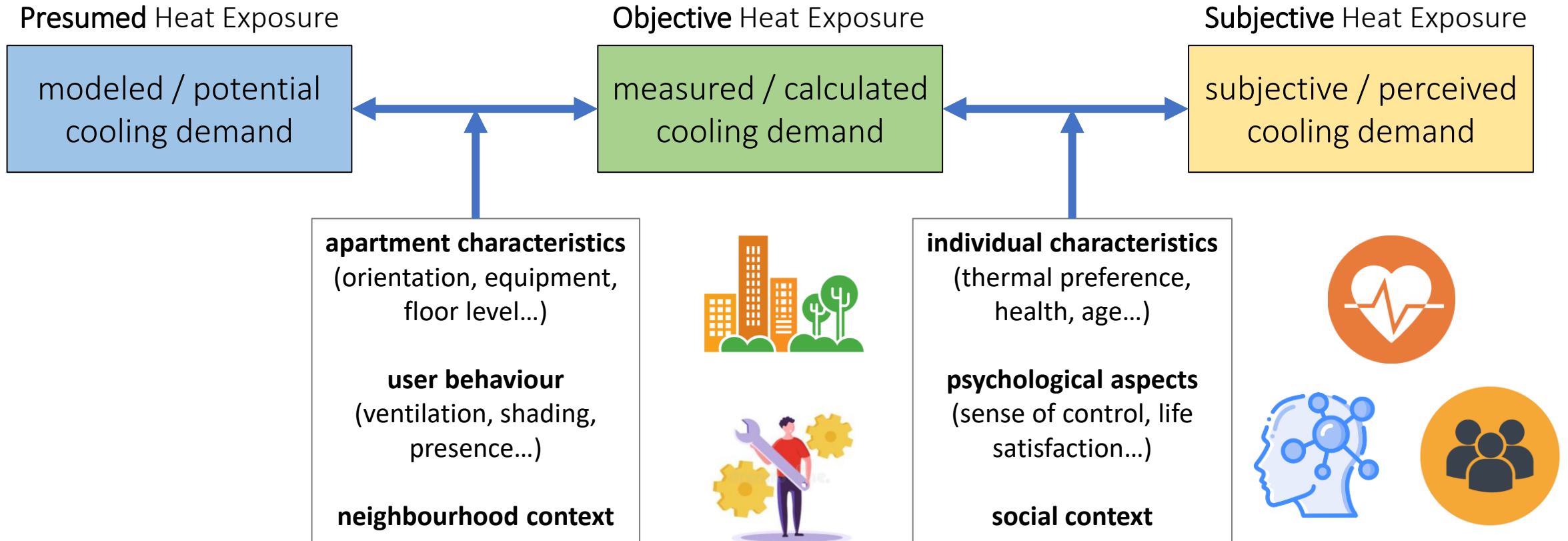
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Computer simulation
→ overheating analysis
→ cooling demand model



