

# SKIN TEMPERATURES AND THERMAL JUDGMENTS IN SEDENTARY SUBJECTS EXPOSED TO EITHER HEATED FLOOR OR HEATED CEILING.

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## INTRODUCTION

When investigating local thermal discomfort (reviews in 1, 2) attention has rarely be paid to local **skin** temperatures (3). We studied these local temperatures under two distinct but globally equivalent indoor climate patterns, namely heated floor (HF) **as** heated ceiling (**HC**). Both produced an overall thermal state of the **environment** corresponding to thermal balance fit to 0.6 clo-clothed **sedentary** ( $M = 1.2$  met) subjects :  $24.5^{\circ}\text{C}$  operative temperature. Both conditions were **non** uniform due to vertical radiant temperature asymmetry which is an important criterion for admitted comfort limits (4). They **differed** in respect to the localisation of the source of radiant asymmetry : either below (HF) or above (HC) the subject. The aims of the investigation were : to collect simultaneously data **on** body (**skin**) temperatures and data **on** subjective thermal feelings (dependent variables) ; to examine the initial adjustments and the temporal evolution of the various (dependent) variables ; to compare the **results** in both climate patterns.

## METHOD

**Two** non-uniform indoor conditions (heated floor : HF at  $34^{\circ}\text{C}$ , or heated ceiling HC at  $45^{\circ}\text{C}$ ) were imposed in a climatic chamber to 2 groups of 10 lightly clothed male subjects (Ss), performing a computer task. When floor and ceiling temperatures (T) were increased beyond the comfort limits, compensation of air ( $T_a$ ) and of the other wall ( $T_w$ ) temperatures enabled the operative T ( $T_o$ ) to be kept constant at  $24.5^{\circ}\text{C}$ . Ten local **skin** temperatures ( $T_{sl}$ ) and various thermal judgments were collected throughout the **200-min** experimental test, which included an initial **30-min** stay at **uniform**  $T_o = 24.5^{\circ}\text{C}$ .

## RESULTS

**When non** uniformity was generated,  $T_a$  and  $T_w$  were slightly decreased in both conditions and most of the  $T_{sl}$  **as** well **as** judgments of thermal sensations **also** decreased, although  $T_o$  was **theoretically** unchanged.

Results obtained after two hours of exposure showed that under HF, foot T increased steadily and leg T decreased **less**. Under HC, forehead, chest and shoulder T decreased less whereas lower back and inferior limb T showed a greater decrease. Mean **skin** temperature changes were  $-0.65^{\circ}\text{C}$  and  $-1.10^{\circ}\text{C}$  under HF and HC **respectively**.

In terms of thermal judgments, feet and floor were recognized as being **warm under HF** but corresponding local dissatisfaction was not expressed. In contrast to this, the shoulder, arm, back, hand **as** well **as** wall and air temperatures were estimated **as** being less and less warm (or cooler), inducing overall dissatisfaction (up to 6 Ss out of 10). Under HC, most parts of the body and of the room were judged **as** slightly cool, with **no** real change throughout the exposure : constant overall dissatisfaction was found in 4 Ss out of 10, in association with local dissatisfaction in foot, shoulder and hand.

## CONCLUSION

It is concluded that the perception of the non-uniform indoor climate **in** our conditions was mainly influenced by those environmental components (here, floor and air) which exerted strongest influence on the thermal **sensors** ; the ceiling was uninfluential. Although operative T was supposed

to be kept constant, the **skin T** changes demonstrated that local and overall heat exchanges were different, depending on the heating source and on the thermal state of the remaining components.

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