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Editorial

Conditioning Demand: Older people, thermal comfort and low-carbon housing

> A lower-carbon society supposes and requires significantly new ways of conceptualizing and realizing conditions of comfort. Shove et al. (2008: 307).

Demographic change has multiple implications for housing and energy policy, as well as for those who design and manage residential buildings. The living experiences of older people are enormously diverse due to differences in physical ability and health, financial resources, aspirations and domestic living situations. Some older people are in good health and are active; they are improving their homes, adopting new sustainable technologies and leading full and mobile lives. Meanwhile, others live comparatively sedentary lives and spend the majority of their time at home (HBF, 2005; DCLG, 2008; Hamza and Gilroy, 2011). The combination of lifestyles as well as variation in building quality and policies and regulations related to housing and energy produce a diverse landscape of domestic energy practises of older people.

A particular implication of demographic change, housing provision, and energy consumption involves health and well-being. Those that live in poorer quality, energy inefficient houses and exist on low incomes can grapple with the challenges of fuel poverty (e.g., Wright, 2004; Day and Hitchings, 2009). Being too cold or too hot presents physical risks, as changes such as lower metabolic rates and poor blood circulation become important. Sight loss and dementia are two conditions common in older people that have implications on how they manage and control their domestic environments (see Van Hoof et al., 2010). All of these factors have implications on how housing and energy are implicated in the daily lives of older people.

At the same time, a wide range of technological innovations is being developed and deployed to reduce the carbon emissions from domestic buildings. Low-carbon thermal technologies (LCTs) such as air and ground source heat pumps, solar hot water, underfloor heating, programmable thermostats, and mechanical ventilation with heat recovery are designed to minimise energy consumption and utilise low-carbon fuels but their influence on thermal experience is often overlooked. For example, heat pumps substitute the high-temperature point sources of warmth in houses with low-temperature background heating, creating a relatively uniform thermal environment. The absence of a highly differentiated thermal landscape in dwellings may lead to the formation of new practises in the same way that central heating ushered in entirely new modes of household management and comfort. At the same time, heat pumps may disrupt existing social practises such as gathering around heat sources (i.e., the hearth) that have been part of everyday life for millennia (Fernández-Galiano, 2000; Rudge, 2012) as well as drying clothes, getting warm after entering from a cold exterior, and so on. Hence, how such technologies become implemented in practise (through networks of actors, governance measures and in relation to existing or new building and energy infrastructures and institutions), how they contribute to thermal experience from users' perspectives and how demand is (or is not) reconditioned as a consequence, are key research questions (Walker, 2008; TSB and ESRC, 2009).

This special issue presents findings from the ‘Conditioning Demand: Older People, Diversity, and Thermal Experience’ research project undertaken between 2011 and 2013. The aim of the project was to address the confluence of two key future trends: Europe's ageing population and the need to reduce domestic energy consumption to counter rising utility prices and the increasing threat of climate change. These dynamic processes play out in a wide range of places but perhaps no more so than in the domestic sphere. The research team started from the premise that demand is not simply about the consumption of energy but rather about the services that energy can provide (Lutzenhiser, 1993). Patterns of energy consumption are not only influenced by economic decisions and value choices but are configured by complex networks of technological, social, cultural, and institutional factors (Shove, 2003).

One such set of energy services relates to thermal comfort – the heating and cooling of air, water, and materials from which various forms of comfort, pleasure, conviviality, sustenance, and utility are derived. The provision of these services in domestic spaces has major implications in the pursuit of more energy efficient and low-carbon society. The findings presented here extends the focus of previous research on thermal comfort (Fanger, 1973; Baker, 1996; Nicol and Humphreys, 2002; Chappells and Shove, 2005; Shove et al., 2008, 2009) by exploring ageing populations and the implications of introducing LCTs. This study is complicated by the diversity of living experiences within the older population, reflecting differences in older occupants' physical ability, health, financial resources, aspirations and domestic situations. In particular, housing types occupied by older people vary enormously; some older people live independently in their own homes while others live in sheltered accommodation or care homes where the management of thermal comfort is not the responsibility of occupants alone.

Utilising ideas from architecture, geography, sociology, and environmental psychology, the articles included in this special issue draw on empirical research related to energy consumption in private homes, care homes and sheltered accommodation in the

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UK and France between 2011 and 2013. In a changing technological and demographic context, our aim was to understand the implications of these trends and how they relate to domestic thermal experiences amongst older people. A range of methods was used to study comfort including quantitative analysis (such as SAP ratings of buildings), spatial analysis using images and building plans, and qualitative analysis of interviews with occupants, designers, building managers and care home staff. As a whole, the collected data allowed the researchers to develop a thorough understanding of day-to-day experiences of thermal comfort. By applying a sociotechnical approach to energy consumption, the researchers investigated the factors affecting the uptake of low-carbon thermal technologies, older people's thermal comfort experiences, and how comfort was conceptualised and practiced in a range of domestic settings. There was a shared understanding that household patterns of consumption and demand and the diffusion of sustainable technologies are dialectically linked.

