Environmental and socio-psychological drivers of building users' behaviours: A case study of tertiary institutional offices in Auckland

Abstract

Purpose: Better identification of comfort preferences and occupant behaviour drivers is expected to improve buildings' user-centred designs and energy operations. In order to understand the underline drivers of occupant behaviours in office buildings, this study evaluated the interrelationships among occupant energy behaviours, indoor environmental quality satisfaction, user control, and social-psychological factors influencing occupant behaviours in New Zealand offices.

Design/methodology/approach: Using an occupant perception survey, this study identifies the occupant behaviour patterns based on multi-domain comfort preferences. A case study was conducted in five office spaces of a University in Auckland, New Zealand. Data were collected from 52 occupants and analysed using descriptive and binary logistic regression analysis. Indoor environmental quality, user control, motivational, opportunity, and ability factors were the independent variables considered. A model to predict the behaviours using environmental, building, and social-psychological aspects was developed.

Findings: Results showed that the primary sources of indoor environmental quality discomfort were related to thermal and air quality, while occupants' indoor environmental quality satisfaction correlated with their comfort preferences. The outcomes emphasise how the connection between building systems and occupants' comfort preferences affect the choice of occupant behaviours in offices. Also, the primary occupant behaviours were drinking hot and cold beverages, opening/closing windows and internal doors, and adjusting clothing. The binary logistic regression analysis showed that occupants' perceived user control satisfaction is the main driver for increasing window actions. No other independent variable showed a statistically significant association with other behaviours.

Originality: This study adopted a novel approach to assess the combined effects of comfort preferences, occupant energy behaviours, and various environmental, building, and socio-psychological factors for modelling energy-saving behaviours in office buildings.

Keywords: Occupant behaviours, user comfort, environmental factors, socio-psychological aspects, tertiary offices.

Introduction

Energy use by global building and construction sectors is rapidly increasing, while the end-use of built environments produces 36% of the global final (IEA and UNEP, 2019). Literature highlights that people spend almost 90% of their time indoors as a significant cause of continuous energy consumption (Abdulaali *et al.,* 2020). Building occupants interact with building systems and components such as windows, doors, blinds/shading, lighting, heater, air conditioning, hot water, and electrical appliances to create a comfortable indoor environment (Delzendeh *et al.,* 2017). These actions are aimed at improving occupants' thermal comfort, acoustic comfort, visual comfort, and indoor air quality (IAQ), ensuring an optimised indoor environmental quality (IEQ) in buildings (Bluyssen, 2019).

Considerable attention has been given to understanding different occupant behaviours and analysing their impact on energy. Initiatives such as IEA-EBC Annex 66 provide a methodological framework for data collection, representation, evaluation, and integration of behaviour models (Yan *et al.,* 2017). The outcomes of Annex 66 were the provision of guidelines to monitor and collect data for occupant behaviours and occupancy, report on existing occupant behaviours modelling and model evaluation methods and provide information on occupant behaviours case studies, large-scale surveys, and simulation modules. Furthermore, IEA-EBC Annex 53 contributes to occupant behaviours research to improve the predictions of the total energy use in buildings (Yoshino *et al.,* 2017). This initiative employed an interdisciplinary approach to analysing and evaluating energy use in buildings, integrating disciplines like social and behavioural science, architectural engineering, building science, and computer modelling and simulation. Nevertheless, further studies must address the multiple comfort preferences of occupants, occupant-centric building design and operations, and human-building interactions through big data and advanced sensing and modelling (O'Brien *et al.,* 2020).

Additionally, occupant satisfaction and acceptable thermal, air quality, visual, and acoustic comfort are also studied (Bluyssen, 2019; Yun *et al.,* 2008). It is also clear that occupant comfort preferences and needs drive human building interactions (Ozcelik *et al.,* 2019). Furthermore, occupants are exposed to multi-domain sources of discomforts that continually affect their comfort satisfaction inside buildings (Heydarian *et al.,* 2020). For example, occupants may be exposed to excessive cold when HVAC is running, while they may feel too warm when natural ventilation occurs (De Vecchi *et al.,* 2017). Moreover, occupants tend to open the windows and blinds to let more daylight in and close them to reduce overheating during the summer season (Bavaresco *et al.*, 2021). Accordingly, the occupant behaviours depend on their exposure to "no discomfort" or "multi-domain discomfort" situations (Ozcelik *et al.,* 2019). Furthermore, occupants first tend to adjust the shades and blinds under simultaneous visual and thermal discomfort, while if a no-discomfort situation exists, their first choice is to adjust the desk fan (Ozcelik *et al.,* 2019). Therefore, O'Brien *et al.* (2013) recommended adjusting blinds and shades under multi-domain comfort preferences. In addition to the primarily concerned thermal comfort aspects, studies also suggest including comfort aspects like indoor air quality and noise level as triggers of window adjustment behaviour (Fabi *et al.,* 2013; Haldi and Robinson, 2010). Recently, another study highlighted that assessing and understanding how occupants use different building systems is still necessary while enriching knowledge about multi-domain comfort stimuli for occupant behaviours (Day *et al.,* 2020).

However, predicting occupant energy behaviours is challenging due to their stochastic and complex nature. Accordingly, the Drivers, Needs, Actions, and Systems (DNAS) framework standardises building monitoring, modelling, and simulating occupant energy behaviours (Hong *et al.,* 2015). To this end, many studies explored various drivers of occupant energy behaviours, where the influence of environmental and contextual drivers was proven first. For example, authors showed that temperature is the primary physical environmental trigger that drives the window opening and closing (Schakib-Ekbatan *et al.,* 2015) and adjusting thermostats (Corgnati *et al.,* 2014; Sarran *et al.,* 2021) in residential and office buildings. The extended version of the DNAS framework includes demographic or physiological drivers that influence occupant behaviours (Putra *et al.,* 2021). For instance, residential and office energy studies considered physiological factors such as gender, age, and metabolic heat (He *et al.,* 2021; Sintov *et al.,* 2019). Furthermore, nine contexts were introduced where building designers have the most significant control over occupant energy behaviour, including building and time-related factors (O'Brien and Gunay, 2014). All these factors that affect occupant energy behaviours may be crucial for occupants to reach the best indoor environment. Nevertheless, earlier research lacks broader views and has been limited to specific behaviours like window operation and HVAC adjustments (Harputlugil and De Wilde, 2021). Further studies on clothing and drinking beverages are essential in the office environment (Day and Gunderson, 2015; Deme Belafi *et al.,* 2018) that are driven by indoor temperature, local climate, metabolic rate, and gender of occupants (Chen and Chang, 2012; Schiavon and Lee, 2013; von Grabe, 2020). The energy modellers overestimate the occupants' clothing insulation in building energy simulation (BES) programs (Gauthier and Shipworth, 2014; Mustapa *et al.,* 2016).

