

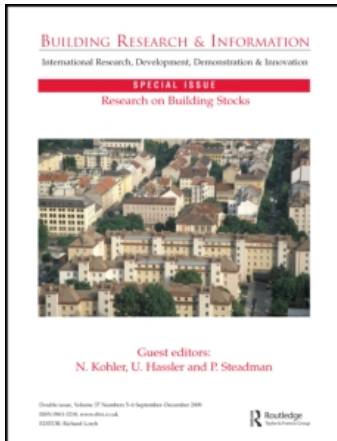
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Debating the future of comfort: environmental sustainability, energy consumption and the indoor environment

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Vast quantities of energy are consumed in heating and cooling to provide what are now regarded as acceptable standards of thermal comfort. In the UK as in a number of other countries, there is a real danger that responses in anticipation of global warming and climate change – including growing reliance on air-conditioning – will increase energy demand and CO₂ emissions even further. This is an appropriate moment to reflect on the history and future of comfort, both as an idea and as a material reality. Based on interviews and discussions with UK policy makers and building practitioners involved in specifying and constructing what will become the indoor environments of the future, four possible scenarios are identified each with different implications for energy and resource consumption. By actively promoting debate about the indoor environment and associated ways of life, it may yet be possible to avoid becoming locked into social and technical trajectories that are ultimately unsustainable. The aim of this paper is to inspire and initiate just such a discussion through demonstrating that comfort is a highly negotiable socio-cultural construct.

Keywords: adaptation, adaptive behaviour, air-conditioning, climate change, comfort, energy consumption, indoor environment, social convention, sustainability

Pour respecter les normes de confort thermique désormais jugées acceptables, le chauffage et le refroidissement consomment d'immenses quantités d'énergie. Au Royaume-Uni et dans bon nombre d'autres pays, on peut réellement craindre que les solutions proposées pour anticiper le réchauffement global et le changement climatique, y compris le recours croissant à la climatisation, aient pour effet d'augmenter davantage la demande en énergie et les émissions de CO². Il est donc opportun aujourd'hui de réfléchir au passé et à l'avenir du confort, qui est autant une notion qu'une réalité matérielle. S'appuyant sur des entrevues et des discussions avec des décideurs et des professionnels du bâtiment engagés dans la conception et la construction de ce qui deviendra notre environnement intérieur, l'auteur retient quatre scénarios possibles qui sont chacun décrits avec leurs différentes incidences en termes de consommation d'énergie et de ressources. Si l'on encourage activement le débat sur l'environnement intérieur et les styles de vie associés, il n'est peut-être pas trop tard pour éviter de se retrouver prisonniers sur des trajectoires sociales et techniques qui, en fin de compte, ne se révèlent pas viables. L'objet de cet article est de susciter et de lancer ce genre de débat en démontrant que le confort est un concept socioculturel parfaitement négociable.

Mots clés: adaptation, comportement adaptatif, climatisation, changement climatique, confort, consommation d'énergie, environnement intérieur, convention sociale, durabilité

Introduction

Those involved in constructing and specifying buildings are today faced with the challenge of anticipating and designing for uncertain, perhaps rapidly changing,

climatic conditions. From an environmental point of view, one of the main risks, particularly in the UK, is that air-conditioning systems will be installed in anticipation of global warming – a strategy that would itself

contribute to energy consumption and associated emissions of carbon dioxide. Anticipating the worst, designers might also be tempted to construct 'climatic fortresses' capable of coping with extreme and unpredictable weather patterns, whatever the cost. The UK government, along with professional organizations like the Royal Institute of British Architects (RIBA) and the Chartered Institute of Building Services Engineers (CIBSE), is paying serious attention to the question of what climate change might mean for the built environment and those who inhabit it (Smith, 2001; Department of Trade and Industry, 2003; Chartered Institute of Building Services Engineers, 2004). The implications are potentially far reaching. As various commentators have observed, technologies and design features considered efficient today may not be so if the climate changes. Likewise, currently comfortable buildings may be entirely unsuited to the conditions of the future (Pretlove and Oreszczyn, 1998). Much depends upon the rate and extent of change, and economic and environmental modellers are already exploring a range of possible scenarios (Hulme and Jenkins, 1998; Cullen, 2001). In practice, much also depends upon whether and how people's understandings of comfort evolve.

