

Unravelling the Complexities of Window Behaviour in Open Offices: Insights from Semi-Structured Interviews and Content Analysis

Pengju Zhang^{1,*}, Shen Wei¹, Niamh Murtagh¹, Yan Ding²

¹ The Bartlett School of Sustainable Construction, University College London (UCL), London, UK

² Tianjin University, Tianjin, 300072, China

*Corresponding email: pengju.zhang.21@ucl.ac.uk

SUMMARY

To achieve sustainability, energy conservation in buildings is imperative. In this context, occupant window behaviour in buildings has garnered extensive attention. Many existing studies have indicated its pronounced impact on buildings' energy consumption and explored potential drivers, focusing mainly on rooms with simple occupancy, such as single or dual offices. Open-plan offices, however, have more people sharing the same environment so social factors may have potential impact on their window operation. This study, therefore, was carried out based on semi-structured interviews, with 30 participants. It aims to provide a novel perspective on the potential social factors that may affect occupants' window behaviour.

KEYWORDS

Interdisciplinary Research; Occupant Behaviour; Social Factors; Decision Making

1 INTRODUCTION

Buildings represent a substantial proportion of global energy consumption, with rising trends making them pivotal to sustainability (Hamilton, Rapf et al. 2020). Occupant behaviour, a complex interplay between individuals and building interfaces, significantly affects the energy consumption of buildings (Yan, Hong et al. 2017). Occupants' window operations, often noted as occupant window behaviour, is one major adaptive behaviour in naturally ventilated and mix-mode buildings, holding considerable influence over buildings' thermal performance, indoor air quality, and energy demands (Scheuring and Weller 2021). Therefore, a better understanding on the drivers of occupant window behaviour becomes necessary for reducing building energy consumption and improving occupants' well-being. Due to the complexity of occupant behaviour, existing studies focused mainly on rooms with simple occupancy, such as single or dual offices (Markovic, Grintal et al. 2018, Han, May et al. 2020). Open-plan offices, however, are becoming increasingly popular nowadays and with more people sharing one environment, and it is believed that some social factors may also affect occupants' behavioural decisions. Although some studies have already explored occupant window behaviour in open-plan offices, they focused mainly on factors that are not difficult to quantify, such as environmental parameters (e.g. indoor and outdoor temperatures) (Schakib-Ekbatan, Cakıcı et al. 2015) and some non-environmental factors (e.g. age, gender and time of day) (Indraganti, Ooka et al. 2015, Langevin, Gurian et al. 2015). The understanding on the interactions between open-plan-office occupants when deciding the usage of their building systems is still not quite comprehensive. This study, therefore, has adopted a social science approach, i.e. qualitative analysis, to identify the potential social factors that would affect occupants' window operation in open-plan offices.

2 METHODS

This study adopted the social science approach and used semi-structured interviews for data collection. The main advantages of semi-structured interviews include delving deeply into specific topics, comprehensive information collection and standardized interview process and

information acquisition (Healey and Webster-Mannison 2012, Adams 2015). The interviews in this study were carried out in some open-plan offices located in a prestigious university in Tianjin, China, focusing mainly on occupants' behaviour of window operation. The data collection occurred between the 1st and 14th May, 2023, just after the transitional season of Tianjin, so the participants still have a clear memory about their window operations. Each interview lasted for about 30 minutes, with 30 participants involved. The interview questionnaire comprises questions in terms of thermal comfort assessment, adaptive behaviour and window operation. The collected data from the interviews was converted into transcripts and then analysed by content analysis. Data were extracted and organised through coding and thematic processes. This qualitative information was subsequently quantified through frequency and cluster analyses.

3 RESULTS

According to the interview results, some social factors have been identified to have influence on occupants' decision of window operation in open-plan offices. The first factor is the control over windows, encompassing both perceived control and actual control. The results indicated that the actual control the subjects had over the windows was significantly influenced by their relative location to windows, as well as the presence of other room occupants. Another factor is hierarchy, with senior occupants showed a more dominant control over windows. The occurrence and outcomes of negotiation action related to window operation were also closely linked to the aforementioned factors.

4 CONCLUSIONS

This study offers novel perspectives on window behaviour in open-plan offices using social science approaches. This findings from this study provide scholars with valuable insights in terms of the more complicated window operation in open-plan offices than single/dual offices. These finds will be useful for more accurate modelling of occupants' window operation and better control of building systems, by pointing out the importance of relevant social factors that may affect occupant adaptive behaviour in buildings.

5 REFERENCES

- Adams, W. C. (2015). "Conducting semi - structured interviews." Handbook of practical program evaluation: 492-505.
- Hamilton, I., O. Rapf, D. J. Kockat, D. S. Zuhaib, T. Abergel, M. Oppermann, M. Otto, S. Loran, I. Fagotto and N. Steurer (2020). "2020 global status report for buildings and construction." United Nations Environmental Programme.
- Han, M., R. May, X. Zhang, X. Wang, S. Pan, Y. Da and Y. Jin (2020). "A novel reinforcement learning method for improving occupant comfort via window opening and closing." Sustainable Cities and Society **61**: 102247.
- Healey, K. and M. Webster-Mannison (2012). "Exploring the influence of qualitative factors on the thermal comfort of office occupants." Architectural Science Review **55**(3): 169-175.
- Indraganti, M., R. Ooka and H. B. Rijal (2015). "Thermal comfort in offices in India: Behavioral adaptation and the effect of age and gender." Energy and Buildings **103**: 284-295.
- Langevin, J., P. L. Gurian and J. Wen (2015). "Tracking the human-building interaction: A longitudinal field study of occupant behavior in air-conditioned offices." Journal of Environmental Psychology **42**: 94-115.
- Markovic, R., E. Grintal, D. Wölki, J. Frisch and C. van Treeck (2018). "Window opening model using deep learning methods." Building and Environment **145**: 319-329.
- Schakib-Ekbatan, K., F. Z. Cakıcı, M. Schweiker and A. Wagner (2015). "Does the occupant behavior match the energy concept of the building?—Analysis of a German naturally ventilated office building." Building and Environment **84**: 142-150.
- Scheuring, L. and B. Weller (2021). "An investigation of ventilation control strategies for louver windows in different climate zones." International Journal of Ventilation **20**(3-4): 226-235.
- Yan, D., T. Hong, B. Dong, A. Mahdavi, S. D'Oca, I. Gaetani and X. Feng (2017). "IEA EBC Annex 66: Definition and simulation of occupant behavior in buildings." Energy and Buildings **156**: 258-270.