However, the occupant behaviours can still be varied under similar indoor conditions in offices (Neves *et al.,* 2020). Therefore, the importance of socio-psychological factors was introduced relating to occupant behaviours research to uncover valuable insights from subjective aspects of occupant behaviours in buildings. For instance, social cognitive theory and the theory of planned behaviour were integrated into the DNAS framework (D'Oca *et al.,* 2017). Also, the literature supports the impact of behavioural beliefs, normative beliefs, subjective norms, and perceived behaviour control (Bavaresco *et al.,* 2020; Bavaresco *et al.*, 2021). Similarly, some of these factors were categorised and integrated into a framework named Motivation-Opportunity-Ability (MOA), incorporating socio-psychological aspects derived from the Norm Activation Model and the Theory of Planned Behaviour (Li *et al.,* 2019). The authors used the MOA framework to determine the factors influencing energy-saving behaviours in the office environment.

Assessing the combined effects of comfort preferences, occupant energy behaviours, and various influential drivers is a ground-breaking approach to modelling occupant behaviours for Building Performance Simulations (BPS) (Carlucci *et al.,* 2020). For instance, a recent study presented the interrelations between multi-domain comfort preferences with human building interactions that address occupant behaviours relating to windows, blinds/shades, HVAC, and lighting in office settings (Bavaresco *et al.,* 2021). Nevertheless, future research intends to extend the identification of multi-domain triggers for the rest of the occupant behaviours, such as adjusting clothing, occupant presence, and other appliances (i.e., fans, heaters, kitchen appliances) usage. Although the recent studies considered environmental, contextual, and personal factors while highlighting subjective aspects such as attitude, subjective norms, and perceived behaviour control (Bavaresco *et al.,* 2021; Schweiker *et al.,* 2020), further studies are necessary to address the uncertainties associated with selecting most appropriate variables for energy behaviour simulations. It is believed that some behaviours like windows, blinds, fan, and heater operations are still effective in keeping the occupants in comfort without compromising the energy thresholds of the buildings (Lee and Malkawi, 2014). Specially, multidisciplinary and international relationships are recommended to provide new insights into occupant adaptive behaviours (D'Oca *et al.,* 2018). Research needs to be extended to different climate zones or countries to find the variations of behaviours in different contexts, cultures, climates, and socio-economic backgrounds (D'Oca *et al.,* 2019; Rupp *et al.,* 2021). In particular, further research is required to understand comfort-related aspects and socio-psychological factors influencing energy-saving behaviours in office buildings. Thereby, the accuracy of occupant energy modelling could be improved for future applications in this arena. Also, disseminating such research findings to building practitioners will enable them to improve the IEQ in offices based on occupant characteristics. This research addresses this critical knowledge gap by focusing on a theoretical framework integrating comfort-related and socio-psychological factors.

Purpose of this study

In order to understand the underline drivers of occupant behaviours in office buildings, this study evaluates the interrelationships among occupant energy behaviours, IEQ satisfaction, user control, and socio-psychological factors influencing occupant behaviours in New Zealand offices. Better identification of comfort preferences and occupant behaviours drivers is expected to improve buildings' user-centred designs and energy operations. This study proposes a theoretical framework by incorporating previous research findings on the influence of IEQ satisfaction, user control, and socio-psychological drivers on occupant behaviours. Based on the proposed framework, a survey was conducted in a selected university case study in New Zealand, and a logistic regression analysis was conducted to test the proposed framework and research hypotheses. The paper is organised as follows:

- Section 2 introduces the theoretical framework and discusses the research hypothesis
- Section 3 explains the research design, data collection, including variables, building and occupant profiles, and the data analysis techniques
- Section 4 presents and discusses the results and the hypotheses validation
- Section 5 concludes the research findings, including research implications, limitations, and further studies

Theoretical Framework and Hypotheses

This study developed a theoretical framework to analyse the determinants of occupant energy behaviours considering the environment, building, and socio-psychological backgrounds in the office spaces. In the theoretical framework, the five main factors: IEQ satisfaction, user control, motivation, opportunity, and ability, are essential drivers of occupant behaviours (Refer to Figure 1).

Figure 1. The theoretical framework for the study (adapted from Bavaresco *et al.*, 2021; D'Oca *et al.*, 2017; Hong *et al.,* 2015; Li *et al*., 2019).

The big picture of occupant behaviours research and the DNAS framework to represent energy-related occupant behaviours explain the several types of occupant energy behaviours to guide future research (Hong *et al*., 2015; Hong *et al*., 2017). IEQ satisfaction and user control are derived from environmental and building factors influencing occupant behaviours, and they are collectively considered to represent occupants' comfort preferences. Occupant behaviours is believed to improve indoor environmental quality (IEQ) satisfaction in buildings via increased thermal, aural, visual, and indoor air quality (IAQ) comfort (Bluyssen, 2019). However, the way occupants interact with these systems, and the built environment may be inconsistent with the initial design parameters of the building (Deuble and de Dear, 2012; Schakib-Ekbatan *et al*., 2015). Also, it causes a change in the use of electrical equipment and occupancy patterns than what was assumed in the design phase (Schweiker *et al*., 2018). Similarly, the building factors such as the access for controlling heating, cooling, ventilation, and lighting, as necessary (Fabi *et al*., 2013). For example, with the opportunity to interact with the building controls, occupants are empowered to operate the building systems (Deuble and de Dear, 2012; Schakib-Ekbatan *et al*., 2015).