It is true that people die if they get too hot, cold, wet or dry, but it is also the case that people have reported being comfortable at temperatures ranging from 6 to 30°C (Goldsmith, 1960; Nicol *et al.*, 1999). There is more to comfort than temperature, but exactly where expectations lie along this range is, largely, a matter of culture and convention. As Cooper (1982a, p. 270) explains, comfort standards are 'social constructs which reflect the beliefs, values, expectations and aspirations of those who construct them'. Although there is some evidence that indoor environments are converging around the world, the specification of thermal comfort remains one of the most controversial topics in building science (Nicol and Parsons, 2002). This is important. As argued below, the ebb and flow of technical debate and the way in which considerations of comfort and energy conservation are defined and 'reconciled' (Cooper, 1982b) is of practical consequence for the sorts of environments that are actually constructed and hence for the kinds of conditions to which people become accustomed.

Accepting that future expectations are, in part, shaped by contemporary experiences, it is important to describe and document the ambitions and assumptions of those involved in specifying and constructing what will become the building, heating and cooling technologies of the future. Interviews with a selection of 13 architects, building services engineers, property developers, manufacturers and regulators, and further discussions with 17 participants at a specially convened workshop provide some insight into the ways in which comfort is currently conceptualized. Respondents and

participants were not selected at random. In all cases, they were chosen specifically because of their expertise and interest in thermal comfort and the built environment. In constructing our sample, a second aim was to investigate the different sorts of contribution that manufacturers and property developers as well as engineers and designers make to the construction of comfort. In talking with people from different backgrounds, the aim was to monitor current thinking and to identify and review ideas held by those actively involved in making, debating and shaping the meaning and reality of future comfort.

Respondents were asked to reflect on changing conventions of comfort, on theories and design methods, and on strategies currently adopted in anticipation of global warming. As described below, responses were more diverse and more complicated than the thermal comfort literature would have one expect.

This research suggests that the future of comfort remains fluid, contested and controversial. This is good news in that it means the range of possible responses is much wider than that currently contemplated by energy and environmental policy-makers whose first reaction when faced with the uncertainties of climate change is to explore ways of maintaining current standards of comfort as efficiently as possible. As argued below, such an approach has the potentially perverse consequence of taking for granted and thereby naturalizing meanings and expectations of comfort that are ultimately unsustainable. Rather than closing the subject down in this way, the authors suggest that the relation between comfort, climate change and environmental sustainability could and should be the subject of explicit social, technical and political debate. A first step in this direction is to articulate and draw out some of the dilemmas and complexities involved in making 'comfortable' buildings and so show just how negotiable is this concept.

Concepts and conventions

In the early 1900s, campaigners in the US argued that school children should study outdoors, fresh air being essential for the development of healthy bodies and minds (Cooper, 1998). By contrast, those who design and specify air-conditioned offices now conclude that productivity and comfort can best be achieved by limiting exposure to the elements.

This reversal of convention provides a dramatic illustration of the historical malleability of what people take to be appropriate, 'natural' and necessary. There is more to be said about how indoor environments have evolved, about which concepts of comfort have come to dominate and about the part that air-conditioning and other systems of mechanical control

have played in this process (for excellent social and cultural histories of air-conditioning in the US, see Cooper 1998; and Ackermann, 2002). One way or another, there is, it seems, an unstoppable demand for air-conditioning and for the standardized conditions it makes possible (Building Services Research and Information Association, 2002; Brager and de Dear, 2003). Air-conditioned cars, for instance, are bought and sold in places as climatically varied as Norway and Singapore. Although the market for domestic air-conditioning has yet to take off in the UK, some industry commentators conclude that it will only take two or three hot summers for a real momentum to develop (Giles, 2003). As these examples suggest, the reproduction of comfort, especially cooling, seems set to become an increasingly resource intensive activity.

There are different ways of thinking about this trend. One is that it is the 'natural' result of an equally natural desire. Technical codes and standards like those produced by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) and the CIBSE embody the results of extensive programmes of physiological research designed to determine the universal qualities, parameters and properties of human comfort (Fanger, 1970). Building designers and engineers around the world consequently rely on a form of scientific analysis that results in the precise specification of optimal conditions, the reliable reproduction of which almost always requires some form of mechanical control. For those who subscribe to this view of comfort, the practical challenge of responding to climate change is one of finding more efficient ways of meeting unavoidable demand.

