

change of about 3 deg ET is required to change a person's sensation from *ideally comfortable* to *cool* or *warm*. From this it may be observed that necessary variations in the effective temperature of air conditioned space for optimum comfort for most persons, need little differentiation for either the winter season or the summer season, and not more than about 4 deg on the average between seasons.

Acclimatization and habits of clothing and diet account for these variations. As a result of a recent analysis³⁵ of all of the evidence available by the A.S.H.V.E. Technical Advisory Committee on Sensations of Comfort, a variation of 3 deg spread in optimum effective temperature for summer cooling and air conditioning with geographical location has been proposed. However, it should be recognized that variations in sensation of comfort among individuals may be greater for any given location, as shown in Fig. 7, than for variations due to a difference in geographical location. The available information indicates rather clearly that changes in weather conditions over a period of a few days do not acclimate people to a desire for different indoor conditions, but in general, people experiencing low temperatures over an extended period of time become acclimated to desiring lower indoor temperatures, while those experiencing higher temperatures become acclimated to a desire for higher indoor temperatures. It is obvious that a person spending a considerable portion of his time in space conditioned to his comfort will become acclimated to his indoor environment. While few people spend more than a small percentage of the total time within an air conditioned enclosure, there is some evidence that persons experiencing comfort air conditioning a large part of the time tend to become acclimated to about 70 or 71 deg ET.

The entering shock to occupants of summer cooled and air conditioned space may at times be important, and is due to the rapid evaporation of perspiration on the skin, accumulated during the incoming occupant's previous subjection to hot and humid outside conditions. While recent studies³⁶ show that for healthy individuals this shock is usually a pleasant experience, for others it may result in unpleasant or even harmful chills. This fact should be taken into consideration in applying summer cooling and air conditioning, particularly to spaces where a large number of the occupants may enter for only a short time, 15 min or less. Such occupants may be satisfied with less cooling. For long occupancy very little deviation from the optimum effective temperature is desirable.

Radiation between the occupant of an enclosure and the surfaces of the room itself and objects within the room, including windows, heating and cooling equipment, and other occupants, has an important bearing on the feeling of warmth and may alter to some measurable degree the optimum conditions for comfort indicated previously. Fig. 10³⁷ shows the necessary elevation in the dry-bulb temperature of the air to compensate for the lower temperature of three of four side-wall surfaces, and indicates that for this condition each degree reduction in the average of the three wall surface temperatures requires an elevation of 0.3 deg in the dry-bulb temperature of the air to compensate. Recent studies by the A.S.H.V.E.

³⁵A.S.H.V.E. RESEARCH PAPER—Comfort with Summer Air Conditioning, by Thomas Chester, N. D. Adams, C. R. Bellamy, G. D. Fife, E. P. Heckel, Dr. W. J. McConnell, F. C. McIntosh, A. B. Newton, B. F. Raber and C. Tasker. (A.S.H.V.E. TRANSACTIONS, Vol. 48, 1942, p. 107).

³⁶A.S.H.V.E. RESEARCH REPORT No. 1102—Shock Experiences of 275 Workers After Entering and Leaving Cooled and Air Conditioned Offices, by A. B. Newton, F. C. Houghten, Carl Gutberlet, R. W. Qualley and M. C. W. Tomlinson (A.S.H.V.E. TRANSACTIONS, Vol. 44, 1938, p. 571).

³⁷A.S.H.V.E. RESEARCH REPORT No. 946—Cold Walls and Their Relation to Feeling of Warmth, by F. C. Houghten and Paul McDermott (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 83).

Research Laboratory³⁸ on the effect of radiation within an enclosure, including the effect of panel heating, indicate that each degree elevation or depression of the mean radiant temperature above or below the air temperature requires about 0.5 deg counterchange in effective temperature of the air. Since the mean radiant temperature of the surroundings is affected by cold, uninsulated walls and windows, particularly single glazed windows, as well as by heating units placed within the room, including panel heaters, these factors must be compensated. Likewise, in densely occupied spaces, such as classrooms, theaters and auditoriums, somewhat lower temperatures may be necessary than those indicated by the comfort line on account of counter-radiation between the bodies of

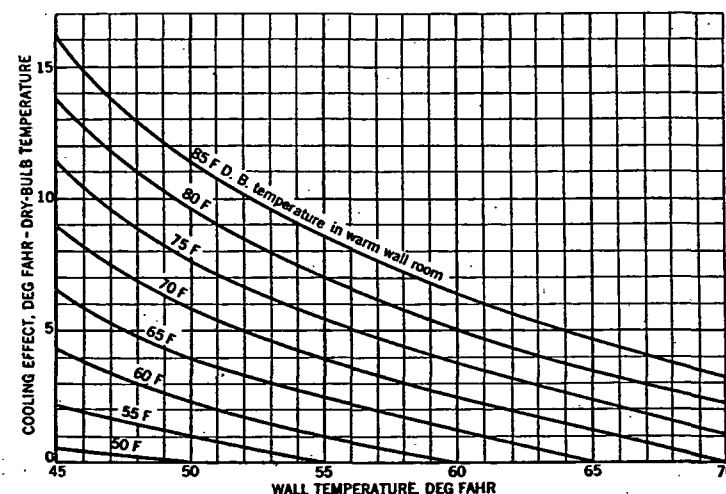


FIG. 10. COOLING EFFECT OF THREE COLD WALLS IN A SMALL EXPERIMENTAL ROOM, AS DETERMINED BY COMPARISON WITH SENSATIONS IN A ROOM OF UNIFORM WALL AND AIR TEMPERATURE

occupants in close proximity to each other, which also will elevate the mean radiant temperature of the room.

The sensation of comfort, insofar as the physical environment is concerned, is not absolute but varies considerably among certain individuals. Therefore, in applying the air conditions indicated, it should not be expected that all the occupants of a room will feel perfectly comfortable. The curves in Fig. 7 indicate that some persons require temperatures as much as 4 and 6 deg lower and higher than the optimum for the average. In this connection it is of interest to note from the characteristic shape of the curves that in general people will object more quickly to a few degrees drop in temperature from the average optimum than will be the case for the same number of degrees overheating. However, when optimum comfort temperatures are applied in accordance with foregoing recommendations, the majority of the occupants should be comfortable, and it should be expected that there will be a few too warm and a few too cold. These individual differences among the minority should be counteracted by suitable clothing.

³⁸Loc. Cit. Note 33.