Aside from the environmental and building-related drivers, previous studies include other drivers of occupant behaviours in offices, namely time-related factors (Peng *et al.,* 2012), contextual factors (Deme Belafi *et al.,* 2018; Wagner *et al.,* 2018), the DNAS framework (Hong *et al.,* 2015), synthesis of physical and socio-psychological factors (Hong *et al.,* 2017), subjective and comfort-related drivers (Bavaresco *et al.,* 2021). Thus, occupant behaviours is rationalised by their intentions in combination with behavioural controls, which aligns with the theory of planned behaviour (TPB) (Azjen, 1991). TPB predicts intentions through a cognitive approach by using subjective norms and perceived behavioural controls (Azjen, 1991; Shi et al., 2017), assuming that decisions to conduct certain behaviours are made based on the available information and knowledge (Ajzen, 2002; Liu et al., 2021). TPB could explain pro-environmental behaviours related to energy consumption using psychological factors/variables (Ajzen, 2002). In the context of this study, the MOA model is derived by integrating TPB and the Norm Activation Model (NAM) (Li *et al*., 2019), and under each of the motivation, opportunity, and ability factors constructs are the socio-psychological aspects influencing occupant behaviours. Accordingly, motivation relating to energy captures occupants' "needs, values, concerns, and involvements in saving energy at the workplace performing the energy-saving behaviours (Li *et al*., 2017). The theoretical framework includes motivation factors: attitudes and personal norms directly affecting occupants' environmental intention and behaviour (Kim and Seock, 2019; Zhang *et al*., 2018). Opportunity includes the organisational factors external to the individuals but influences their energy-saving intentions (Michie *et al*., 2011). An organization's encouragement to save energy positively supports occupants' pro-environmental behaviour (Xu *et al*., 2017) while introducing behavioural interventions further improves these energy-saving behaviours (Mulville *et al*., 2017). Therefore, the theoretical framework included organisation support and behavioural interventions contributing to opportunity. Ability is the psychological and physical capabilities required to interpret the information on energy-saving behaviour (Michie *et al.*, 2011). The factors like perceived behavioural control (PBC), perceived knowledge, and the actual knowledge of the building occupants explain their ability to save energy (Li *et al*., 2019). According to Ajzen (2006), the PBC perceives the ease or difficulty of performing any behaviour. Furthermore, actual knowledge reflects the ability to know energy-related facts, and perceived knowledge is the prior knowledge of energy use to achieve energy-saving behaviour. Thus, this study's theoretical approach includes PBC and perceived knowledge.

Research Hypothesis

Five hypotheses were tested in the study considering the five independent variables selected for the binary logistic regression analysis. The null hypotheses (H0) were rejected if the significance level was ≤ 0.05 and accepted the alternative hypotheses (H1). The hypothesis tested is listed here:

$H0_1$ – Indoor environmental quality satisfaction does not influence the occupant behaviours
$H1_1$ – Indoor environmental quality satisfaction influences the occupant behaviours

$H0_2$ – User control does not influence the occupant behaviours
$H1_2$ – User control influences the occupant behaviours

$H0_3$ – Motivation does not influence the occupant behaviours
$H1_3$ – Motivation influences the occupant behaviours

$H0_4$ – Opportunity does not influence the occupant behaviours
$H1_4$ – Opportunity influences the occupant behaviours

$H0_5$ – Ability does not influence the occupant behaviours
$H1_5$ – Ability influences the occupant behaviours

Methods

The methodological design presented in the current study scope is more related to the descriptive (explanatory) research purpose, positivism philosophy, deductive approach, and survey strategy. The descriptive nature of the study explains causal relationships among variables instead of the exploratory study that develops a conceptual model and a set of hypotheses for further inquiry (Saunders *et al.*, 2019). The deductive approach involves the development of a theory that is then subjected to a rigorous test through a series of hypotheses and is most likely to be underpinned by the positivist research philosophy (Saunders *et al.*, 2019). Following the survey strategy, a questionnaire was used to study occupants' energy-related behaviours and develop occupant energy models (Day and O'brien, 2017). The occupancy survey provides more insights than experiments and field observations regarding various factors influencing behaviours (Hong *et al.,* 2017). Accordingly, an online questionnaire was distributed through the Qualtrics Survey platform from October 2020 to January 2021. Individual questionnaire links were emailed to potential respondents among university staff and PhD students who regularly occupied the office spaces in the selected five buildings and asked them to complete the survey.

Data collection

Dependent and Independent Variables

As explained in the theoretical framework, the study investigates the causal relationships between the dependent variable: occupant behaviours, and the independent variables: IEQ satisfaction, user control, motivation, opportunity, and ability. Table 1 shows the aspects surveyed, associated survey questions, and responses to capture the occupants' perceptions for analysis.

Table 1. Variables used and their coding

As seen in Table 1, the dependent variable of the current scenario is the possibility of an occupant showing a primary energy behaviour, which was measured using binary levels yes=1 and no=0. All occupant behaviours considered in the study were listed in Table 5 alongside the relevant occupant comfort preferences.

Regarding independent variables, the IEQ satisfaction variable was surveyed in different IEQ parameters: thermal and air quality, lighting comfort, and acoustic comfort. Respondents were asked to state the level of satisfaction with each IEQ parameter using 7-point Likert-type scales (1-completely dissatisfied to 7-completely satisfied). The binary logistic regression analysis considered the mean score of IEQ parameters. Next, the extent of user control available for heating, cooling, ventilation, lighting, and noise was surveyed, asking, "How much control do you personally have over your working environment's heating systems and appliances?". These controls were evaluated separately using a 7-point Likert-type scale (1-no control to 7-full control). After that, the mean score of each control was considered in the binary logistic regression analysis. The occupants' subjective perspectives on the socio-psychological factors: motivation, opportunity, and ability were measured using 7-point Likert-type scales (1-strongly disagree to 7-strongly disagree). The respondents were asked to state their agreement on statements that indirectly measure these three parameters. The mean score of the statements under each parameter was continued for the regression analysis.

Characteristics of the buildings

The study conveniently selected five buildings with office settings, including private rooms, shared rooms, and open-plan offices at a University complex in Auckland, New Zealand. The buildings were equipped with central heating/cooling for most office spaces and split air conditioners for some spaces, while there was no mechanical heating/cooling or ventilation system in other areas. Natural ventilation was applied in those areas through operable windows allowing occupants to control over adjust the indoor temperature. The inside temperature was variable between 18-22°C during the winter and between 19-24°C in summer and other seasons. The relative humidity was set between 40 and 70%, and the airspeed was 0.1-0.2 m/s for thermal comfort. An automatic fresh air intake activates when the CO2 level is above 800ppm, complying with WorkSafe New Zealand's recommended CO2 level below 1000 ppm inside the building. Table 2 presents the details of the selected buildings.

Table 2. Profile of Buildings

Respondent demographics

The selected buildings have a population of 257 office occupants that count as staff and PhD students who regularly work on the buildings. Structured online questionnaires were sent to the total population of these buildings through the relevant school administrators, where 52 completed responses were achieved, making up a response rate of 20%. The data collection was conducted from October 2020 and January 2021. Usually, a sample with ten or more events per variable (EPV) is considered less biased (van Smeden, 2019). However, Vittinghoff and McCulloch (2006) found that confidence interval coverage, type I error, and relative bias problems are reasonably frequent when EPV=2–4, uncommon when EPV=5–9 EPV, and still observed when EPV=10–16. Therefore, the logistic regression analysis sample size was calculated using $N = EPV \times p/events\ fraction$, where EPV=5 (Vittinghoff and McCulloch, 2006) and the events fraction = ½ (van Smeden, 2019). Given the five variables (p) in the current study, the above equation gives $N = 50$ as the minimum sample size. Table 3 includes the respondents' gender, age, ethnicity, and office type information.

