Overview of Cooling Effect on the Thermal Comfort for Car Drivers

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Abstract:
This research includes, first, an introduction to clothing comfort. Clothing comfort can be classified into four types; thermal comfort or thermophysiological comfort, sensual comfort, resulting from the contact between clothes and the skin, fitting and pressure comfort, and finally physio-psychological comfort. Thermal comfort is reviewed, where clothes can change the rate of heat and moisture loss from the skin surface, thus, it plays a vital role in maintaining the person's thermal equilibrium. Second, the theories of heat transfer and the concept of thermal equilibrium of the body are presented. Heat transfer process is divided into a number of simple operations, conduction, convection and radiation; usually heat transfer is carried out by two or three ways at once. Heat exchange between a person and the surrounding environment happens through clothes. Previous studies showed that the best-suited temperatures for the different parts of the human body, within which the body is most comfortable. Similarly they focused on the different sweating patterns of the human body during relaxation and during physical activity. The human body is able to produce notable amounts of sweat during activity in warm environment, in order to maintain its thermal equilibrium. The sweat glands density varies significantly between the parts of the human body, where the density is usually higher in the limbs than the torso; relevant studies have shown a significant difference in sweating rate between different parts of the body. Third, clothing comfort of car drivers is analyzed and its relation with automotive textiles. Sitting for long periods, in the unsuitable microclimate created in the car with the possibility of raised temperature, with mechanical vibrations, could cause health risks to vehicles' drivers. Some studies have also presented cases of burns to children caused by car seats, especially if the car is placed in direct sunlight. The determination of thermal comfort level for car drivers is a complex task as it includes the interaction of many variables. Finally, cooling effect in clothing systems is presented through various methods, in order to increase a person's thermal comfort; such as sportswear, air-conditioned clothes (air-circulating clothes), and cooling clothes using liquid circulation. To achieve cooling effect in clothes, two techniques are presented: phase-change materials and thermoelectric cooling systems based on electrical phenomena, including Peltier effect. Cooling effect could be one of the most desired features of clothing. Recently, new technologies have succeeded in offering clothes that provide a cooling effect, without relying on external cooling sources. It is evident from the above-mentioned examples a difference between two cooling systems for clothes, namely: passive system and interactive system. Passive systems exist in the sportswear, air-conditioned clothes (air-circulating clothes), and cooling clothing using liquid circulation. These types of clothes are not affected by the external environment no the human body temperature, but they carry out cooling with no external input. As for phase-change materials and thermoelectric cooling systems, they are considered interactive systems because they are affected by the external environment and interact according to inputs from the environment such as high/low ambient temperature or high/low body temperature.

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Cooling Effect, Thermal Comfort, Thermophysiological comfort, Physio-psychological comfort, Heat transfer, Thermal equilibrium,

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