Providing an acceptable level of thermal comfort in buildings – whether that’s at home, work, school or other public space – is important for our wellbeing and health. Here we take a look at what thermal comfort is, which factors impact it and why it’s so important.

What environmental factors impact thermal comfort?

When you first think of thermal comfort you may immediately think of air temperature – and while this is one indicator of thermal comfort, there are others that need to be considered. From an indoor environmental point of view, as well as air temperature, we also need to take into account parameters such as radiant temperature, humidity and air velocity. To address these in building design an understanding of how project specific variables such as location, orientation and build type can affect comfort is required.

In addition to the building design specifics, the intended use of the building and the users’ profiles need to be addressed at the beginning during the design stage. When we’re thinking about the building’s use, there are a few things we need to consider. Is it a building which is occupied 24 hours a day where users have relatively low levels of activity, like a nursing home, for example? Or is it a building which is unoccupied for long periods, has sporadic occupation patterns and occupied by younger people, such as a young professionals’ starter home?

In addition, internal sources of heat such as electrical equipment and number of occupiers need to be considered. Understanding how, when and by whom the building is used will define design decisions in order to optimise thermal comfort.

When looking at the users’ profiles, we need to understand the demographic of the intended user as this will also inform design decisions. This can include physical factors such as age and health, and also vocational requirements such as the clothing they need to wear. For example, users of the space may be required to wear a uniform of some description – nurses working in a hospital, factory workers in protective clothing, or students wearing school uniform.

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Why is thermal comfort in buildings so important?

Like most physiological perceptions thermal comfort is highly subjective and can vary between individuals. However, if an indoor environment is unfavourable it can greatly affect mood, sense of wellbeing, concentration and health. In extreme cases, it can even lead to fatalities.

This is because we respond physiologically to the environment around us in order to maintain our core temperature of around 37°C and our skin temperature of an average of 34°C. Internal and external sensors on our skin allow us to monitor the temperature and environment around us and respond accordingly, for example we shiver when it’s cold to try and get our temperature up, and sweat when we’re too hot to cool ourselves down.

The way our bodies respond in this way can have many different consequences.

Let’s look at students in schools. Studies have shown students perform better when learning in a comfortable temperature. If it’s too cold or too hot, it can impact their performance, with some recommendations that the indoor air temperature should be maintained between 20°C and 24°C in winter, and between 23°C and 26°C in the summer.

And it’s a similar case in offices. A study of employees showed a reduction in performance of 6% when the temperature was 30°C, and a reduction of 4% when the temperature dropped to 15°C, compared to a baseline of between 21°C and 25°C.

Fluctuations in temperature can also lead to illnesses – and in some cases death. In summer 2006, there was an estimated 75 additional deaths each week for each degree of increase in temperature. Respiratory and cardiovascular diseases are the main causes of illness and death during a heatwave, but there are other heat-related illnesses which can affect people such as heatstroke, heat exhaustion, heat rash and heat cramps. Even during a moderate heatwave, some demographics – such as the elderly, babies and children, and people with Alzheimer’s – are at risk of such illnesses.

How can the design consider thermal comfort?

As we have already explored, there are many different factors that can affect thermal comfort in buildings – and these could well vary from one day to the next as the weather outside changes and people carry out different activities.

Because of this, when designing and building spaces, we need a carefully balanced combination of building systems that can be adapted to both the local climate and the users’ activities and behaviours. Through informed design and considered construction we can create comfortable thermal environments that are flexible and easily adjusted to the occupants’ changing needs.

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When designing for thermal comfort, there are four areas to consider:

- **Project specifics:** Such as the project geographical location, existing surroundings, building orientation and intended use.
- **User profiles:** Information on the user demographic both personal – age and health, and vocational – clothing requirements, and activity level.
- **Building specifics:** Parameters such as thermal performance of elements and details, airtightness and ventilation design.
- **Glazing design:** Design to optimise glazing specifications for solar gain, natural daylighting and thermal performance, without creating issues associated with overheating risk.

In future articles we will explore in more detail how each of the four areas can influence design and help to create more comfortable spaces across the built environment for the benefit of their users.

See how the first Multi Comfort school was designed and built to provide the best possible thermal comfort for students.

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