Table 3. Demographic Information of Participants

Data analysis

Descriptive or correlational methods are considered the backbone of studies when assessing the impact of occupant behaviours on the energy consumption of buildings (Wagner *et al.,* 2018). Considering the above and the dichotomous nature of dependent variables of the current study, the authors adopted descriptive and binary logistic regression analysis. Statistical Package for Social Sciences (SPSS) version 27 was used to conduct all statistical analyses.

In the first step, the responses received on IEQ user satisfaction, comfort preferences, and occupant behaviours were analysed using descriptive analysis to find the primary occupant behaviours based on the occupants' responses on comfort preferences and the thermal, air quality, visual, and acoustic user satisfaction levels in the selected case.

Next, binary logistic regression analysis was carried out that allows binary or dichotomous levels of measurements with only two categorical outcome variables for dependent variables (Kassambara, 2018). This statistical method is often used to infer the probability of windows opening based on environmental variables (Haldi and Robinson, 2008; Nicol, 2001; Rijal *et al.,* 2007). Firstly, the assumptions of logistic regression were tested for its application. The dependent variable was measured using binary levels (yes/no), and the observations considered in the current study are independent and do not include repeated measurements.

The following assumption is that there is little or no multicollinearity among the independent variables. The multicollinearity between predictor variables was examined using collinearity statistics (Guerra *et al.,* 2016; Stephanou and Varughese, 2021). Although there is no formal criterion for determining the expected tolerance value and Variance Inflation Factor (VIF), a tolerance value of less than 0.1 and VIF higher than 10 shows significant multicollinearity (Chatterjee and Hadi, 2012). The logistic regression model is more stable if there is no multicollinearity between the predictor variables with no apparent outliers. Based on the collinearity statistics, those variables with strong correlations can be removed from the analysis. Also, outliers were checked, creating box plots of Z-Score values of the independent variables (Kassambara, 2018).

The final assumption is that logistic regression requires the independent variables to be linearly related to the log odds. The linear relationship between the logit of the outcome and each predictor variable was tested, creating and inspecting the logit values. Afterward, the binary logistic regression analysis was carried out. The binary logistic model based on more than one predictor is expressed by the logit transformation given in equation 1, which describes a non-linear relationship in a linear form (Field, 2009).

$$\log\left(\frac{p}{1-p}\right) = a + b_1X_1 + b_2X_2 + \cdots + b_nX_n \qquad (1)$$

Where p is the probability of a particular occupant behaviours given the predictor variables with values of $X1, X2, \ldots, Xn$, a is the intercept of the equation, and $b1, b2, \ldots, bn$ are the coefficient of the predictor variables (Bruce-Konuah, 2014). The inverse of the logit transformation provides probability p by using equation 2.

$$\mathrm{p} = \frac{e(a + b_1X_1 + b_2X_2 + \cdots + b_nX_n)}{1 + e(a + b_1X_1 + b_2X_2 + \cdots + b_nX_n)} \qquad (2)$$

where : e = the exponential function (approx. 2.72)

A significantly smaller model deviance than the null deviance shows that the model is the best fit to describe the outcome. The goodness of fit (R^2) varies between 0 and 1, determining how well the data predicts fits the observed data (Field, 2009). A value close to 1 indicates that the model predicts the outcome perfectly (Field, 2009). The significance of the predictors is measured through the odds ratio (OR) or test.

The logistic regression coefficient (b) is the estimated increase in the log-odds of the outcome per unit increase in the exposure, while the exponential function of the regression coefficient (eb) is the odds ratio associated with a one-unit increase in the exposure (Szumilas, 2010). The OR is a measured relationship between an exposure and an outcome, which explains the odds of an occurrence of an outcome in a given exposure compared to the odds of occurring when that exposure is absent (Szumilas, 2010).

- OR<1Exposure associated with lower odds of an outcome

- OR=1 exposure does not affect the odds of an outcome
- OR>1Exposure associated with higher odds of an outcome

The OR's precision is estimated using a 95% confidence interval (CI). A small CI shows a higher precision, while a large CI indicates a low precision (Szumilas, 2010). In practice, the 95% CI does not measure statistical significance like the p-value, often used as a proxy for the presence of statistical significance if it does not overlap the null value (OR=1) (Szumilas, 2010).

Assumptions Tested

The collinearity statistics of predictors were run for the independent variables: IEQ, user control, motivational, opportunity, and ability factors. Based on the findings on IEQ satisfaction and comfort preferences, only the thermal and air quality-related aspects were considered when creating the covariates for IEQ and control. According to the collinearity statistics, the tolerances were more than 0.1, the VIF values were less than 10, and they only moderately correlated (1<VIF<5) with each predictor. The selected predictors can be applied to develop the binary logistic model for occupant energy behaviours due to the non-existence of multicollinearity between predictors.

One outlier (Zscore = -3.32667 < -2.68) was identified, illustrating the box plots of Zscore values of the predictors. The outlier is related to observations of the Ability factors. Therefore, the outlier was modified using the median value for that observation instead of the mean value. Accordingly, the modified Z value equals -3.06007, which was still less than -2.68. However, the outlier was not eliminated from the dataset, assuming there is no or minimal impact.

The statistics of the binary logistic regression was run by pairing independent variables with their log values. The significance values of the variables are greater than 0.05, and the relationship is not significant. Thus, the assumption is not violated.

The binary logistic regression modelling

The binary logistic regression was used to assess the possibility of drinking hot/cold beverages, opening/closing windows, opening/closing internal doors, and adjusting clothing driven by IEQ, user control, motivational, opportunity, and ability factors.

The goodness of fit statistics helps to determine whether the model adequately describes the data. This was tested using the Chi-square analysis. If the model is significant, this shows that the model shows a good fit, and there is a significant improvement in fit compared to the null model. These test results for each energy behaviour are summarised in Table 4. However, only the model "adjust clothing" adequately fits the data, considering the p-value < 0.05. The Chi-square value for the overall "Adjust clothing model" was 13.35 at a significance of 0.020.

Table 4. Omnibus Tests of Model Coefficients

Nagelkerke's R Square is an approximate variation indicator of the dependent variable that the predictor variables in the model can account for. Table 5 presents the model summary for each dependent variable. Each Nagelkerke R^2 value implies that a combination of IEQ, user control, motivational, opportunity, and ability factors could explain 23.8%, 20.3%, 18.5%, and 31% of the variance in drinking hot/cold beverages, opening/closing windows, opening/closing internal doors, and adjusting clothing observed, respectively.

Table 5. Model Summary[a]

Table 6 indicates how well the developed models can predict the correct category once the predictors are added to the study. The percentage in the first two rows provides information regarding the specificity and sensitivity of the model in predicting group categories on the dependent variable.