Given the diversity and variability of the outdoor environment – an environment in which people have lived for much of human history – it is perhaps surprising that scientific research should generate such precise conclusions about what is comfort and how it might be provided (Baker, 2004). Is the notion of a universal optimum temperature merely an artefact of the theories

and methods of building science? Alternatively, is that design standards are 'self-fulfilling' in the sense that they inadvertently construct and reproduce increasingly standardized concepts and conventions of comfort (Baker, 1993; Humphreys, 1994; Shove, 2004)? If the latter, the 'need' for air-conditioning is not a 'natural' consequence of the human condition. It is instead the outcome of a sequence of events through which a particular model of comfort has been reified, naturalized and reproduced (Shove, 2003).

Field studies such as those undertaken and reported on by Nicol *et al.* (1999) and Humphreys (1994) provide some support for this view, for they show how people of different cultures manage, value and maintain very different indoor conditions and interpretations of comfort. The lesson here is that comfort is a provisional and always precarious social and cultural achievement. From this point of view, responding to global climate change is not simply, or not only, a matter of finding more efficient ways of meeting unwavering human need. It is instead important and possible to challenge contemporary conventions, the relentless reproduction of which threatens to condemn society to a trajectory of escalating energy consumption.

These two theoretical positions – one that comfort is a universally definable state of affairs, the other that it is a socio-cultural achievement – have quite different consequences for energy and environmental policy (Table 1).

The next section considers how the problem of defining and providing comfortable yet sustainable indoor environments is currently being addressed in the UK.

Comfort and climate change: UK policy

In the recently published Energy White Paper, the UK government commits itself to a 60% reduction in carbon dioxide emissions by 2050. Given how much energy is used in heating and cooling buildings,

Table 1 Contrasting concepts of comfort and what they mean for policy and practice

	Comfort as a universally definable state of affairs	Comfort as a socio-cultural achievement
Theory of comfort	heat balance model	historically and culturally specific experience
Characteristics of comfort	definable universal condition	social phenomenon
How to provide comfort	deliver specified comfort conditions	provide opportunities in which people make themselves comfortable, whatever that means
Policy response to the challenges of climate change	develop and promote technical fixes and so increase the efficiency with which comfortable conditions are provided	debate and explore diverse meanings of comfort; construct new and varied infrastructures, contexts and experiences of comfort

reductions in this sector are essential if the emissions target is to be met. The White Paper reports that:

Energy is often wasted because of poorly insulated buildings or where heating, ventilation, air-conditioning and lighting are poorly controlled. (Department of Trade and Industry, 2003, p. 32)

In response, the government proposes a variety of initiatives designed to promote efficiency and improve product standards. Although the White Paper does not directly address the meaning of comfort, one concern is to ensure that all UK homes are adequately, affordably and efficiently heated in the future. A particular priority is to bring all 'fuel poor' households (those that currently spend more than 10% of their income on keeping warm) 'up to a decent standard' (Department of Trade and Industry, 2003, p. 108).¹ Another is to ensure that peak demand can be met in exceptionally cold weather.

Aside from acknowledging that air-conditioning 'may become more widespread in future' (Department of Trade and Industry, 2003, p. 108), the White Paper says nothing about how conventions and expectations of comfort might change or how the existing building stock and its inhabitants might respond in the event of global warming. If the government's approach to cooling were to parallel that currently taken towards heating, steps would have to be taken to provide households with adequate and affordable 'coolth' as well as warmth. Research is currently underway to investigate the use and efficiency of domestic air-conditioning in the UK,² for there is no doubt that the implications for energy consumption are potentially immense. If domestic air-conditioning was to become normal, infrastructures might have to cope with peak demand for cooling in the summer and for heating in the winter. Meanwhile, building regulations, currently designed to improve insulation and minimize draughts, might require overhauling if homes were not to become intolerably hot in the summer. According to this study's respondents, such issues are of current concern to those responsible for Part L (energy) of the UK building regulations and various policy responses – including the development of performance standards for air-conditioning – are being debated. In focusing on heating, ventilation and air-conditioning systems, current environmental policy presents the problem and the solution as one of technical control, design and engineering. As such, it shows a continuing commitment to maintaining current standards of comfort even in the face of anticipated global warming.