Comparing Heat Exposures: Filling the Gaps

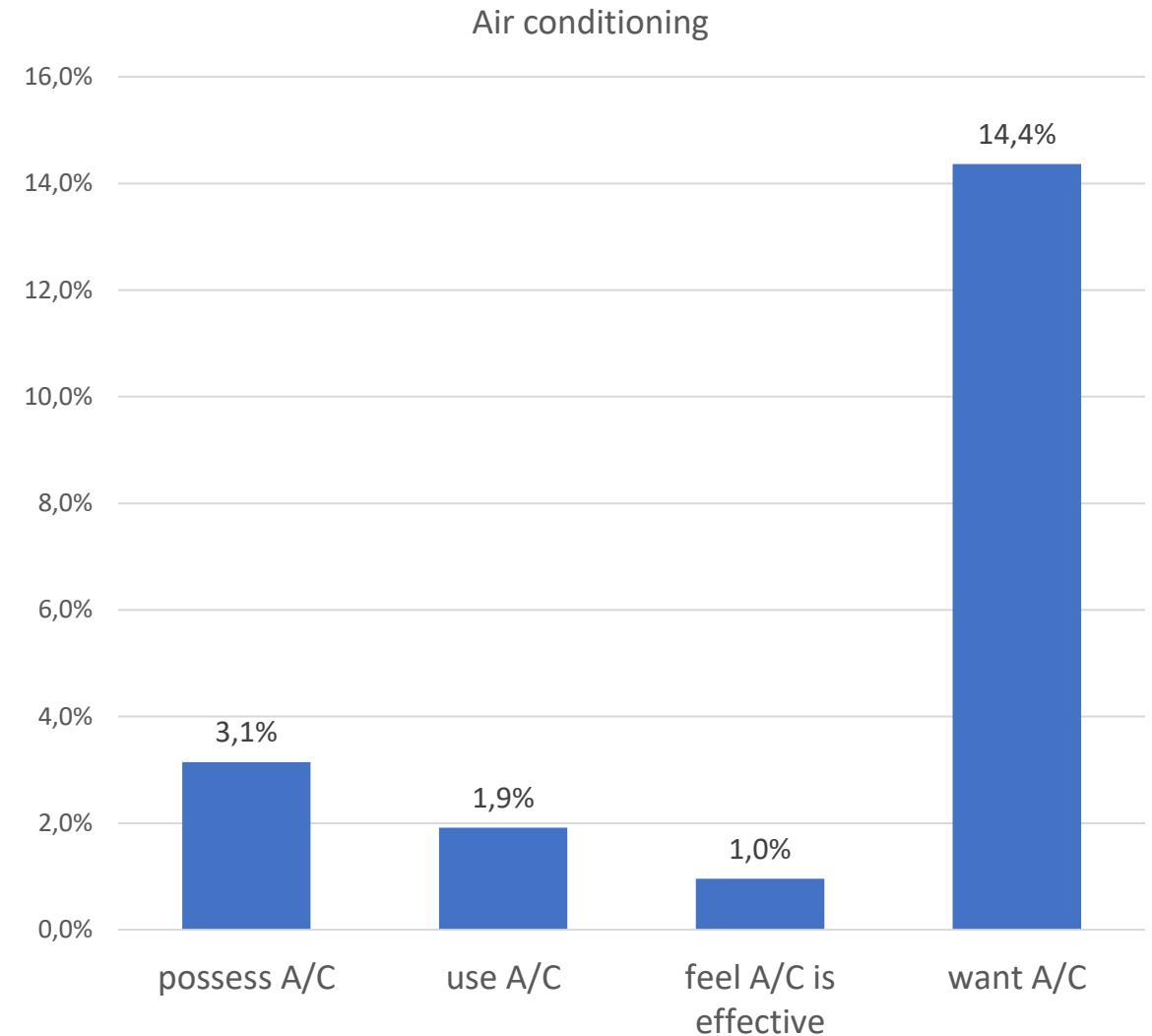


Status Quo: Air Conditioning