THERMAL COMFORT
PHYSICAL HEALTH
Research Brief

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Figure 1:
Multiple factors contribute to how a body responds to a thermal environment.

Source: Satchita Melina, https://www.mkthink.com/2017/09/27/thermal-comfort-101/

Keywords:
Thermal Comfort, Physical Health, Thermal Variation, Sick Building Syndrome

CONTENT OVERVIEW

THERMAL COMFORT + PHYICAL HEALTH SUMMARY

Physiological impacts are often overlooked when determining thermal comfort ranges. Satisfaction is the metric used to establish comfort ranges for the Predicted Mean Vote Model and the Adaptive Comfort Model. Several factors can influence how an individual's body responds to a thermal environment.

I. Thermal Variation

Current ASHRAE standards suggest delivering a steady temperature within an allowed limit to control the indoor climate of a building and maintain thermal comfort. Studies show that a lack of thermal stimulation could have adverse effects on user health (Johnson 2011, Van Marken Lichtenbelt 2018, Stoops 2004). One study found that the lack of exposure to variability of temperature could reduce the thermogenic capacity of the user and decrease amounts of brown adipose tissue (BAT). BAT is a thermogenic organ that releases energy as heat and is a large contributor to thermogenesis, the production of heat within the body (Johnson 2011). Much like light influences the circadian rhythm of humans, temperature affects physiological rhythms. The initial threshold for sweating is higher in the evening and lowest in the morning due to circadian modulation. To align with the changing physiological cycles, the adaptive comfort model which includes wider temperature ranges could be most effective (Krauchi 2002).

Variability in indoor temperatures can also contribute to our metabolic health and exposure to heat and cold more frequently could help create resilience to varying temperatures (Van Marken Lichtenbelt 2018). Studies indicate benefits to mild exposure from heat and cold. Exposure to mild cold was found to influence the maintenance of weight and glucose metabolism. A small increase in mild heat exposure has been linked with improved cardiovascular function (Stoops 2004), a decrease of blood pressure, cutaneous vasomotor function, and more efficient sweating (Van Marken Lichtenbelt 2018). However, too much exposure to heat and cold could cause distress to the body including increased cardiovascular and respiratory issues (Uejio 2016), and sleep disturbance (Van Loenhout 2016).

II. Sick Building Syndrome and Thermal Comfort

Maintaining thermal comfort has also been found to reduce sick building syndrome (SBS) symptoms in building users (Jaakkola 1989, Amin 2015, Fang 2004). An increased temperature and relative humidity in a space can begin to generate increased levels of pollutants, leading to minor respiratory issues and other symptoms related to SBS (Heerwagen 2000). Several studies indicated that temperature was the most influential indoor air factor contributing to SBS symptoms and that persons not satisfied with the temperature experienced SBS symptoms such as dryness of skin, nose, throat, nasal congestion, itchy skin, and headache (Jaakkola 1989, Amin 2015, Ormandy 2012). One study predicted that absenteeism due to SBS symptoms could be up to 34% lower if employees had the means to control their immediate microclimate conditions (Heerwagen 2004).

III. KEY REFERENCES

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