The 'Climate Change and Built Environment Fora', part of the government's UK Climate Impacts Programme (UKCIP), takes this approach a stage further. The fora help organizations involved in the construction industry assess how they might be affected by

climate change and how they might prepare for impacts on the built environment. The report of a UKCIP workshop highlights trends considered important for building design including the possibility of 'higher summer temperatures that would lead to a significant increase in the demand for air conditioning' (UK Climate Impacts Programme, 2001, p. 2). A two-pronged response is proposed: 'We must begin to reduce emissions (mitigation) and we must adapt to what is effectively unavoidable change' (UK Climate Impacts Programme, 2001, p. 1). The checklist of suggested tools and methods includes designing more shading, promoting natural ventilation and increasing the thermal mass of buildings. Again, the task is defined as one of transforming design processes and of educating designers, clients and users. In focusing on behavioural or technological adaptation, proposed responses fail to engage with the possibility that cultural and institutional conventions might change. They also fail to recognize existing diversity in the way that indoor environments are constructed in the UK today.

Constructing comfort in practice

The interviewed designers and practitioners were much more uncertain about the nature and future of comfort than these policy strategies suppose. In practice, the thermal performance of an individual building and the type of indoor environment it provides are the result of complex processes involving clients, designers, manufacturers, regulators, managers and occupants. In this, divisions of responsibility, power and influence, e.g. between architects and engineers, or between building owners and occupants, are important. Institutional and professional arrangements have practical consequences for whose assumptions and judgements, including judgements about the relations that should 'obtain between people and the environments they occupy' prevail (Cooper, 1982a, p. 279). The built environment consequently reflects and embodies a cocktail of contrasting and often competing concepts. The following paragraphs illustrate something of what these mean for how comfort is constructed in practice.

Specifying comfort

Echoing Heschong's (1979) experiential account of 'thermal delight', a number of respondents elaborated on the complexity of people's perceptions of comfort and challenged the view that these could be reduced to a bundle of variables including temperature, humidity, air quality, etc. The more ordinary point that building occupants, engineers and designers work with different languages of comfort is important. It is one thing to experience being hot, cold, chilly, sticky, etc., but another to know how this rather elastic term-

nology translates into the precision of degrees centigrade.³ The gulf between designers' detailed calculations on the one hand and the effect of adding or removing a sweater on the other remains wide. As our respondents explained, occupants' 'fuzzy' meanings and terminologies do not provide a sufficiently consistent point of reference around which to make detailed decisions about building design. On the other hand, technical measures, models and calculations can easily acquire a life of their own, albeit one divorced from real meaning and experience. One of the respondents was, for example, critical of rote following of norms and guidelines regarding over heating.

I think all this stuff of saying it's the percentage of time it is above 27°C or something ... that has absolutely no meaning at all.

(building services engineer)

In the context of the interview, the challenge was one of finding a realistic and appropriate – but not spuriously precise – language with which to describe the indoor environment.

Another explains how much more is involved than that which can be monitored and measured:

We see comfort as being a broader issue than just thermal, that doesn't mean we can assess all those other issues equally well but at least it means we recognise it might mean more than just an air temperature or radiant temperature. We also understand that there are a number of theories of comfort out there, so we know that thermal comfort is one of a number of comfort parameters that need to be considered and we understand that comfort is physiological and psychological and we try wherever possible to be as adventurous with both or consider both.

(building services engineer)

Confronted with this complexity and given the added uncertainties of future climate change, designers and clients described different ways of figuring out what to do. One method is to work with existing specifications like those developed by the British Council of Offices (2000). Some of the clients with whom we spoke adopted just such an approach. This generated correspondingly, and from the designer's point of view, sometimes unrealistically tight definitions of success and failure. Inhabited buildings are such complex systems that it is not easy to guarantee that they will always meet precisely defined and exacting standards of indoor climate control – or at least not without over-sizing the systems involved. As a couple of respondents commented, some clients are so anxious about future global warming that they are making 'unreasonable' requests, for instance demanding buildings that can cope (i.e. deliver standardized

conditions of comfort) should the temperature outside reach 40°C (in the UK).

The design criteria used to be 28°C and now jobs come in at 30 and a lot of jobs even come in at 35. Now whether we ever have 35 I don't know, we had one recently that was 40, now 40 degrees is seriously hot. ... I said to the guy have you ever experienced 40 degrees do you know what its like?

