

# THERMAL COMFORT FOR LOCAL COMMUNITIES AND LIFESTYLES

## UNDERSTANDING INCLUSIVITY AND BIAS IN DESIGN

### OVERVIEW

Thermal comfort is an important factor in improving health and wellbeing of populations, encouraging people to use outdoor spaces, promoting outdoor exercise, active travel, and social events. Heat stress can have significant negative impact on urban health with cities being more vulnerable to raised air temperatures due to the urban heat island effect and further amplified by global warming (Bulkeley, 2013; IPCC, 2019). Urban design can impact thermal comfort by modifying elements of the urban form, surface materials, or landscapes. Various design guidelines exist, aiming to improve the local microclimate and reduce heat stress occurrence through urban interventions, including LEED or Mostadam. However, many guidelines have been influenced by principles from temperate climates, and they often disregard the local subjective, social, and cultural dimensions. To address this challenge, the Atkins team set out to produce an index outlining key parameters per region through an understanding of key theories of thermal comfort and satisfaction.

### PROJECT OBJECTIVES

The main objective of this project is to better understand the microclimatic requirements per geographic region to provide a comprehensive and informed approach to designing for human comfort in diverse environments. While numerous thermal comfort indices and international standards are established setting the acceptable ranges of comfort, these were exclusively designed on hypothetical examinations of occupant experience in the mid-latitude climates of North America and Europe and do not work well in other climatic, cultural, and economic contexts. As an example, research indicates that a wider range of climatic acceptance and adaptation exists which is not reflected in existing indices (Nikolopoulou, Baker & Steemers, 2001; Vasilikou & Nikolopoulou, 2013; Cocolo et al., 2016). Through interdisciplinary collaboration, we have developed an in-depth understanding of the links between theories of thermal comfort, the factors that affect thermal satisfaction, and the gaps in knowledge and indices.

### METHODOLOGY

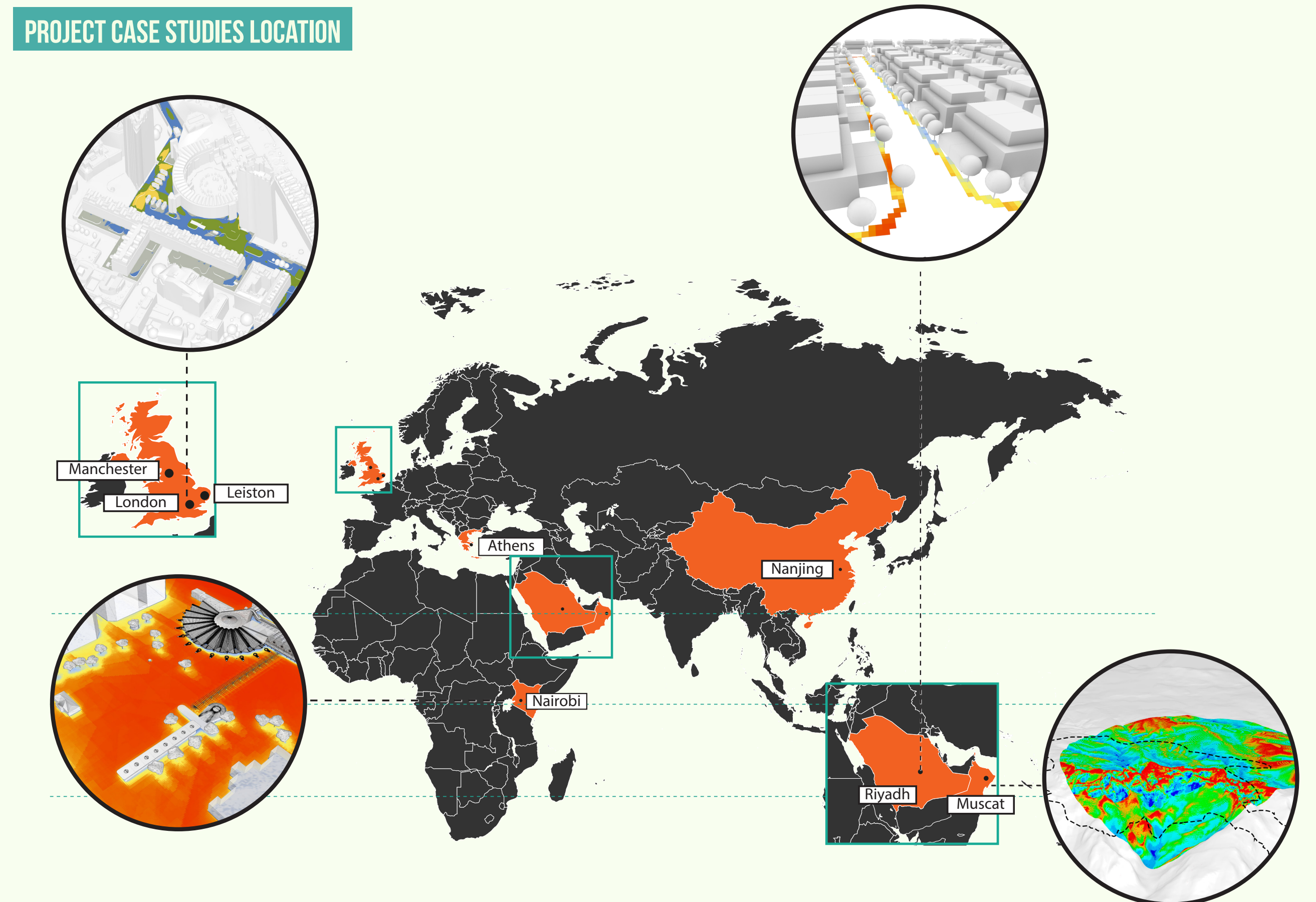
Through a series of urban simulation case studies, utilising industry recognised tools, such as Ladybug, Envi-Met and SimScale, we have compared thermal comfort indices to identify gaps and biases in existing approaches via a qualitative comparative analysis. A summary of the key parameters which vary regionally has been produced, outlining the numerous subjective, social, and cultural dimensions of thermal comfort indices and their trade-offs between the identified variables.