Table 6. Classification Table[a]

As seen in Table 6, specificity or the true negative rate refers to the % of cases predicted by the model to fall into the “no behaviour” category. In contrast, sensitivity or true positive rate refers to the % of cases predicted by the model to fall into the behaviour category. For example, the model correctly predicted that 25% of cases do not drink hot/cold beverages. In contrast, the model correctly predicted 95% of cases to drink hot/cold beverages. Considering both scenarios, the overall accuracy rate was 78.8%, which is particularly good. Also, the model shows a good sensitivity where 95% were correctly predicted to drink hot/cold beverages based on the model. Likewise, the models for the other behaviours also indicate a good sensitivity. However, the model to predict open/close internal doors has a lower overall accuracy of 69.2% compared to other behaviours.

Results and discussion

Indoor environmental quality satisfaction of occupants

Occupants in the selected buildings were asked to rate their comfort in thermal and ventilation in summer and winter, visual comfort, and acoustic comfort. The frequency, percentage, and cumulative percentage of occupants’ responses on the given Likert scale of occupant satisfaction with IEQ are shown in Table 7.

Table 7. Indoor Environmental Quality Satisfaction levels

As shown in Table 7, most respondents were satisfied with the office’s visual and acoustic conditions due to the Venetian blinds and roller shades controlling external illuminance levels in the selected buildings. In both cases, most occupants were mainly satisfied with the current conditions. Thus, the selected buildings perform up to occupants’ visual and acoustic comfort expectations.

On the other hand, the cumulative percentage of occupant responses highlighted that most occupants were dissatisfied with thermal and air quality comfort in winter and summer. Although the selected buildings had low-emissivity glazing windows that may act as a helpful link in thermal performance by preventing cold in winter and reducing heat penetration in summer, only a smaller number of occupants showed satisfaction with thermal and air quality comfort in winter. Also, most of the selected buildings had air-conditioned spaces, and occupants were dissatisfied with the air quality. At the same time, a considerable percentage of occupants were neither satisfied nor dissatisfied, which makes only a slight difference between their satisfaction and dissatisfaction regarding thermal and air quality in summer and winter.

Considering that the selected buildings had mixed-mode ventilation, the results of the current study emphasised the thorough understanding of occupants’ thermal and air quality preferences to improve the operation of mixed-mode ventilated buildings and user-centred design. Also, occupants may be exposed to excessive cold when HVAC is operating, while they may feel too warm when natural ventilation occurs (De Vecchi *et al.,* 2017). For instance, past works show that occupants respond to comfort sensations and environmental discomfort through adaptive behaviours (Haldi and Robinson, 2008). Furthermore, as those parameters may strongly link occupants’ actions, it is critical to discuss the effect of perceived satisfaction of IEQ aspects on occupant behaviours (Yun *et al.,* 2008).

Comfort preferences and occupant energy behaviours

The occupant comfort preferences and energy behaviours are presented in Table 8 alongside the frequency and percentage of respondents who selected each choice.

Table 8. Comfort preferences and occupant energy behaviours

As seen from Table 8, more than 50% of responses were received for the occupant behaviours: drink hot/cold beverage, open/close windows, open/close internal doors, adjust clothing, turn lights on/off, and adjust shades and blinds. Amongst, occupant behaviours relating to windows and doors are interlinked with comfort preferences like letting in the fresh air, feeling warmer and cooler, increasing air movement, and hearing/avoiding outdoor noises (Bavaresco *et al*., 2021). However, only a few comfort preferences received more than 50% responses, such as letting in the fresh air, feeling warmer, feeling cooler, and increasing air movement.

Considering other behaviours that received more than 50% of responses, drinking hot/cold beverages and adjusting clothing are more related to the preferences of thermal comforts, such as feeling cooler or warmer, than other comfort preferences. Specifically, these behaviours are related to indoor temperature, local climate, metabolic rate, and gender of occupants (Chen and Chang, 2012; Schiavon and Lee, 2013; von Grabe, 2020). However, the studies on drinking beverages and adjusting clothing are somewhat limited compared to the studies that focused on behaviours that have the most prominent and direct influence on energy, such as windows, lights, shades and blinds, computers, and personal heaters (Bavaresco *et al*., 2021; Fabi *et al*., 2013; He *et al*., 2021). Therefore, further studies on clothing and drinking beverages are essential in the office environment (Day and Gunderson, 2015; Deme Belafi *et al*., 2018).

On the other hand, turning lights on/off and adjusting shades and blinds are more linked to visual comfort-related aspects. Although occupants' lighting behaviour has received a higher response, the concern about increasing artificial and daylighting received a lower response. For instance, Bavaresco *et al*. (2021) found that occupants adjust lights to increase daylighting or reduce artificial lighting in their study. Regarding adjusting shades and blinds, the current study responded less to most comfort preferences. However, the occupants open blinds to let more daylight in, access outside view, warm up the office while closing the blinds to reduce glare, overheating, and privacy (Bavaresco *et al*., 2021).

Additionally, all other behaviours received a less than 50% of responses. However, adjusting the computer screen/brightness can prevent glare and save energy by enhancing battery life. On the other hand, turning off the computer monitor contributes to energy-saving. The results also imply that their attitude toward saving energy influences occupants' comfort-related behaviours. Additionally, only a few occupants expected to follow management guidelines through their occupant behaviours, which showed the significance of individual comfort preferences over managerial concerns. Furthermore, a low response was received on adjusting portable/ceiling fans, room air conditioning units, and thermostats due to the limited availability and accessibility to control these systems. Similarly, a low response was recorded for non-adaptive behaviours such as moving through spaces and reporting discomfort to the building management. Apart from these behaviours, adjusting the computer table was suggested by one occupant. However, the links between those behaviours and comfort preferences are purely hypothetical concerning the lack of literature to strengthen these relationships.

Considering these grounds, the study selected drinking hot/cold beverages, opening/closing windows, opening/closing internal doors, and adjusting clothing as the primary behaviours, and continued further analysis using logistic regression.

