

Outdoor temperature and comfort indoors

Michael Humphreys
Oxford Brookes University

The relationship between the temperature for comfort indoors and the outdoor temperature is obtained from the data of surveys of thermal comfort. Many surveys are now available, and the flow of new surveys continues. This paper considers what analytical procedures would best make use of all the available data. It also reflects on the meaning of the relation.

The comfort temperature must be derived for each batch of data that is used. It is calculated from the regression equation of comfort-vote upon temperature for the batch. The regression equation can be calculated only if the raw data (or the means, variances and correlation) are available. For small batches of data the regression coefficient is highly variable, and if the mean comfort vote differs much from neutral, results in unreliable estimates of the comfort temperature. It is therefore appropriate to calculate a single value, and apply it to all batches. It is based on surveys of a single day's duration, transverse in design, and taking place in a single building. A value may be established by analysis of the ASHRAE database and the SCATs data. The method is explained.

The reason for taking the single day and single building is as follows. From day to day considerable adaptation is likely to occur, reducing the apparent regression coefficient. We usually wish to know what swing of temperature is permissible during a single day, so we should use the single day survey, which will reflect only the adaptation that takes place during the day. People are likely to adapt to the normal temperature in their building, and as this may differ from building to building it is inappropriate to pool data from several buildings.

Having obtained the 'standard' regression coefficient, the way is open to use data from surveys that are reported in much less detail, were conducted over an extended period, or contain data pooled from several buildings. All that is needed is the mean temperature and the mean comfort vote. The accuracy of the comfort temperature can be estimated from the number of observations, using an assumed value for the residual variance of the comfort vote – a fairly stable statistic. Many surveys that otherwise would be rejected may therefore legitimately be used, and surveys with as few as 25 votes will provide a usefully accurate estimate of comfort temperature.

In this way it will be possible continually to update the relation between indoor comfort and climate as new data come in from different climates and from buildings of different thermal characteristics.