### CONCLUSION

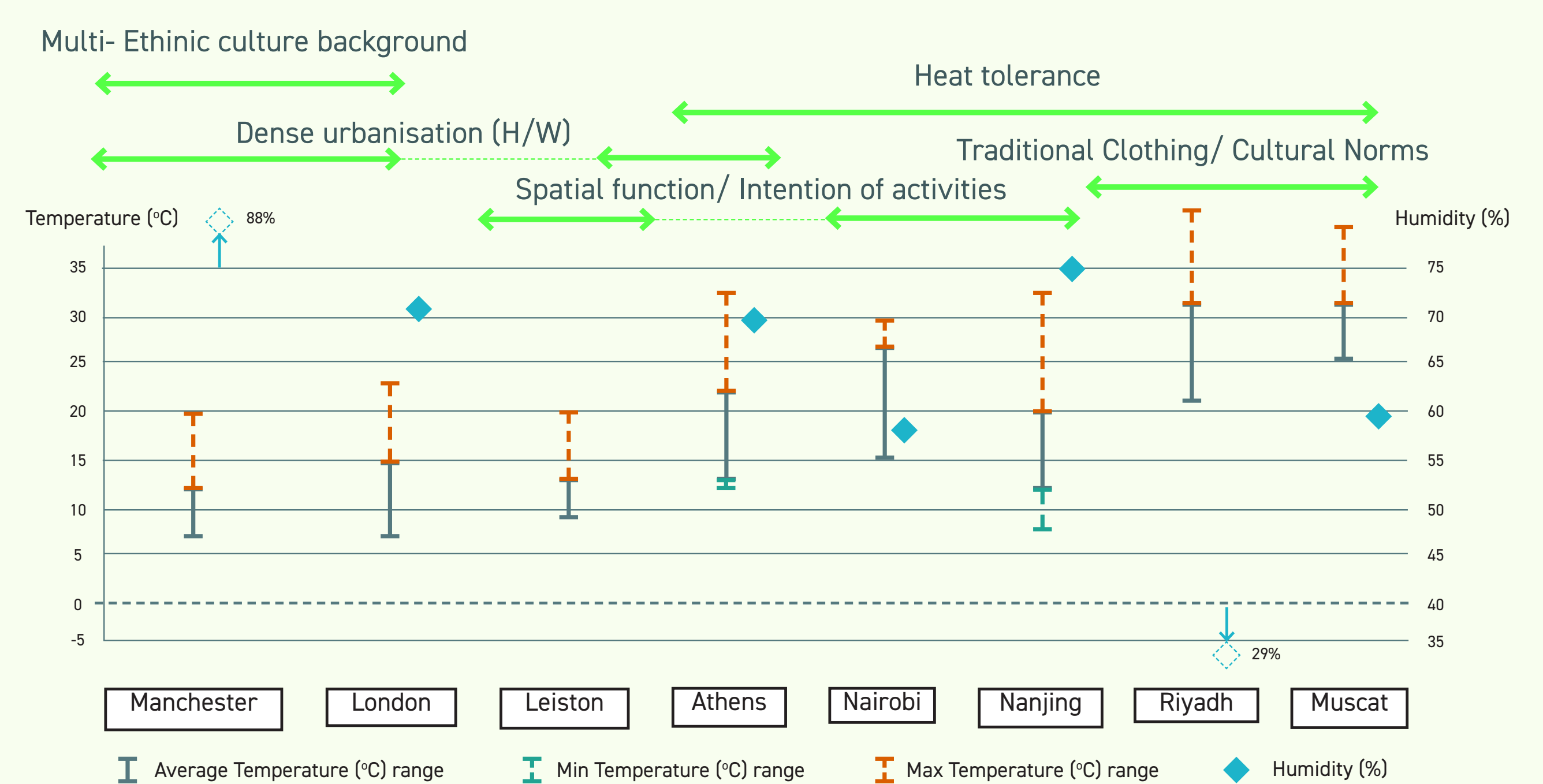
As our industry increasingly recognises the need to understand inclusivity and bias in design, our consideration of local thermal comfort is critical. The qualitative comparative analysis revealed that the complexity of the urban environment is not captured by existing thermal comfort indices.