(air conditioning manufacturer)

All this is to equate 'comfort' with a predetermined, non-negotiable, set of conditions. Though common, this was not the only way forward.

A number of the design respondents described situations in which comfort strategies were the subject of extensive debate and in which clients were positively interested in stretching formulaic 'rules' and exploring different ways of managing the indoor environment. These discussions revolved around a handful of critical questions. For example, were clients willing to act on the basis that the relationship between human physiology, outside temperatures, seasonal and cultural variation, and social convention influence people's expectations of comfort? The following extract is from an interview with an architect who suggests that more complicated interpretations of comfort are sometimes used to justify forms of 'cutting back' or compromises made in the name of environmental sustainability.

These projects have a client who is committed to sustainability and who will compromise to be more sustainable and will listen to the consequences of following that approach ... with comfort, these types of client are happy to listen to the argument that comfort is not just keeping between 21 or 23 degrees and they are prepared to accept the concept of complicated equations – the relationship to the outside [temperature], seasonal changes, wearing the right clothes – all these sorts of things that enable you to be more flexible in attitudes towards comfort.

(architect)

Others believed that variation is itself an important part of being comfortable and that far from representing a compromise, solutions based on these sorts of arguments are superior to those that deliver uniform conditions of 'thermal monotony'. In any event, the central point is that clients differ in what they are willing to go along with, as illustrated by this second example:

The client said they wanted a non-air-conditioned building, and so we talked to them

about what conditions would be like and what temperature they might achieve. And, they said what about comfort, so we advised them that they must expect to make adjustments, to take jackets off or loosen ties, and they said oh well we can't do that, we're solicitors, actually we have a dress code ... and the engineer who was working on it said well if you really mean that it actually means you'd better have an air-conditioned building because otherwise it would be uncomfortable.

(building services engineer)

Fundamental decisions like whether or not to air-condition set the agenda for much of what follows. This is an obvious point but one that has extensive consequences for the kinds of questions that do and do not arise with respect to the detailed design and subsequent management of the indoor environment. How far are occupants able to determine their own conditions, how much 'adaptive opportunity' does the building afford and how are responsibilities for the day-to-day definition and management of comfort distributed both between humans and between people and technologies? As these questions indicate, it is impossible to disentangle comfort-related strategies on the one hand from the social and political dimensions of building design and use on the other. In other words, theories of comfort and associated technological solutions themselves reflect and reproduce contrasting formulations of socio-technical power (Foucault, 1979).

What is deemed possible and what is and is not up for negotiation relates to a range of other conventions about what buildings should contain and what they should look like. These are anything but static. Office air-conditioning has become increasingly common in the UK, not necessarily for reasons of comfort, but because it constitutes one amongst other signifiers of 'quality' and prestige. This process of normalization is one in which estate agents, valuers and property developers play at least as important a role as clients and end-users (Guy and Shove, 2000).

It is again obvious, but again important, to recognize that the images, expectations and combinations of pressure that influence the comfort-related aspects of high status office developments are not the same as those affecting hospitals, schools or homes. As these brief examples illustrate, the process of specifying and designing for comfort is subject to localized, context-specific considerations. Indoor environments – and hence meanings and experiences of comfort – consequently reflect and are the result of entire sequences of decisions over which different actors have varying degrees of influence. It is tempting to suggest that more environmentally forgiving strategies might be adopted if end-users and occupants had a

more powerful role and greater control over their own environments. However, such an arrangement need not lead to any less demanding interpretation of comfort, particularly not now that people have become accustomed to a uniquely standardized understanding of what conditions 'should' be like indoors.

Changing conventions and criteria

For all the differences hinted at above, people's expectations of comfort have changed significantly over the last few decades. Indoor conditions are still immensely varied and in the UK, as elsewhere, those who suffer from fuel poverty are still likely to wake to traces of frost on the inside of the windows. However, the waistcoat has gone out fashion and the hot water bottle is in decline. Whether or not they can achieve it, people increasingly expect and have become accustomed to the same conditions indoors, in cars, offices, hotels and shops. This is an important development, but there is no reason to suppose that current conventions will last forever.

When asked about how they thought the future might unfold, the respondents identified four possible scenarios.