This study of thermal comfort has explored this diversity of experience. Rather than assuming that engineering approaches which seek to control and optimise the temperature of buildings are sufficient, the contributors recognise that comfort is the result of a complex mix of factors, including the materiality of buildings but also extending to levels of physical activity, the extent to which occupants can exercise control over heating and cooling systems, and the cultural and social underpinnings of how comfort is experienced and managed in everyday life. The research also paid attention to the ways in which people adapt their activities to maintain comfort; whether opening windows and blinds, changing clothing, or modifying their food and drink intake. The overall aim of this special issue is

– to investigate the factors affecting the uptake of low-carbon thermal technologies in older people's housing, including in private households and care homes;
– to explore older people's thermal comfort experiences, arising from the introduction of low-carbon thermal technology and, in the case of institutional care settings, management decisions; and
– to consider how representations of older people and conceptualisations of thermal comfort impact on policy and practise.

In the first article of this special issue, Neven et al. (2015) explore the factors that influence the uptake of LCTs in residential care homes in the UK. Observing that most care homes have a high energy consumption, not least because they operate 24 h per day for seven days per week, they suggest that care homes are particularly appropriate for the implementation of low-carbon thermal technologies. However, drawing on qualitative interviews with care managers and staff, Neven and colleagues note that the reduction in operating costs achievable by installing LCTs is often marginal compared to the overall cost of operating a care home. Furthermore, the cost benefits of installing LCTs need to be balanced against the potential risks associated with the failure of these technologies. Any delay in acquiring replacement components for a failed heating system could negatively impact on a care home provider's reputation, particularly given the scrutiny to which care homes are subject by regulators. The decision to install LCTs is therefore informed not by considerations of energy consumption alone, but is also affected by the degree to which such technologies are likely to impact on care practises and institutional competition and regulation.

Lewis (2015) provides findings on a very different type of domestic building – extra-care housing – which provides older occupants with self-contained dwellings and access to communal facilities and care. Through interviews with those individuals involved in the design, development and management of extra-care housing, Lewis explores how ideas about ageing inform housing design, which in turn affects thermal comfort. The respondents emphasised the ‘biological’ and ‘institutional’ dimensions of ageing such as physical and physiological changes associated with ageing that can cause older people to be vulnerable to the cold or at risk of falling against hot surfaces or from high windows. Interviewees also discussed the importance of reduction in income that often comes with retirement and the implications for paying energy bills. These user representations, based on assumptions about older occupants' needs, preferences and competences, were scripted into the design of extra-care housing though the selection of thermal technologies. This focus on design highlights how comfort is influenced by designers' and managers' assumptions about occupants' activities and preferences.

Grandclément et al. (2015) further explore the idea that an extended network of actors negotiates thermal comfort. They argue that intermediaries play an important part in the lives of older people, particularly for those who are frail or infirm. Through study of a low-carbon housing scheme for older people in Grenoble, France, the authors explore the role of intermediaries in helping occupants to achieve thermal comfort while reducing energy consumption. They demonstrate how the building manager, family members and user guides facilitate intermediation processes. For example, the building manager turned some vents through 180° to reduce draughts, some family members helped occupants to programme their thermostats, while some occupants relied on the user guide in programming thermostats. Grandclément and colleagues conclude that reductions in energy consumption are not only achieved through effective engineering and changes in occupant behaviour but also through on-going sociotechnical negotiations. Thus, it is important to understand the dynamics of how comfort is negotiated and who is doing the negotiation and why.

Occupant understanding of thermal environments is further explored by Tweed et al. (2015) in the context of single-family housing. The authors argue that older people have a more sophisticated understanding of their thermal environments than is often acknowledged. For example, respondents were able to identify areas within their homes where particular thermal conditions could be achieved, and showed an awareness of seasonal or diurnal changes to these conditions. Furthermore, the findings revealed that occupants are active in operating, modifying or moving within their homes to achieve thermal comfort. These observations challenge the idea that older occupants are merely passive consumers of thermal conditions delivered by the particular configurations of building fabric, heating system and controls. Instead, older occupants are likely to have accumulated experience of maintaining thermal comfort. Also, the greater the scale and cost of any interventions made by occupants, the more likely it is that occupants will want to achieve multiple goals, such as improved thermal comfort, enhanced usability of the home and greater energy efficiency.