and Need for Cooling in Munich



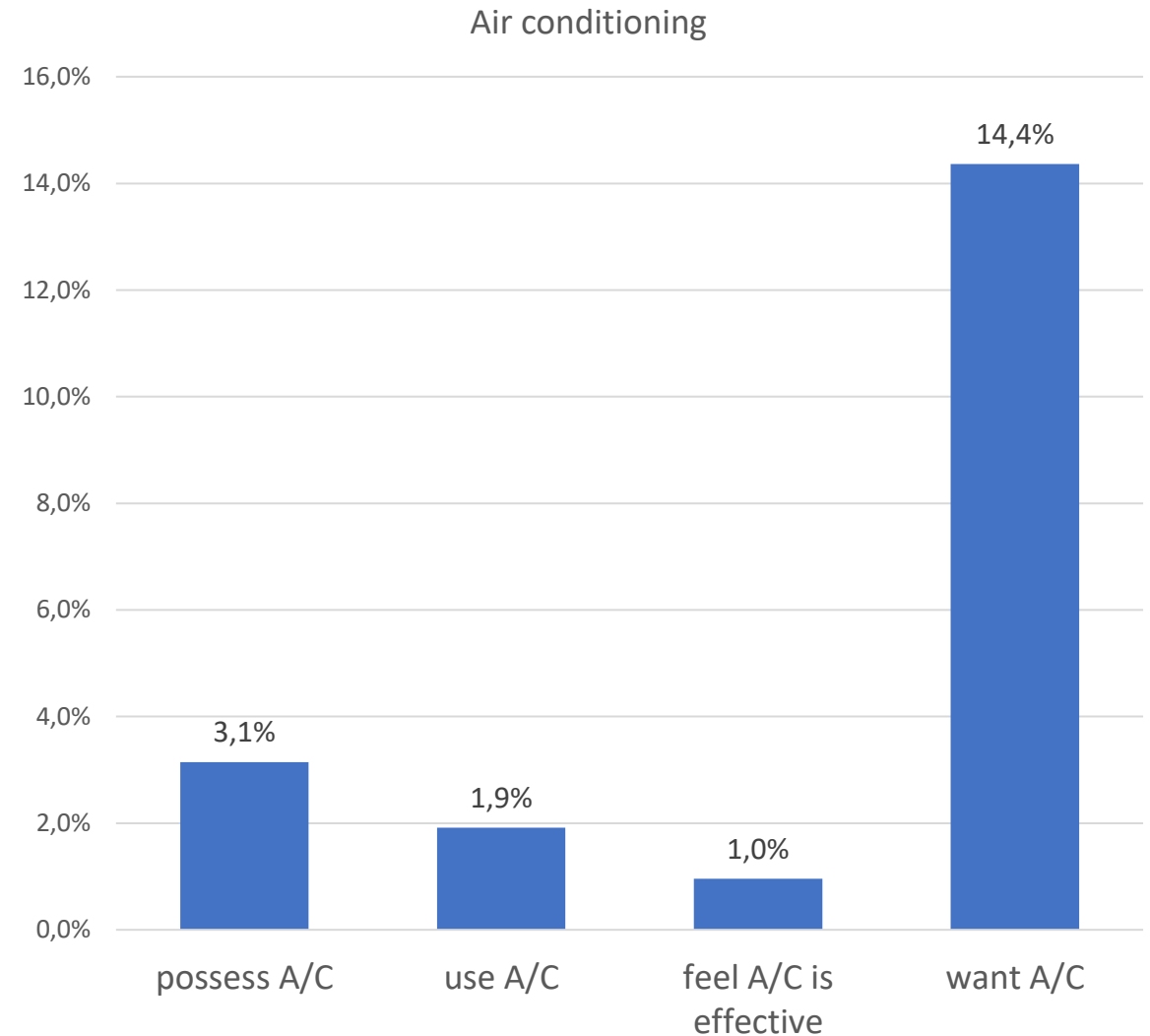
What Drives the Need for Air Conditioning?