Many expected conventions of comfort and clothing to *stabilize and standardize* still further. Assuming that this happens and that the climate does become warmer, the result will be an increased 'need' for cooling in particular. The market for domestic air-conditioning has yet to develop in the UK, but under these circumstances, it is reasonable to expect that it would. In theory, at least, the government might make some radical intervention, e.g. introducing regulation to ban domestic air-conditioning before the idea takes hold. In practice, the more likely policy response is to develop much more efficient ways of providing and delivering precisely defined conditions of comfort. This might involve new forms of technology, better controls or carefully calibrated, climatically sensitive, passive design strategies.

A second related possibility is that interpretations of comfort will develop in ways that are *even more demanding* to meet than those of today. What if people expect to be even warmer during the winter and even cooler during the summer? Results from household surveys suggest that UK homes are routinely heated above 21–22°C (Hunt and Gidman, 1982; Walters *et al.*, 2000) and in the US, it is common for indoor environments to be cooler during the summer than in the winter. In environmental terms, trends of this kind make the search for more efficient technological solutions even more urgent.

Alternatively, the 'comfort zone' might extend in ways that reduce rather than increase resource consumption.

Instead of expecting standardized conditions indoors all year round, people may become used to *greater variety* such that they expect to be colder than at present during the winter and warmer than at present during the summer. If this were the case, seasonal fashions might provide an important means of managing climatic variation. Clothing, combined with much more elastic definitions of comfort, could significantly reduce energy demand and provide a means of accommodating global warming without adding to the problem itself. More elaborately, new clothing technologies could be developed to provide for insulation and environmental control, so taking the pressure off the indoor environment. Designers would still produce buildings that required heating and cooling, but only by as much as required to maintain indoor temperatures within a much expanded range. The idea that staff might be allowed to work different hours on very hot days, or that they wear shorts and not business suits, might become so institutionalized that it would be taken for granted by designers, users and clients alike (Morgan and de Dear, 2003). As one respondent noticed, the collective social and institutional renegotiation of 'normal practice' is a real possibility.

We know from studies across the world that if people don't have air-conditioning or if they don't have heating that they will dress appropriately and they will be comfortable in a very wide range of conditions, but we haven't quite brought that into play yet.

(building scientist)

Although most respondents expected meanings of comfort to converge around the globe, partly as a result of designers' reliance on standardized methodologies, partly because of the powerful commercial interests at stake – this is not the only option. It is, for instance, possible to imagine a fourth scenario involving the reinvention and positive valuation of local *cultural and climatic diversity*. Developing this theme, Cole and Lorch (2003) explore related ideas like those of developing 'regionally appropriate' environmental building practices (p. vii).

More immediately, the notion that movement between contrasting conditions is an important part of being and of making oneself comfortable might justify lower energy solutions that maximize adaptive opportunity. The respondent quoted below does not go quite this far, but he does challenge the 'need' for an entirely uniform environment:

People can move and you can at least accept that some areas can be less comfortable if they are not permanently occupied and that might mean that these areas could be slightly warmer in the summer. I don't think you would set out to make a space more uncomfortable, but you

would set out to relax the conditions at which comfort would be achieved.

(architect)

Several interviewees drew attention to some people's dislike and distrust of standardized air-conditioned environments. Is it really healthy to spend so much time in such 'unnatural' conditions? Concerns of this kind were frequently cited by those seeking to explain contemporary resistance to domestic air-conditioning. Looking ahead, naturally ventilated buildings might become fashionable and highly sought after precisely because they provide conditions that are not so precisely controlled.

The four possibilities sketched above are not exclusive alternatives and it is, in any event, important to remember that much of the built environment and many of the social conventions of the future already exist. Having said that, each scenario has significantly different implications both for resource consumption and for what might be done to contain it. Whether the trend is toward greater standardization or away from it remains to be seen. Either way, what happens next is of enormous environmental significance.

Interests, institutions and the future of comfort

Developing some of the points made above, it is suggested that the future of comfort is likely to depend, at least in part, on the relative influence of different interests and institutions involved in the construction process, and on the types of building science that are favoured and developed as a result.