Occupant energy behaviours and the influence of factors

Table 9. Logistic regression coefficients of residential occupant behaviours

Referring to Table 9, occupants with the higher ability (perceived behavioural control and perceived knowledge) were 2.262 times (CI% 0.846-6.048) more likely to drink hot/cold beverages than those without perceived behavioural control and perceived knowledge. Accordingly, with the increased perceived behavioural control and perceived knowledge, occupants believed to use actions to adapt themselves to their environment rather than actions to adapt the indoor environment to their needs or preferences. This may contribute toward energy-saving through fewer interventions with the building systems. Considering user control as the reference variable, occupants with more control over their indoor environment were 1.041 times (95% CI 0.556-1.950) more likely to drink hot/cold beverages than those in offices with no user controls. However, these associations were not significant ($p > 0.05$). There is a lack of studies in the existing literature to confirm the above association of drinking hot/cold beverages with the ability and user control-related factors. However, one study underlined indoor and outdoor temperatures and thermal sensation as influencers of occupants' drinking beverages behaviour (Rupp *et al.,* 2021). Similarly, the results highlighted that the odds of drinking hot/cold beverages based on the variation in the IEQ parameter show a negative or decreasing relationship. If the occupants are thermally satisfied, their consumption of beverages reduces, where occupants may drink hot beverages to feel cooler and cold beverages to feel warmer.

On the other hand, a significant association was seen between user control and open/close windows. Occupants who have more user control were 1.979 times more likely to open/close their office windows than the occupants who have less control over their indoor parameters. Interestingly, this odd of occupants' window behaviour given the user control does not reach statistical significance in the 95% CI of 1.094 to 3.581 spans 1.0. However, the user control over building systems was considered the primary behaviour for adaptive behaviour in offices and integrated into the predictive modelling for window opening/closing (Bavaresco *et al.,* 2021). Additionally, a decreasing association is found between IEQ and window behaviour, while the existing literature supports that satisfaction with temperature and air quality are linked with the window opening behaviour in offices proportionately with the window opening time (Yun *et al.,* 2008). Accordingly, when the occupants' IEQ satisfaction increases, the odds of window behaviour decrease. However, another study compared the window behaviour in three offices and found varied behaviour under similar indoor conditions in offices (Neves *et al.,* 2020). Thus, the association between IEQ satisfaction and window behaviour may be twofold, given the influence of other factors. Furthermore, the motivation, opportunity, and ability related factors also showed negative relationships in the current study. At the same time, the literature supports positive and significant relationships contributed by attitude (β=0.71, p-value<0.05) and perceived behavioural control (β=0.50, p-value<0.05) towards occupant window behaviour (Bavaresco *et al.,* 2020).

Regarding open/close internal doors, the odds of occupants opening/closing internal doors are 1.295 times higher when the occupants' IEQ satisfaction increases. Since 95% CI of 0.625 to 2.685 spans 1.0 and the p-value (0.487) > α, this association was statistically insignificant. A lack of literature supports the association between selected parameters and the operation of internal doors in offices. A simulated model of door use based on airspeed using an agent-based modelling approach enables the agents to calculate Predicted Mean Vote (PMV) parameters to keep track of the comfort level and determine which behaviours are more effective in maintaining the occupants' comfort (Lee and Malkawi, 2014). However, using doors was not recognised as behaviour optimised energy savings and comfort. Therefore, the occupants' use of internal doors influenced by indoor environmental conditions may contribute to an energy-wasting behaviour.

Likewise, the odds of an occupant adjusting clothing based on ability factors are 1.637 times higher than those who do not adjust clothing based on ability factors, with a 95% CI of 0.741 to 3.615. However, this association was not significant (p > 0.05). According to the positive association, when the value of ability factors increases, the odds of adjusting clothing increase. This is similar to the occupants' drinking beverages behaviour and contributes energy-saving while assuring occupants' comfort. However, the energy modellers overestimate the clothing insulation/level in building energy simulation (BES) programs (Gauthier and Shipworth, 2014). Similarly, the percentage of occupants who adjusted clothing was exceptionally low (Mustapa *et al.,* 2016). Unlike the literature supports, the findings of the current study highlight that adjusting clothing is a prominent behaviour among office building occupants and has a decreasing relationship with the IEQ and user control.

Hypotheses Testing

The null hypothesis of the study states that the logistic regression coefficient (b1) is equal to zero, or there is no statistically significant relationship between the predictor (independent) variable and the response (dependent) variable. The alternative hypothesis states the opposite of this. Five hypotheses stated in the current study were tested based on the corresponding p-values. The null hypothesis was rejected for the relationship with a significance level of less than 0.05. Accordingly, there is a statistically significant relationship between user control and occupant behaviours, and motivation and occupant behaviours. IEQ satisfaction, opportunity, and ability factors have a significance level of more than 0.05. Therefore, the null hypothesis did not reject these relationships. Accordingly, there is no statistically significant relationship between occupant behaviours and these factors.

Conclusions

This study evaluated the interrelationships between user comfort preferences, occupant energy behaviours, and drivers in office settings. The survey approach was based on synthesising the literature on comfort preferences, occupant behaviours, and environmental, building, and socio-psychological factors, and a case study was conducted in Auckland, New Zealand. Compared to earlier studies, the study adds significant knowledge on occupant behaviours in office settings based on the occupants' multi-domain comfort preferences. Also, by integrating binary logistic regression, the study evaluates perceived subjective aspects like socio-psychological factors alongside the environmental and building user control-related factors, making the research in this field more interdisciplinary.

The occupants' satisfaction with IEQ parameters: thermal and air quality in winter, thermal and air quality in summer, lighting comfort, and acoustic comfort was evaluated and observed dissatisfaction with thermal and air quality in both seasons. Accordingly, this correlates with the main comfort preferences of occupants identified in the office setting as all related to thermal and air quality improvement of the space. Based on occupants' IEQ satisfaction and comfort preferences, the prominent occupant behaviours in the office setting were identified, including drinking hot and cold beverages, opening/closing windows and internal doors, and adjusting clothing. Considering the building characteristics, these outcomes also emphasise the complexity of balancing natural and mechanical ventilation in offices, how mixed-mode ventilation affects perceived IEQ satisfaction, and the choice of occupants' actions in offices. The predictive modelling approach used in the study (binary logistic regression) proved that occupants' perceived user control satisfaction is the main driver for the increase in window actions. Additionally, the negative but insignificant relationship of IEQ satisfaction to window behaviour shows a twofold relationship different from most literature confirms. This may be due to the influence of individuals' socio-psychological preferences, while most literature-based entirely on measurements of environmental parameters.

The current study suggests that building practitioners improve the IEQ in offices based on occupant characteristics. These findings encourage building energy managers to address the occupant motivation, opportunity, and ability related issues in buildings. The results provide researchers with how social psychological constructs of occupants influence the decision-making of their behaviours and thereby aid building designers and energy modelers in improving the internal environment and building systems to suit occupants' comfort preferences and actions. Overall, the study outcomes enable the improvement of social theories and subjective aspects related to office building spaces and systems.

