

Editorial

Special issue on thermal comfort standards

Some among the readers of *Energy and Buildings* may wonder why the editors have agreed to this special issue dedicated to the study of standards for thermal comfort. Is the specification of the exact temperatures to be delivered by buildings really that important? What interest is there in the detailed physics of clothing or the way questions are framed in comfort surveys? Anyway, haven't we got perfectly good standards already?

So how to justify this special issue? Firstly the energy consumption of buildings is critically dependent on the indoor temperatures which the building and its services must deliver. The sensitivity of occupants to the indoor climate also has implications for how closely we need to control the environment—again with energy implications. Secondly the research which underpins the science of thermal comfort is very diverse—ranging from climatology and building design, through simulation and the physics of clothing to physiology and psychophysics. The results of this research are widely spread in the literature and difficult to draw together; a single volume representing the major strands of thought is therefore attractive.

The recent conference *Moving Thermal Comfort Standards into the 21st Century* held in Windsor, England—on which this issue is based—revealed the breadth of research and the depth of controversy which continues to inspire interest in this subject. The full range of papers is available in the proceedings of the conference.¹ In this special issue we have tried to give a flavour of the papers presented through a representative selection of the best.

The Windsor Conference

The conference was called jointly by research teams at Oxford Brookes and Loughborough Universities in England. The call for papers set the conference the following goals:

- The current international thermal comfort standard (ISO 7730) is based upon research conducted in the 1960s. The PMV/PPD thermal comfort index was developed from knowledge and thinking at that time.
- In the intervening years, numerous researchers have been investigating and discussing specific aspects of thermal comfort in the laboratory and in the field.
- With new knowledge and the proposed revision of ISO 7730 it is timely to thoroughly review what has been achieved in the past 30 years and integrate new knowledge and ideas into future standards.
- Standards bodies have already indicated a willingness to incorporate new findings in any revisions. The way in which this is done will be the subject of intense debate and provides a strong reason to call a conference bringing together leading experts to discuss the issues involved in the development of new standards.
- The conference will present the thinking behind current international standards and debate the way in which they can be improved by the incorporation of new findings. Members of the relevant standards committees have been invited to attend the conference and will take an active part in the debates. At the same time, researchers will have an opportunity to present their results and take part in far-reaching scientific debates.

The residential conference venue, Cumberland Lodge in the grounds of Windsor Castle, provided an unparalleled chance for a 'full and frank' discussion of the research and the controversies. Full board with five-star cuisine meant that discussions (as well as games of snooker and table tennis) could continue into the night without fear that the pampered delegates would lose their way home.

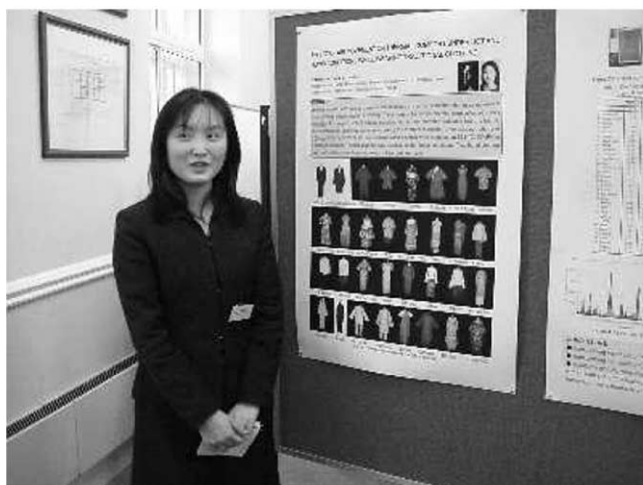
¹ Available using the form on the website through windsor@brookes.ac.uk



Cumberland Lodge conference centre



Group photographs of the delegates



Dr. Shigemi Mitsuzawa (Ochanomizu University, Japan)



Prof. Francoise Thellier (Universiti Paul Sabatier, France)

A major controversy in the science of thermal comfort—which will be familiar to old hands—is between the heat-balance approach and the adaptive approach. On the one hand there are those who seek to explain the comfort of subjects using an approach applying physics and physiology to the heat balance of the human–environment system calibrated under controlled conditions in the laboratory. This approach is exemplified by the PMV/PPD of current thermal comfort standards. On the other hand, there are those who rely on statistical analysis of the results from surveys of thermal comfort in the field. This approach is widely used and is exemplified by a number of papers in this volume. Field surveys suggest that in many real situations people are more tolerant of temperature change than the laboratory studies suggest, a phenomenon which has been given the name ‘adaptive’ since the subjects are assumed to be adapting to their environment.

The conference opened with a surprise from Ole Fanger, the veteran thermal comfort expert, and leading exponent of the heat-balance approach. In his opening address, he acknowledged the existence of the adaptive effect, and his paper (Fanger and Toftum) he supplies a tentative formulation to explain the difference with his own PMV.



Prof. Ole Fanger (Technical University of Denmark)

The body of the conference papers starts with Olesen and Parsons setting out the purpose and methodology of existing international comfort standards and their intended modification in this round of revision. deDear and Brager then present

an addendum (due to be incorporated into ASHRAE standard 55) using an adaptive approach to set temperatures for naturally ventilated buildings. Nicol and Humphreys present a more radical proposal advocating ‘sustainable standards’ based entirely on an adaptive approach. The discussion which followed this group of papers is available on the web at www.brookes.ac.uk/schools/arch/res/ocsdconf.html and gives some flavour of the debate.



Prof. Gail Brager (University of California Berkeley, USA)



Prof. Michael Humphreys (Oxford Brookes University, England)

But the adaptive controversy did not by any means occupy the entire conference. A number of papers centre on testing and improving the existing standard. Loveday et al. demonstrate that ISO 7730 describes the thermal environment in rooms with displacement ventilation and chilled ceilings. Improvements in the representation of clothing and metabolic rate in thermal indices is the subject of the paper by Havenith et al. Parsons reports on a series of laboratory experiments into the effects of gender, acclimation state, and physical disability on thermal comfort requirements. Toftum explores the effects of local discomfort.

The results of a number of field studies are reported. Heidari and Sharples look at comfort temperatures in Iran. Nakano et al. report the differences between local people and visitors in Japan. McCartney and Nicol report a wide-ranging series of studies conducted in countries throughout Europe and show how a variable indoor climate can save energy without compromising comfort.

New approaches are also presented such as the development of complex whole-body simulations described by Tanabe et al. and the presentation by Evin and Siekierski of a new method for evaluating heating and air conditioning systems using subjective assessment by a panel of experts. Jones summarises the strengths and weaknesses of different modelling approaches and Höppe reflects an increasing interest in outdoor comfort in a paper which highlights

the dangers of using steady-state models in a continually changing environment.

Finally Humphreys and Nicol return to the adaptive debate by providing an ingenious and comprehensive analysis of data from the ASHRAE international database of field studies to demonstrate the bias in the PMV equation which forms the basis of both ISO 7730 and ASHRAE 55.

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