	A/C demand (stand. effect size)
Objective Heat Stress Index (<i>Tmean, overtemp. DH, Tmax timelag</i>)	n.s.
Subjective Heat Stress Index (<i>TCgen, TChome, Tcbedroom</i>)	0,234***
Sensitivity (<i>low obj. heat stress – high subj. heat stress</i>)	0,308*
Thermal Control (<i>level of satisfaction</i>)	-0,208***
Thermal Preference (<i>for hot weather</i>)	-0,158***
Impaired Health Index (<i>general health, medical condition, symptoms</i>)	0,112**
Financial Situation (<i>level of satisfaction</i>)	n.s.
Housing Situation Index (<i>building type, microclimate, m²/person, ownership</i>)	n.s.
Adaptive Behaviour (<i>shading windows, using autom. fan</i>)	0,124** 0,084*



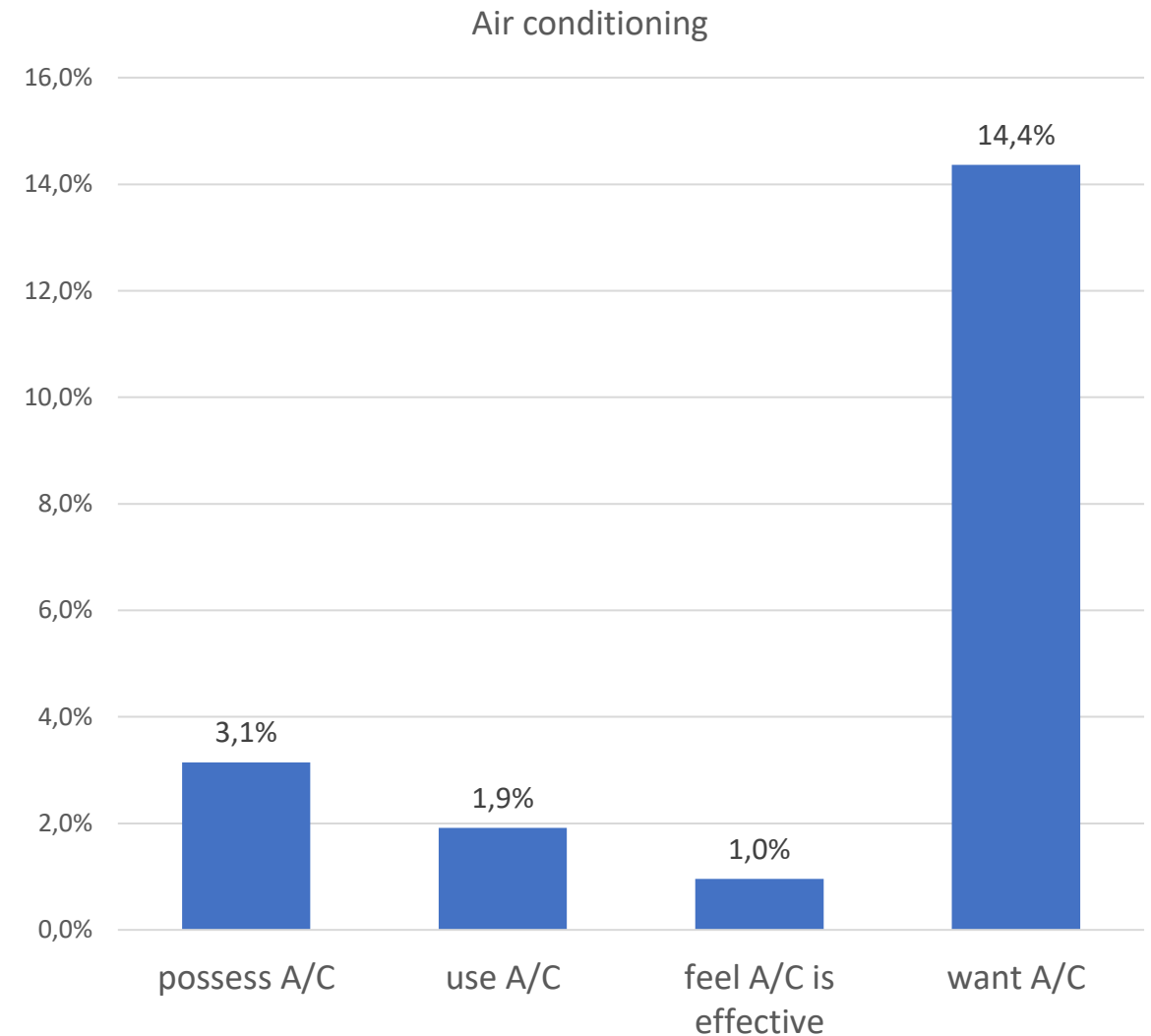
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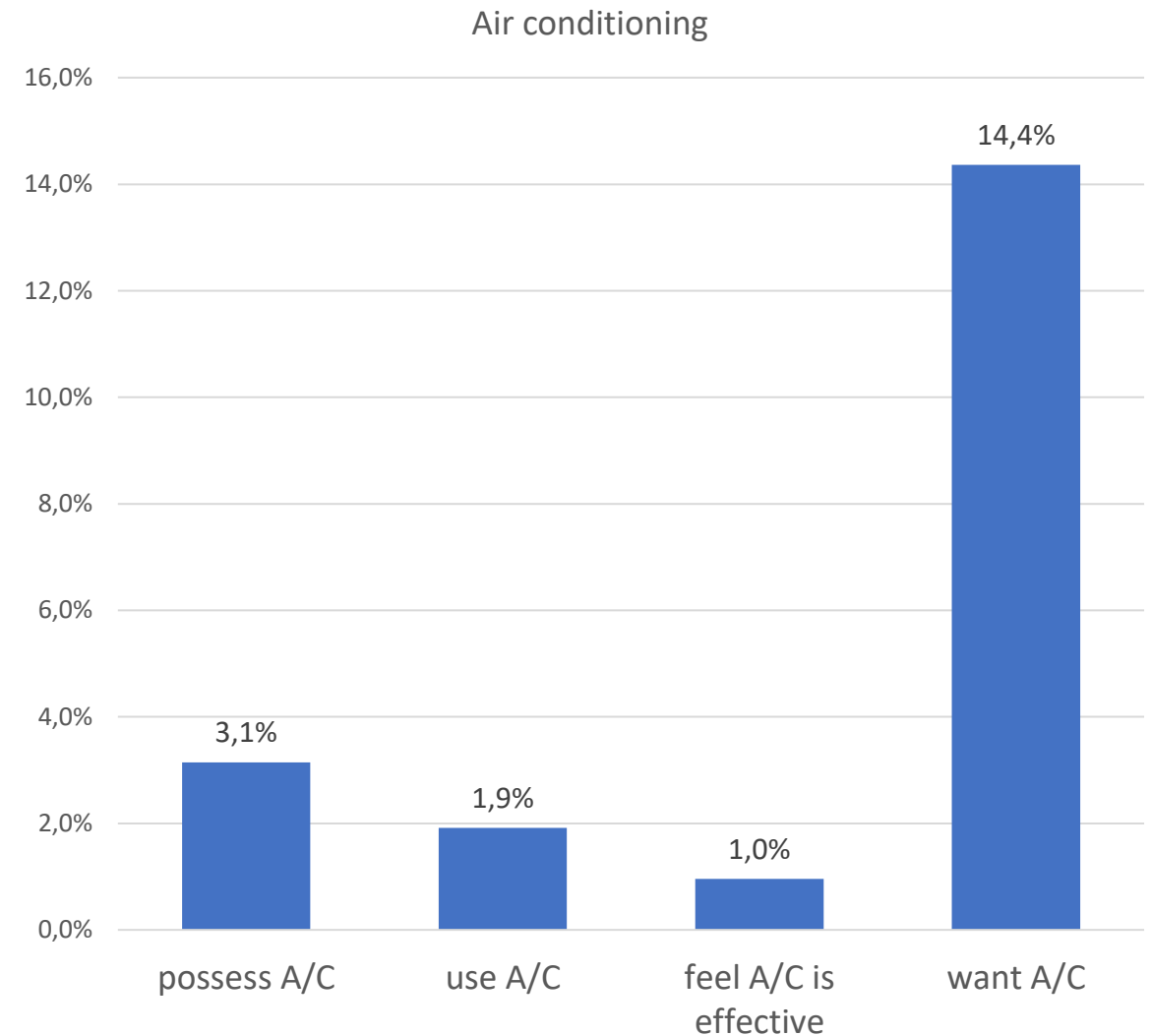
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Financial Situation (<i>level of satisfaction</i>)	n.s.
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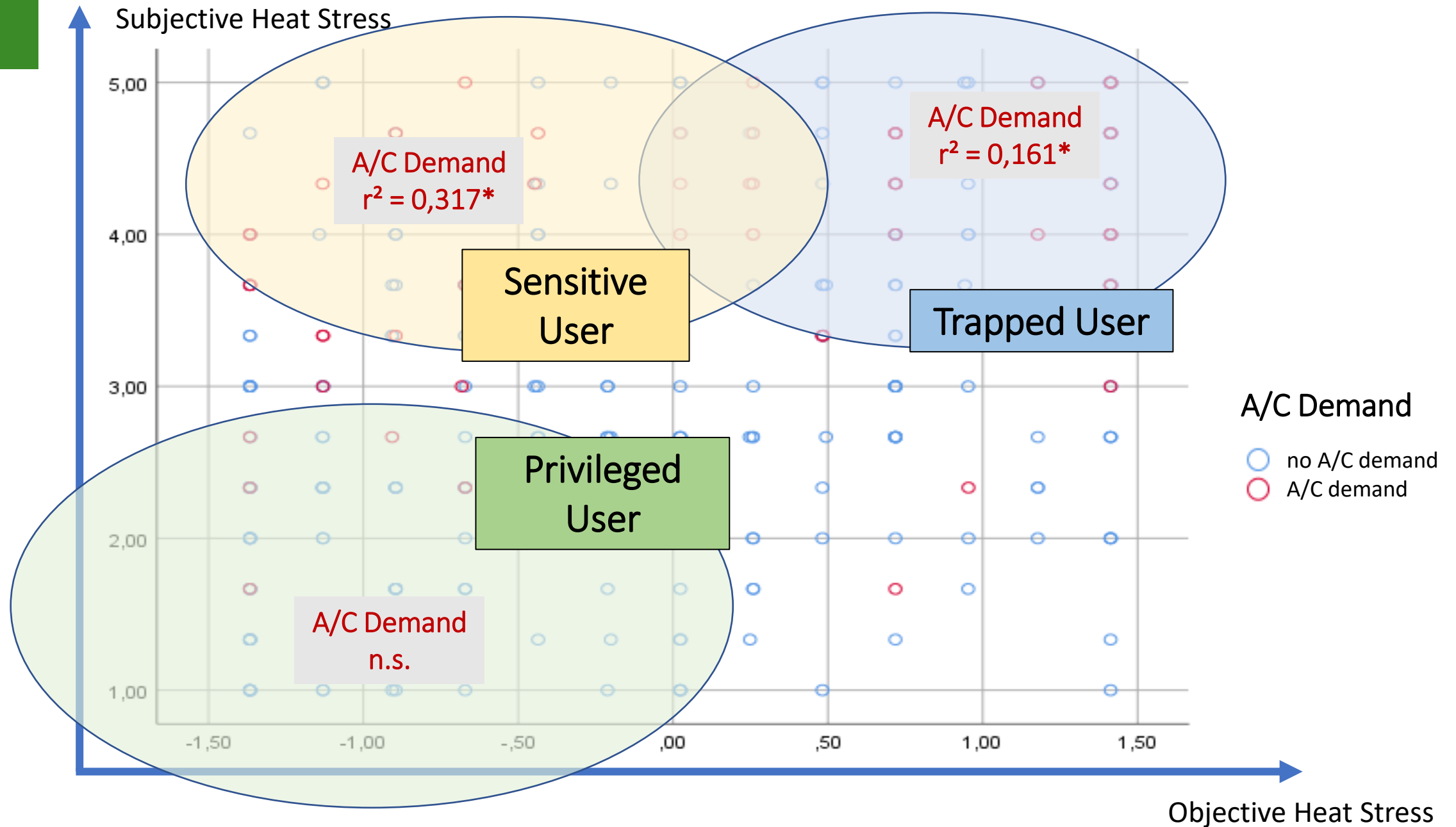
Subjective Heat Stress