However, except for the association between user control and window behaviour, the significance level was more than 0.05 in all the other scenarios. Therefore, variables in the binary logistic models do not show a statistically significant association with the dependent variables drinking hot/cold beverages, opening/closing internal doors, and adjusting clothing. Accordingly, this evaluation grasped hypotheses that may be tested using a larger sample size in future studies. Furthermore, the covariates created in the current analysis may not highlight the subjective aspects within the variables such as attitudes, personal norms, organisational support, behavioural interventions, perceived behavioural control, and knowledge. Although these parameters were deemed essential in the existing literature, the direct influence of these aspects is still missing in the current evaluation. The minimum sample for logistic regression is based on the least frequent outcome and the number of independent variables (Field, 2009). The larger the sample size, the better the probabilistic model fits the observed data (Szumilas, 2010). Therefore, further studies are required to refit the model for more reliable predictions. Such an improved approach may explain how environmental, user control, and socio-psychological factors are interrelated with the occupants' actions and building interactions. Also, field studies may show how different the occupants' comfort preferences and perceived IEQ satisfaction are. This knowledge is vital to introducing acceptable thresholds of IEQ conditions for most workers. Such understanding is also critical for building managers to optimize energy-saving and occupants' productivity.

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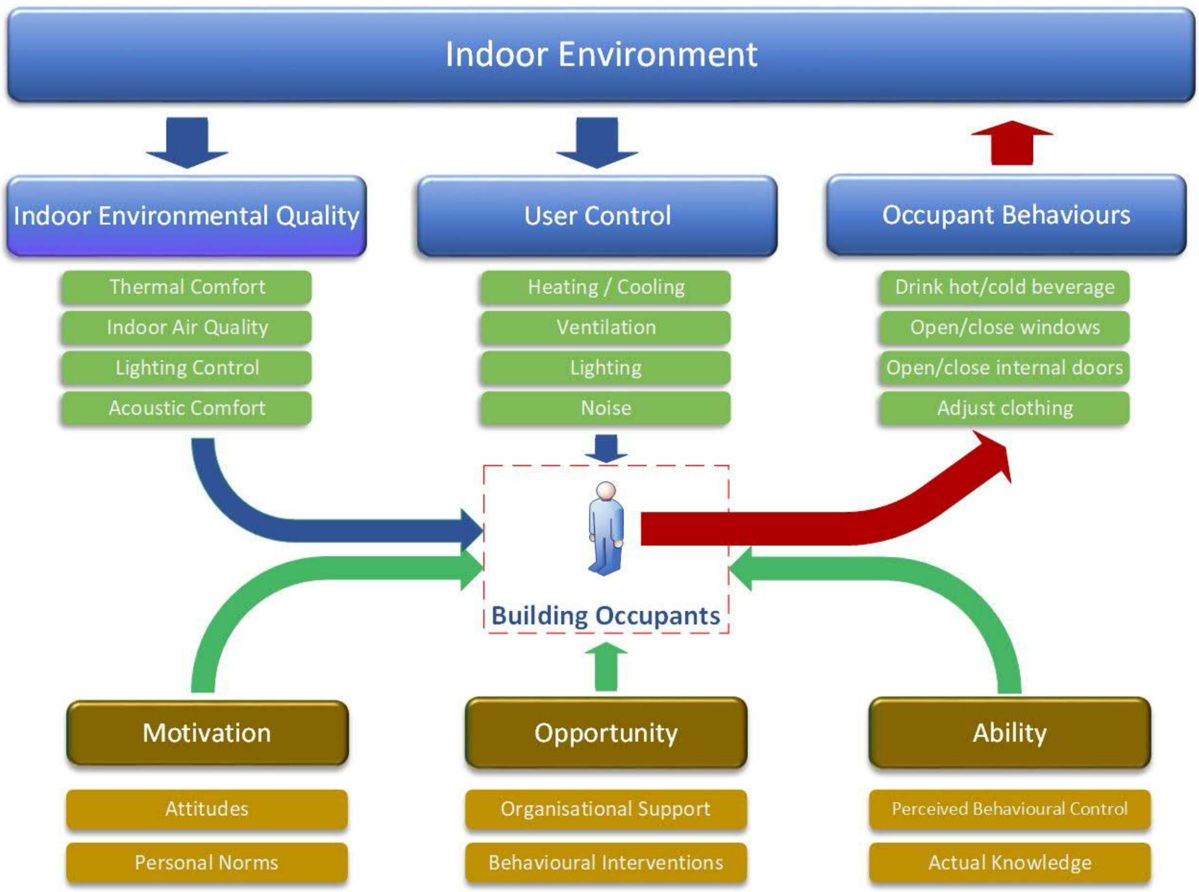

Figure 1. The theoretical framework for the study (adapted from Bavaresco *et al.*, 2021; D'Oca *et al.*, 2017; Hong *et al.,* 2015; Li *et al.*, 2019).

Table 1. Variables used and their coding

Aspects surveyed		Survey Question	Response	Variables
1.1. Gender		What is your Gender?	Male/Female	N/A
1.2. Age		What is your age?	Below 25, 25 – 34, 35 – 44, 45 – 54, Above 55	N/A
1.3. Ethnicity		How do you describe your ethnicity?	European, Māori, Asian, Pacific Peoples, African, Other	N/A
1.4. Office type		Is your office or normal work area?	Private room, shared office, open-plan office	N/A
1.5. *Occupancy - working days*		How many days do you spend in the building in a typical working week?	Less than 5 days/5 days or more	N/A
1.6. *Occupancy - working hours*		How many hours per day do you usually spend working on a computer screen?	Below 8 hours/8 hours or above	N/A
1.7. Occupant preferences		Which of the following changes do you expect in your work area by exercising the adjustments above?	Yes/No	N/A
1.8. Occupant behaviours		Which of the following adjustments do you personally exercise in your work area?	Yes/No	Dependent Variable
1.9. IEQ satisfaction (Environmental factors)	*Thermal and air quality in winter*	Overall Thermal and Air Quality in winter	7 point Likert-type scales • 1 – completely dissatisfied • 7 – completely satisfied	Independent variable 1 (Mean score of IEQ factors)
	Thermal and air quality in summer	Overall Thermal and Air Quality in summer		
	Lighting comfort	How would you describe the lighting quality in your regular work area?		
	Acoustic Comfort	How would you describe noise in your regular work area?		
1.10. User control (Building factors)	*Heating control*	How much control do you personally have over your working environment's heating systems and appliances?	7 point Likert-type scales • 1 – no control • 7 – full control	Independent variable 2 (Mean score of user control factors)
	Cooling control	How much control do you personally have over your working environment's cooling systems and appliances?		
	Ventilation control	How much control do you personally have over your working environment's ventilation systems and appliances?		
	Lighting control	How much control do you personally have over your working environment's lighting systems and appliances?		
	Noise control	How much control do you personally have over your working environment's noise systems and appliances?		
1.11. Social-psychological factors	*Motivation – Attitudes and personal norms*	Motivation 1 - Saving energy at work is essential to me.	7 point Likert-type scales • 1 – strongly disagree • 7 – strongly agree	Independent variable 3 (Mean score of motivational factors)
		Motivation 2 - I change my behaviours to increase my performance/ productivity.		
		Motivation 3 - Actions I take to save energy depending on my comfort needs and preferences.		
	Opportunity – Organisational support and behavioural	Opportunity 1 - The building manager's feedback on individual energy use is essential for changing my behaviour.		Independent variable 4 (Mean score of