Henshaw and Guy (2015) compare and contrast the experiences of older occupants living in a range of housing-types including private houses, extra-care housing and residential care homes. They consider how older occupants' experience of LCTs and traditional thermal technologies is affected by sensory stimulus, including non-thermal information such as auditory and olfactory stimuli, and how this influences the management and maintenance of thermal technologies. For example, a sealed building envelope might minimise heat loss from a building, but in separating the internal from the external environment it can also reduce occupants' exposure to sensory stimuli from outside. Being unable to feel the breeze, to smell plants in the garden or to hear the sound of children playing might impair a sense of comfort for people who spend much of their time indoors owing to infirmity or impaired mobility. The desire to experience or eliminate certain sensory stimuli will affect the use of thermal technologies in ways that can work with or against the logic of operating systems, and which in turn will affect a building's energy efficiency performance. Thus, sensory experience is an important but overlooked part of thermal management of buildings.

Addressing the means of studying comfort, Bickerstaff et al. (2015) suggest that the application of qualitative methods in energy research has helped to improve our understanding of energy-related social practises. Qualitative research is particularly useful for uncovering people's values and motivations, and the roles played by building-occupants in conditioning energy demand. However, the complex narratives that often result from such research are difficult to distil for policymakers, and the small-scale of many qualitative studies raises questions about the extent to which the findings reflect the characteristics of the wider population. To address these concerns, Bickerstaff and colleagues argue for an approach to the analysis of qualitative data that involves combining data from multiple studies. They demonstrate this idea by comparing data from the Conditioning Demand project and the UK-based study ‘Carbon, Comfort and Control’. While these two projects differed in terms of aims and methodologies, a comparative analysis approach yields insights that were not apparent during the original analyses. For example, both studies showed that the installation of LCTs involved the appropriation of devices into pre-existing spatial and social conditions, and revealed how material interventions affect established practises.

In the final article of this special issue, Day (2015) provides commentary and reflection on the outcomes of the Conditioning Demand research project. Day highlights the enduring tensions between social welfare, energy consumption, and the drive to lower carbon emissions in housing. The ageing population provides a useful lens to explore the connections between lived experience and the material world. Biological and physiological factors of ageing play a significant part in the negotiation of comfort but it is also important to consider everyday domestic activities and how these shape consumption patterns and individual expectations and preferences. Technological interventions to lower carbon emissions and improve comfort can be both positive and negative and a wide range of actors can serve as intermediaries or midwives to ease the adoption of a new comfort regime. Day concludes with a call for universal design principles that can create flexible indoor environments to reflect the diversity of older populations. She also recommends the development of more inclusive design practises to allow older people to co-produce low-carbon, thermal environments to enhance their quality of life.

Overall, it is clear that any political, technical, social, fiscal, or other intervention alone cannot achieve a reduction of energy consumption (Garder and Stern, 2002). Rather, the next generation of our efforts to achieve a more sustainable energy future, driven by the ever-strengthening climate change agenda and its implications for both carbon reduction and future climate variability (Shove et al., 2009) will require a more nuanced, contextual and relational understanding of how people, technology, and resources are intertwined. Moreover, as designers, building managers and other practitioners are increasingly being called upon to anticipate and accommodate the diverse and changing needs of older people and the ways in which their experiences of thermal comfort affect their health and quality of life, it is important to understand how LCTs can simultaneously contribute to the decarbonisation of energy consumption while also improving social welfare.

The research presented in this special issue contributes to this agenda by providing insights into the complex web of factors that condition demand, including not only technical, material and user issues, but also the mechanisms, actors, and practises that mediate the dynamics between them. This expands the milieu of energy consumption and low-carbon activities to include institutions, legal arrangements, taxes, information providers, vocational training, supply chains, architects, heating engineers, plumbers, electricians, building managers, and their skills, knowledge and expectations (Guy and Shove, 2000). Taken together, the papers make the case that we need to translate the challenge of an ageing population, thermal comfort and low-carbon housing into a co-design agenda that more flexibly responds to a range of stakeholders including policymakers, housing providers, architects, manufacturers and installers of low-carbon heating technologies, and older ‘users’ by elucidating the multiple factors that shape thermal comfort. Given both the demographic trends which highlight the rising importance of older people to energy issues and the increasing diversity of experience of ageing, the development of a sociotechnical agenda that can trace and translate this complex conditioning of demand is urgently needed.

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