

# Does a table fan reduce the room temperature?

Questions should be of general interest and be about temperature measurement techniques and/or heat transfer.

**QUESTIONS?**  
**ANSWERS!**

**QUESTION:** When the temperature in my office goes above 25 °C I put a table fan on my desk and then the room feels a lot cooler. Would a thermometer placed in the air flow also show a lower temperature?

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**ANSWER:** The fan on your desk does not lower the temperature in your office. However, it does increase both the heat flow and moisture transport from our bodies and we therefore feel cooler. The heat flow from the body to its surroundings occurs via radiation and convection. In this case, the moisture transport is sweat and water is emitted into the surrounding air. The velocity of the air does not affect the radiation process but it does influence both the convection process and the moisture transport process.

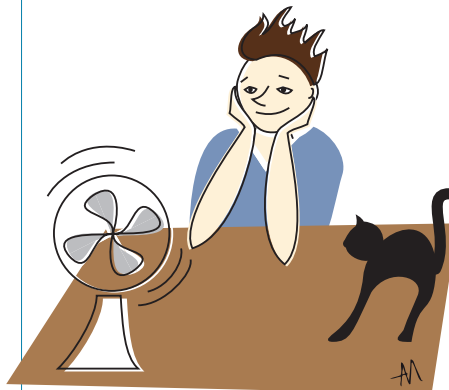
Without a fan or cross-draught in the room, natural convection is in operation, and the heat transfer coefficient at a person's head is then about 4 W/m<sup>2</sup> K. If the air velocity is 2 m/s the heat transfer coefficient is then about 12 W/m<sup>2</sup> K and at 4 m/s it is about 19 W/m<sup>2</sup> K. The heat flow to the surroundings via radiation is greater than via natural convection but is of the same order of magnitude. Accordingly, when the convective heat flow increases, the total heat flow from the body goes up and the body's surface temperature goes down.

## How does the thermometer react?

When we sweat, the moisture from our body is transported to the surrounding air. The transformation from fluid to steam requires heat, thereby cooling the body. The moisture transport process becomes more efficient with an increase in air velocity. Our sensation that the room becomes cooler is therefore due to the more efficient transport of heat and moisture from the body, and not to a lower room temperature. In fact, the room temperature actually increases slightly because the electric energy transferred to the

fan is transformed into heat, which causes a slight rise in temperature. When a fan blows air onto a dry thermometer, it does not cause the same effect as when it blows onto a body. The difference is that the body is constantly producing heat and emitting moisture in the form of sweat. The thermometer therefore measures the air temperature, but this can be slightly raised due to the heat generation in the fan. This is particularly true if we are measuring the temperature in small, poorly ventilated spaces. Warm or cool surfaces nearby can also influence the measurement process, so in such cases it may be a good idea to equip the thermometer with a radiation shield. However, the air velocity does affect the response time – the higher the air velocity the shorter response time. [Ref 1]. In contrast, if the thermometer is damp when we start up the fan, the response time will be prolonged.

*References: see [www.pentronic.se](http://www.pentronic.se) > Pentronic News > Pentronic News archive [Ref 1] See Pentronic News 2009-3 page 4.*



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