Thermal Mavericks in Australia: A Study of Occupant Preferences in Dwellings of Atypical Construction

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Abstract

The preferences and behaviour of occupants are critically important in the environmental performance assessment of proposed and existing dwellings. Performance assessment should respond to both the needs of the occupants as well as societal goals, and when used as a tool in energy efficiency regulation should allow individuals to make informed choices that align with their particular housing aspirations. Within Australia, the existing approaches to meeting societal goals, expressed through the Energy Efficiency provisions in the National Construction Code (NCC), are intended to meet the perceived needs of a standardised population. This causes an incongruity when used to assess dwellings designed to meet alternative needs.

To investigate these issues this research studied the preferences and behaviour of occupants within two distinct forms of housing; dwellings incorporating earth construction elements in a cool temperate climate and naturally ventilated dwellings in a hot humid climate. A review of the literature provided anecdotal evidence indicating that these occupants have alternative performance expectations of their dwellings which are not currently being met by existing thermal performance assessment methods. The research was conducted through national surveys to confirm that the cohorts' attitudes, behaviours and preferences were distinguishable from those of the broader population. These surveys were followed by a longitudinal comfort study of 40 households from these cohorts; 20 in Melbourne and 20 in Darwin. The comfort study was complimented by the analysis of long-term household energy use records, an exploration of dwelling operation in relation to thermal conditions and, importantly, an assessment of the individuals' environmental attitudes.

Results of the national surveys confirmed that occupants of the two forms of atypical housing are identifiable cohorts whose perception and operation of their dwelling is different when compared to those of the broader population. These trends were similarly reflected across the 40 case study households. Notably, the type of fuels used and the operation of heating and/ or cooling appliances were dissimilar to typical houses in the same locations. This was seen in the considerably lower average energy consumption of the two case study cohorts when compared to the figures for households generally in those areas. Rather than choosing to

control the internal temperature by using heating and/or cooling appliances the occupants demonstrated a range of means of adapting to and modifying their thermal environment across a wide range of conditions. Their acceptance and preference for diversity within their thermal environment was further revealed through acceptable thermal sensation votes cast outside of the range of the adaptive comfort model. This illustrates the disadvantage imposed upon occupants when standard methods of design assessment are applied. The occupants displayed significantly higher levels of environmental concern than the broader population, likely motivating their preferences and behaviour in relation to the operation of their dwellings. Despite the uniqueness of the two cohorts (e.g. construction characteristics of the houses, climate and use of heating and/or cooling) the relationships between prevailing outdoor conditions and the occupants' subjective response to internal conditions were similar, as were their overall levels of environmental concern.

Based on the collected data, this research offers an alternative process by which to judge the potential thermal performance of new dwellings of these typologies. The method developed is aimed at reducing energy use by demonstrating that an acceptable level of comfort is achieved without heating and/or cooling. Whilst the applicability of the proposed method is confined to the types of houses presently studied, it is expected that its application could be broadened to other forms of housing, where occupants demonstrate comparable levels of environmental concern.

This research is the first in Australia of residential buildings that combines both the use of traditional thermal comfort and post occupancy evaluation methods with a measure from environmental psychology to provide contextual information about the actual operation and performance of two distinct forms of housing. Importantly, this research supports broadening the boundaries of thermal comfort parameters in situations where occupants have access to a wide range of adaptive opportunities. The implications of these findings are theorised in the proposal of alternative building performance assessment methodology in the Australian context. On an international scale, this work offers an exciting pathway towards the creation of less energy intensive built environments, not just through the rationalisation of technical systems, but also through consideration of how individuals' thermal preferences may be informed by their value system.

Statement of originality

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Associated publications

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