If manufacturers, professional organizations, software developers, designers and environmentalists are to introduce more elastic concepts of comfort or produce indoor environments that are culturally satisfactory rather than technically optimal, they will have to challenge established definitions of risk and failure and question methods, standards and procedures that their colleagues follow as a matter of course. It is difficult to imagine that many will run against the grain of professional convention. On the other hand, and as we have seen, each building is different and no one party is entirely in control. In general, it is probably true that few clients are willing to 'compromise' comfort (narrowly defined) for the sake of environmental sustainability. However, it is also true that the client body is immensely diverse and that trade-offs, judgements and compromises are made all the time, not just during the design phase, but also in the way that buildings are managed and maintained. These detailed variations have a cumulative effect on the current and future construction of comfort and in

that sense the future is more flexible and more malleable than it might at first appear.

At the same time, science is an important and constant point of reference across the board. Scientific research underpins established codes and standards and informs any number of design decisions. Yet the science of comfort is complicated and contested. This is not the place to embark on a detailed discussion of contemporary controversies in physiology and building physics, but it is important to note that they revolve around a handful of enduring questions about the cultural and/or physiological nature of comfort; the relative significance of different variables under different climatic conditions; and the possibility of adaptation (Brager and de Dear, 2000). Such debates take place remote from the world of design and practice but in a way both are structured and organized with reference to the prior question: What does one need to know to produce what people count as a comfortable environment? (Humphreys, 1995). Some ways of addressing this question generate research the conclusions of which support the design and development of increasingly standardized indoor environments. Others do not.

Neither the contested sciences of comfort or the complicated politics of construction provide a definitive answer: future understandings of comfort might be more restricted than they are today, or they might be more elastic. From an environmental point of view, more flexible interpretations appear to be less resource intensive to maintain both in the short term and in the longer run. It is therefore important to recognize that current policy approaches take current comfort standards so much for granted and that they take them out of the frame. This is severely restricting. By searching for more efficient ways of delivering standardized indoor environmental conditions, energy and environmental policy-makers inadvertently sustain a narrow and therefore uniquely demanding concept of comfort. This move has the further consequence of unnecessarily limiting the range of organizations, stakeholders and institutions involved in responding to anticipated climate change. As indicated above, concepts of comfort are made and reproduced through and as a consequence of the intersecting actions of a really very wide cast of players, all of whom have a part to play in constructing the future. In conclusion, it is suggested that there is real scope for broadening the reach and remit of environmental policy.

Rather than figuring out more efficient ways of maintaining 21–23°C in the face of global warming, society should be embarking on a much more searching debate about the meaning of comfort and the ways of life associated with it. In this way, it might be possible to exploit existing diversity and variety both in people's expectations and in the built environment and so avoid a commitment to an unsustainably standardized future.

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References

- Ackermann, M.E. (2002) *Cool Comfort: America's Romance with Air Conditioning*, Smithsonian Institution Press, Washington, DC.
- Baker, N. (1993) Thermal comfort evaluation for passive cooling, in Palz, W. (Ed.): *Solar Energy in Architecture and Urban Planning*, H. Stephens Associates, Bedford, pp. 103–106.
- Baker, N. (2004) Human nature, in Steemers, K. and Steane, M.A. (Eds): *Environmental Diversity in Architecture*, E & FN Spon, London, pp. 47–64.
- Brager, G. and de Dear, R. (2000) A standard for natural ventilation. *ASHRAE Journal*, October, 21–27.
- Brager, G. and de Dear, R. (2003) Historical and cultural influences on comfort expectations, in Cole, R. and Lorch, R. (Eds): *Buildings, Culture and Environment: Informing Local and Global Practices*, Blackwell, Oxford.
- British Council of Offices (2000) *BCO Guide 2000 – Best Practice in the Specification of Offices* (available at: <http://www.bco-officefocus.com>).
- Building Services Research and Information Association (2002) *The World Market for Air Conditioning*, BSRIA, Bracknell.
- Chartered Institute of Building Services Engineers (2004) *Energy White Paper Implementation Workshop Report*, CIBSE, London.
- Cole, R. and Lorch, R. (Eds) (2003) *Buildings, Culture and Environment: Informing Local and Global Practices*, Blackwell, Oxford.
- Cooper, G. (1998) *Air Conditioning America: Engineers and the Controlled Environment, 1900–1960*, Johns Hopkins University Press, Baltimore, MD.
- Cooper, I. (1982a) Comfort theory and practice: barriers to the conservation of energy by building occupants. *Applied Energy*, 11, 243–288.
- Cooper, I. (1982b) Comfort and energy conservation: a need for reconciliation. *Energy and Buildings*, 5, 83–87.
- Cullen, N. (2001) *Climate Change – Designing Buildings with a Future*, in Proceedings of the CIBSE National Conference, Regent College, 18 October (available at: <http://www.cibse.org/pdfs/climate.pdf>).
- Department of Trade and Industry (2001) *The UK Fuel Poverty Strategy*, HMSO, London.
- Department of Trade and Industry (2003) *Our Energy Future – Creating a Low Carbon Economy*, HMSO, London.
- Fanger, O. (1970) *Thermal Comfort Analysis and Applications in Environmental Engineering*, McGraw-Hill, New York.
- Foucault, M. (1979) *Discipline and Punish*, Peregrine, Harmondsworth.
- Giles, A. (2003) Air conditioning still waits for the big push. *Building Services and Environmental Engineer* (available at: <http://www.bsee.co.uk>).
- Goldsmith, R. (1960) Use of clothing records to demonstrate acclimatisation to cold in man. *Journal of Applied Physiology*, 15(5), 776–780.
- Guy, S. and Shove, E. (2000) *A Sociology of Energy, Buildings and Environment: Constructing Knowledge, Designing Practice*, Routledge, London.
- Heschong, L. (1979) *Thermal Delight in Architecture*, MIT Press, Cambridge, MA.