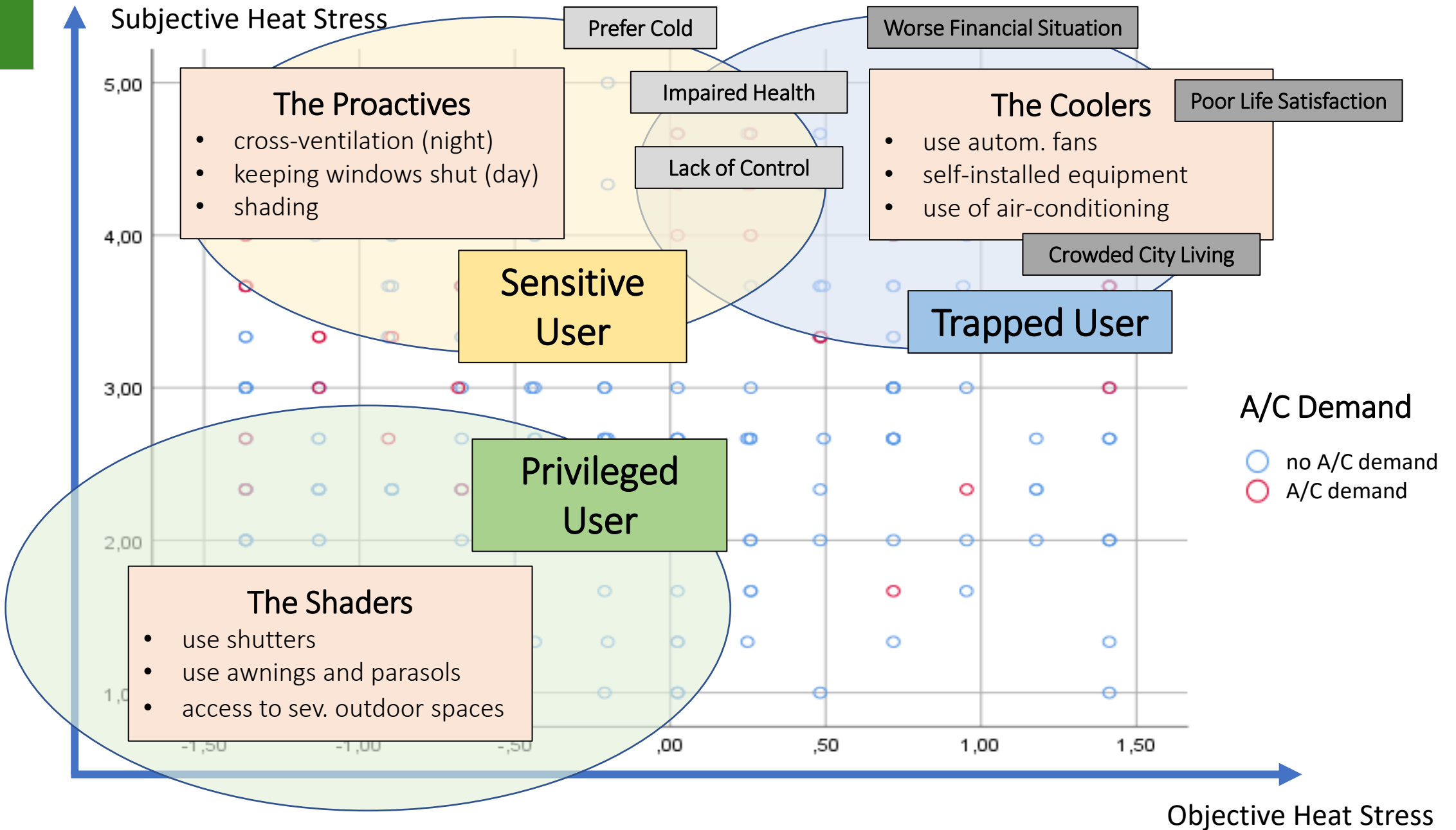


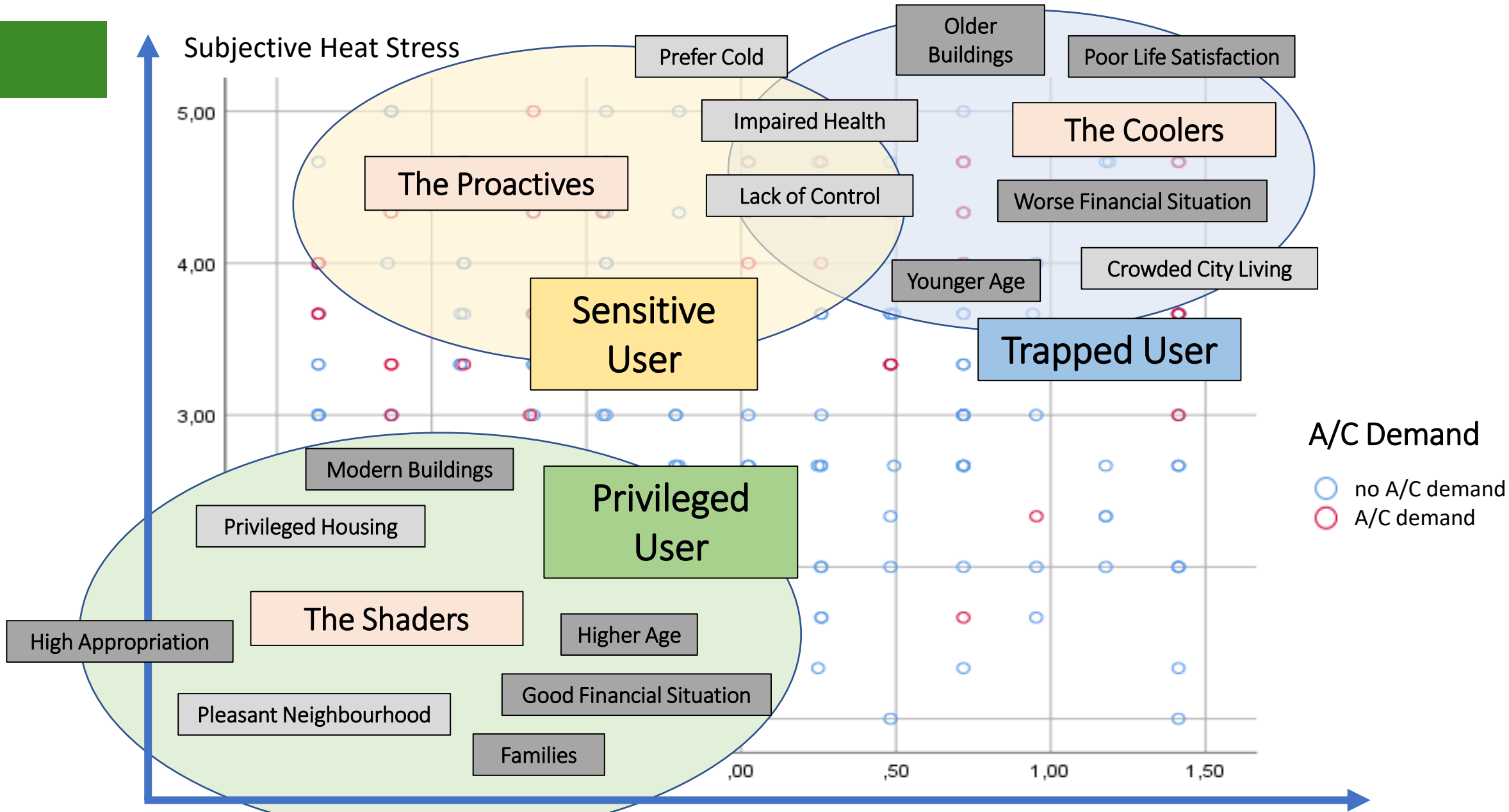
A/C Demand

- no A/C demand
- A/C demand

Objective Heat Stress

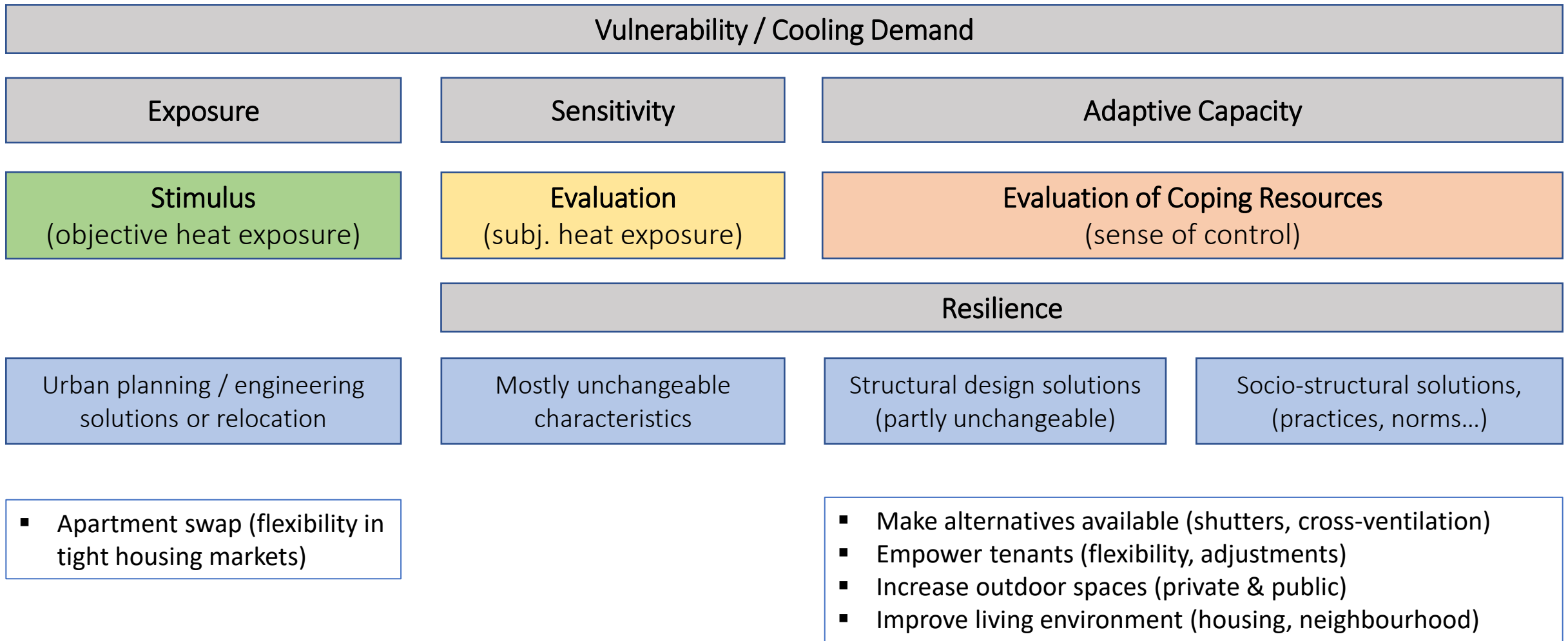






Objective Heat Stress

Resilience and Possible Solutions



Conclusion

- **Perceived heat exposure** is a better predictor for potential cooling demand than computer modelling and temperature measurements
- Building standards oriented at fixed overheating thresholds bear the danger of normalizing electric cooling and **creating** **‘undiscovered’ needs**
- Future cooling demand in temperate regions will likely be driven by **two vulnerable subgroups**: the ‘sensitive users’ and the ‘trapped users’
- Next to reducing heat exposure in cities by big investive long-term infrastructural measures, smaller adjustments aimed at enhancing **adaptive capacities** (sense of control) can have immediate effects
- To improve the fit between thermal preferences and living situation **apartment swap platforms** could be a solution (esp. in tight housing markets)
- There seems to be **no need for further education** regarding passive cooling strategies



Thank You – Comments &
Questions Welcome!

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