

A long series of studies have been made to determine the optimum effective temperature for comfort of normal persons in both winter and summer air conditioned space, in different geographical regions and for different age groups of men and women. A group of these studies³⁰ was made between 1935 and 1940 by the A.S.H.V.E. Research Laboratory in Pittsburgh, and in several metropolitan districts of the United States and Canada in cooperation with the managements of offices employing large numbers of workers. Some of the results are shown in Fig. 8. Taking all of these studies together, women of all age groups studied indicate an average effective temperature for comfort 1.1 deg higher than for men. All men and women, beyond the age of 40 years, show an average desire

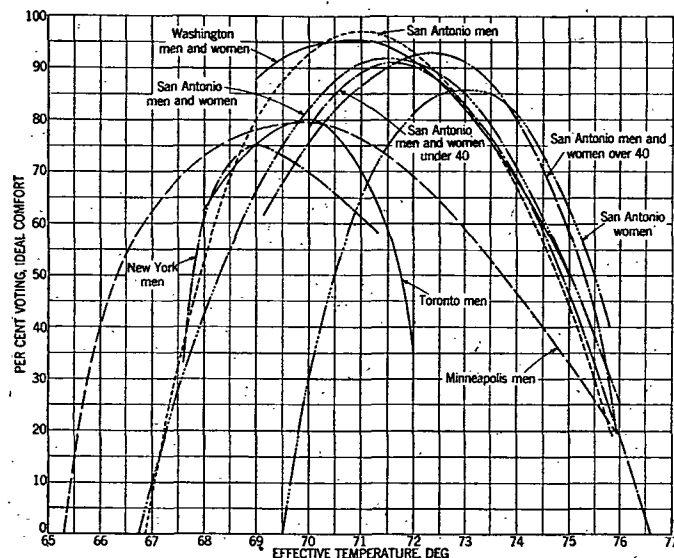


FIG. 8. RELATION BETWEEN EFFECTIVE TEMPERATURE AND PERCENTAGE OBSERVATIONS INDICATING COMFORT

for 0.9 deg ET higher than those below this age, while the men and women, respectively, beyond 40 desired effective temperatures of 0.8 and 1.2 deg higher than those below 40. The persons serving in all of these studies were representative of office workers clothed for air conditioned space in the summer season and engaged in the customary sedentary activity of office workers.

On the basis of present knowledge, for different geographical regions and age groups, the total spread in optimum comfort conditions ranges from a low of 66 deg ET for winter heating and air conditioning, to a high of 73 deg ET for summer cooling and air conditioning.

The spread for summer cooling and air conditioning for optimum comfort is confined entirely to an effective temperature range of from 69 to 73 deg; and it may be presumed that for winter conditioning a like spread would exist; while for inter-seasonal conditions there will be a fluctuation between these two ranges.

Laboratory studies²⁸ indicate that for the average individual a temperature 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. An analysis³¹ of most of the material published up to 1942, made by the A.S.H.V.E. Technical Advisory Committee on Sensations of Comfort, indicates a spread of approximately 3 deg in the optimum effective temperature for summer cooling and air conditioning due to geographical location. However, it should be recognized that variations in sensation of comfort among individuals may be greater for any given location, as shown in Fig. 8, than 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 summer comfort air conditioning a large part of the time tend to become acclimated to about 70 or 71 deg ET.

The sudden sensation of coldness felt by persons entering a cooled and air conditioned space during the summer months, and often referred to as shock, may at times be important. It is due to the rapid evaporation of perspiration which accumulated on the skin during previous subjection to hot and humid outside conditions. While studies³² have shown that for healthy individuals this *shock* is usually a pleasant experience, it is plausible, but not proven, that under some conditions it may result in unpleasant or even harmful cooling. Where a large number of 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.

An exit shock when leaving air conditioned space and entering a warm atmosphere is equally plausible. Experiments at the A.S.H.V.E. Research Laboratory³³ indicated no demonstrable harm to a healthy individual. Complete acclimatization occurred as soon as normal perspiration was established in 5 to 15 min and mild exercise shortened the time required.

Satisfactory comfort conditions for persons at work³⁴ are found to vary depending upon the rate of work and the amount of clothing worn. In general, the greater the degree of activity, the lower the effective temperature necessary for optimum comfort. However, work by the A.S.H.V.E. Research Laboratory³⁵ indicates that under certain conditions moderate activity on the part of a person standing up and moving about may result in a slightly higher optimum effective temperature than for a person seated at rest, because of the larger body surface area exposed for heat elimination and the increase in effective air movement over his body. Where few workers occupy a large space in hot industries, work by the