- Hulme, M. and Jenkins, G.J. (1998) *Climate Change Scenarios for the UK: Scientific Report*, UKCIP Technical Report No. 1, Climatic Research Unit, Norwich.
- Humphreys, M. (1994) Field studies and climate chamber experiments in thermal comfort research, in Oseland, N. and Humphreys, M. (Eds): *Thermal Comfort: Past, Present and Future*, Building Research Establishment, Watford, pp. 52–69.
- Humphreys, M. (1995) Thermal comfort temperatures and the habits of hobbits, in Nicol, F., Humphreys, M., Sykes, O. and Roaf, S. (Eds): *Standards for Thermal Comfort*, E & FN Spon, London, pp. 3–14.
- Hunt, D. and Gidman, M. (1982) A national field survey of house temperatures. *Building and Environment*, 17(2), 107–124.
- Morgan, C. and de Dear, R. (2003) Weather, clothing and thermal adaptation to indoor climate. *Climate Research*, 24(3), 267–284.
- Nicol, F. and Parsons, K. (2002) Editorial: Special issue on thermal comfort standards. *Energy and Buildings*, 34(6), 563–572.
- Nicol, J. F., Raja, I.A., Allaudin, A. and Jary, G. (1999) Climatic variations in comfortable temperatures: the Pakistan projects. *Energy and Buildings*, 30, 261–279.
- Pretlove, S. and Oreszczyn, T. (1998) Climate change: impact on the environmental design of buildings. *Building Services Engineering Research and Technology*, 19(1), 55–58.
- Shove, E. (2003) *Comfort, Cleanliness and Convenience: The Social Organisation of Normality*, Berg, Oxford.
- Shove, E. (2004) Social, architectural and environmental convergence, in Steemers, K. and Steane, M.A. (Eds): *Environmental Diversity in Architecture*, E & FN Spon, London, pp. 19–29.
- Smith, P.F. (2001) *Architecture in a Climate of Change: A Guide to Sustainable Design*, Architectural Press, London.
- UK Climate Impacts Programme (2001) *Climate Change and the Built Environment*, Research Fora, Workshop Report, UKCIP, London, 9 October.
- Walters, G.A., Kempson, I. and Shorrocks, L. (2000) *Domestic Energy Fact File*, Building Research Establishment, Watford.

Endnotes

¹In the UK Fuel Poverty Strategy, this is specified as ‘21°C in the living room and 18°C in the other occupied rooms’ (Department of Trade and Industry, 2001, p. 6).

²This work is being carried out at the Bartlett School of Graduate Studies, University College London, with funding from the Engineering and Physical Sciences Research Council.

³The workshop on which part of this paper is based was held in January 2004 in a building in which the heating system failed. Participants, all experts in thermal comfort, were invited to estimate the indoor temperature. Answers ranged from 9 to 20°C when the thermometer read 15.5°C.