Blog Post: Task 59

Embedding thermal comfort into retrofitting design

Reducing energy consumption in the built environment is one of the severest challenges of our times. In Europe, older buildings constitute 25% of the building stock and are responsible for 40% of the total primary energy consumption. This gives great potential for reducing energy and CO_2 emissions.

However, during the last decade, the retrofit processes applied to existing buildings have been dominated by energy and economical approaches, regularly resulting in unintended consequences such as overheating, mould growth and the increase of indoor pollutants[1]. This is despite the fact that thermal comfort is recognized as the prime objective of most construction, and is the main reason for stakeholders to embark in retrofit ventures[2].

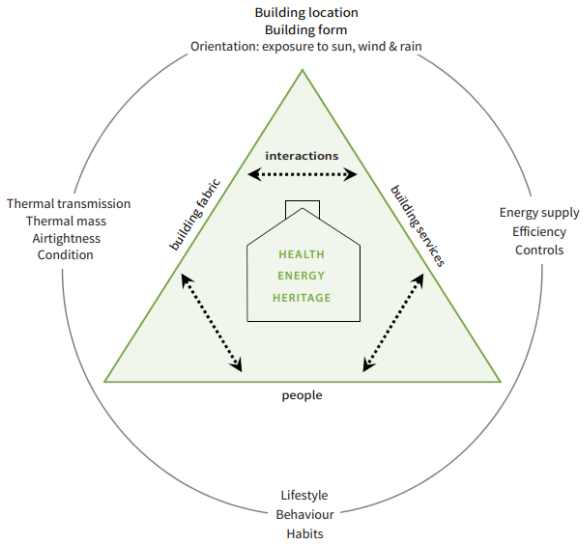

Figure 1: Building performance Triangle, Energy Efficiency and Historic Buildings (source: Historic England)

Although professionals acknowledge thermal comfort as a key priority[3,4], there is no specific process for assessing this as part of carbon or energy retrofitting of existing buildings. Even when thermal comfort is taken into account, it is reduced to a consideration of air temperatures, to the neglect of all other parameters. Yet a better appreciation of those other parameters can lead to retrofit interventions that are less invasive to the building envelope, healthier for the indoor environment, and more appropriate for the conservation of the heritage values of buildings. An added advantage is that these retrofit approaches generally use less carbon and energy to produce, install, and operate. It would be beneficial to prioritize thermal comfort with minimum energy use in retrofitting historic buildings taking into account also technical compatibility and minimum effect of the building structure.

According to de Dear, we must not only reconsider the approach taken over the past 100 years to define and assess indoor thermal climatic parameters and Standards, but also quantify the influence of comfort factors on occupants, and how these are affected by the building envelope.[5] Putting users at the centre of the approach could significantly affect the energy

outcome of a retrofit intervention. Thermal comfort should provide a compass in the design of the retrofit process.

My research project at the UCL Institute of Environmental Design and Engineering and Historic England is focusing on this topic. I am aiming to find ways to use thermal comfort meaningfully, by defining which criteria practitioners should employ to incorporate it as a design factor. How should we assess the things materially affecting thermal comfort, and investigate the conditions under which people feel comfortable or uncomfortable?

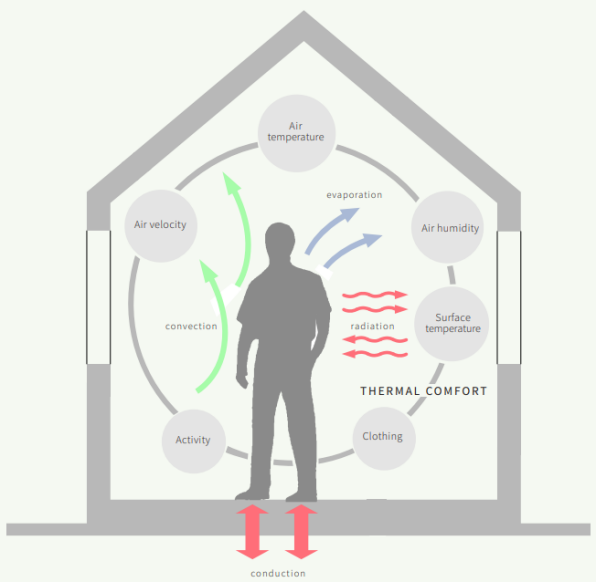

Figure 2: Physical Factors affecting thermal comfort, Energy Efficiency and Historic Buildings, Historic England

At the moment, it is almost universally accepted that for any indoor space to be comfortable and useable, the air temperature must be controlled. And yet, as we know, a controlled indoor temperature does not guarantee thermal comfort[7]. We need to move away from comfort as a range of temperatures, and see it for what it is: the complex interaction of environmental, behavioural, psychological and social factors[6]. Clothing factor is one parameter that has been researched and integrated into comfort standards, but other overlooked factors such as body heat loss through radiation and user behaviour, may be still more important. There is also room for more research on how different situations constrain occupant behaviour, and the effect that group behaviour has on the individual (noting that "comfortable conditions" is a social notion that reflects current values, and changes over time[8]).

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