Research is slowly progressing towards the establishment of renewed thermal comfort models that capture local population attributes by modifying and redefining the parameters at the physiological and psychological level (Zhou et al., 2015; Zhao et al., 2021). Such advancements indicate the need for refined metrics that consider the individual characteristics of the local communities. New approaches to micro-climate analysis and thermal comfort metrics will ensure the liveability of our designs via the optimisation of the local outdoor environments, delivering benefits to local health and wellbeing, supporting local communities and the types of activities typical to a locality.

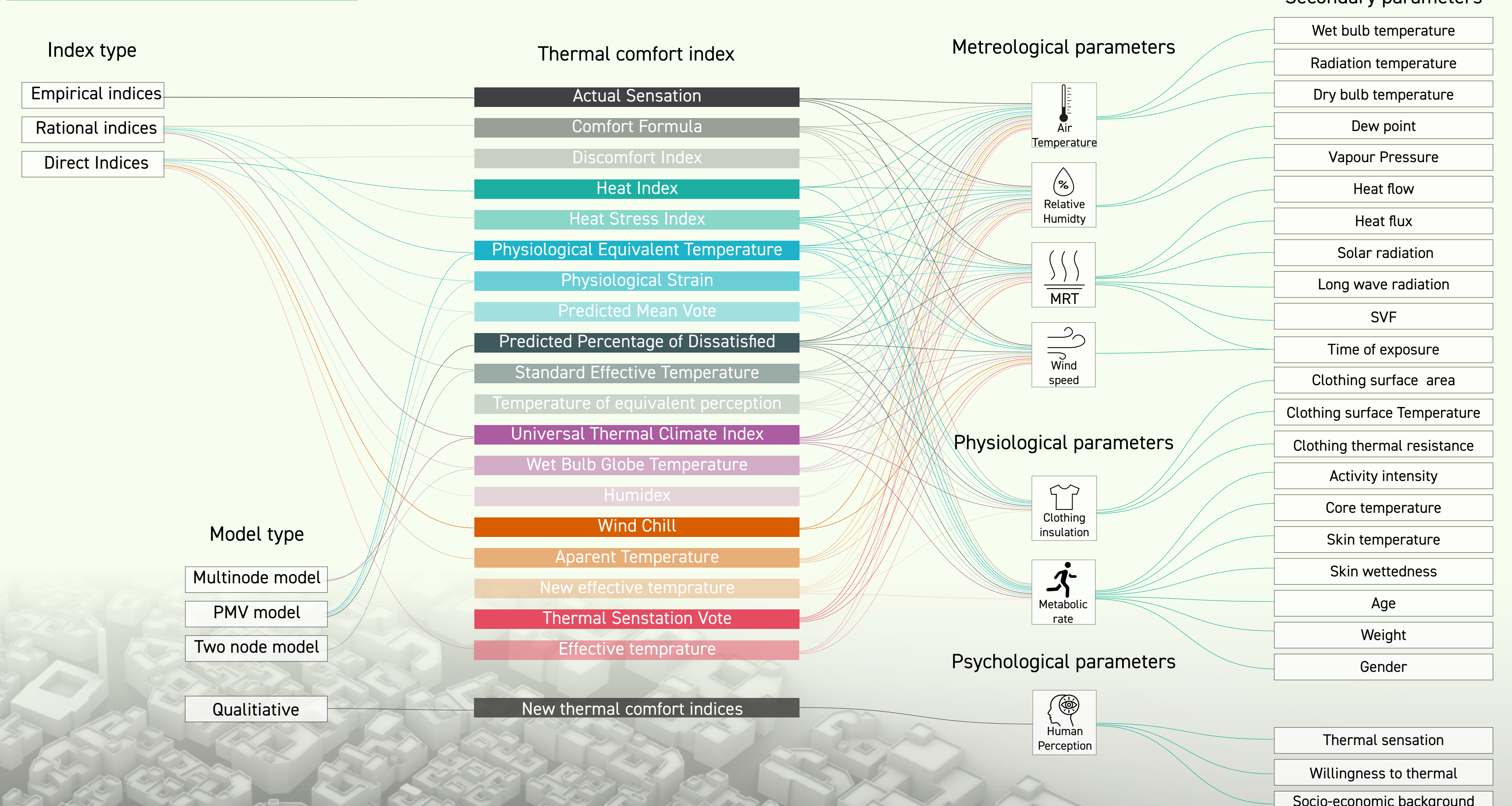
### PROJECT CASE STUDIES LOCATION



### COMPARATIVE ANALYSIS OF CASE STUDIES



### OUTDOOR THERMAL COMFORT INDICES REVIEW



### OUTDOOR THERMAL COMFORT CONCEPT