	interventions	Opportunity 2 - The building manager often sends energy use feedbacks.		opportunity factors)
		Opportunity 3 - Building manager encourages me to be more energy efficient		
	Ability – Perceived behavioural control and knowledge	Ability 1 - Doing something positive for the environment is desirable.		Independent variable 5 (Mean score of ability factors)
		Ability 2 - If I feel slightly cold/warm at the workplace, I will try to put another layer of clothing/adjust my clothing level rather than use a personal heater/fan.		
		Ability 3 - Closing windows, turning off the lights, heaters, fans, etc., whenever I leave the office, and unplugging appliances when not in use can save energy		

Table 2. Profile of Buildings

Building	Year of Completion	No. of Floors	HVAC	Glazing	No. of Individual Workstations
Build A	1984	1	Natural ventilation + No mechanical cooling or heating	Single	46
Build B	1995	4	Central heating/cooilng	Double	82
Build C	1998	3	Central + Split heating/cooilng	Double	96
Build D	1993	2	Central heating/cooilng	Double	12
Build E	1998	6	Central heating/cooilng	Double	21

Table 3. Demographic Information of Participants

Demographic Info		Staff and PhD Students	
		Count	Percentage
Gender	Male	27	51.9%
	Female	25	48.1%
Age	25 - 34	24	46.2%
	35 - 44	10	19.2%
	45 - 54	13	25%
	Above 55	5	9.6%
Ethnicity	European	17	32.7%
	Asian	22	42.3%
	African	3	5.8%
	Other	10	19.2%
Office Type	Private office	18	34.6%
	Shared Space	22	42.3%
	Open-plan Office	12	23.1%

Table 4. Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Drink hot/cold beverage	8.913	5	0.113
Open/close windows	7.811	5	0.167
Open/close internal doors	7.467	5	0.188
Adjust clothing	13.350	5	0.020

Table 5. Model Summary[a]

	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
Drink hot/cold beverage	47.268[a]	0.158	0.238
Open/close windows	52.768[a]	0.139	0.203
Open/close internal doors	59.616[a]	0.134	0.185
Adjust clothing	54.922[a]	0.226	0.310

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 6. Classification Table[a]

Observed		Predicted		
		No	Yes	Percentage Correct
Drink hot/cold beverage	No	3	9	25.0
	Yes	2	38	95.0
Overall Percentage				**78.8**
Open/close windows	No	5	9	35.7
	Yes	1	37	97.4
Overall Percentage				**80.8**
Open/close internal doors	No	7	11	38.9
	Yes	5	29	85.3
Overall Percentage				**69.2**
Adjust clothing	No	9	10	47.4
	Yes	5	28	84.8
Overall Percentage				**71.2**
a. The cut value is 0.500				

Table 7. Indoor Environmental Quality Satisfaction levels

Likert Scale Levels	Thermal and air quality in winter			Thermal and air quality in summer			Visual comfort			Acoustic comfort		
	Frequency	Percentage	Cumulative	Frequency	Percentage	Cumulative	Frequency	Percentage	Cumulative	Frequency	Percentage	Cumulative
Completely dissatisfied	3	5.77%	5.77%	7	13.46%	13.46%	0	0%	0%	2	3.85%	3.85%
Mostly dissatisfied	7	13.46%	19.23%	5	11.54%	25.00%	1	1.92%	1.92%	5	9.62%	13.47%
Somewhat dissatisfied	13	25.00%	44.23%	13	25.00%	50.00%	4	7.69%	9.61%	8	15.38%	28.85%
Neither satisfied or dissatisfied	9	17.31%	61.54%	10	19.23%	69.23%	6	11.54%	21.15%	10	19.23%	48.08%
Somewhat satisfied	4	7.69%	69.23%	8	15.38%	84.61%	7	13.46%	34.61%	3	5.77%	53.85%
Mostly satisfied	10	19.23%	88.46%	8	15.38%	99.99%	21	40.38%	74.99%	18	34.62%	88.47%
Completely satisfied	6	11.54%	100%	0	0%	100%	13	25.00%	100%	6	11.54%	100%

Table 8. Comfort preferences and occupant energy behaviours

Comfort Preferences	Frequency	Percentage	Occupant behaviour	Frequency	Percentage
To let in fresh air	38	73.08%	Drink hot/cold beverage	40	76.92%
To feel warmer	37	71.15%	Open/close windows	38	73.08%
To feel cooler	33	63.46%	Open/close internal doors	34	65.38%
To increase air movement	32	61.54%	Adjust clothing	33	63.46%
To avoid outdoor sounds	22	42.31%	Turn lights on/off	31	59.62%
To avoid glare	16	30.77%	Adjust shades and blinds	31	59.62%
To feel healthier	15	28.85%	Adjust computer screen/brightness	30	57.69%
To have access to outside view	14	26.92%	Turn off the computer monitor	25	48.08%
To save energy	13	25.00%	Adjust personal heaters	24	46.15%
To increase artificial lighting	10	19.23%	Open/close external doors	22	42.31%
To increase daylighting	9	17.31%	Moving through spaces	21	40.38%
To experience the outdoor climate	8	15.38%	Report discomfort	19	36.54%
To hear outdoor sounds	3	5.77%	Adjust portable/ceiling fans	14	26.92%
To follow management guidelines	3	5.77%	Adjust room air conditioning unit	10	19.23%
			Adjust thermostats	5	9.62%
			Inaction (None of the above)	1	1.92%
			Adjust computer table	1	1.92%

Table 9. Logistic regression coefficients of residential occupant behaviours

		B	S.E.	Wald	df	Sig.	Exp(B)/OR	95% C.I.for EXP(B)	
								Lower	Upper
Drink hot/cold beverages	Motivation	-1.128	0.576	3.833	1	0.050	0.324	0.105	1.001
	Ability	0.816	0.502	2.648	1	0.104	2.262	0.846	6.048
	Opportunity	-0.340	0.304	1.253	1	0.263	0.711	0.392	1.291
	IEQ	-0.122	0.402	0.092	1	0.761	0.885	0.402	1.948
	User Control	0.040	0.320	0.016	1	0.900	1.041	0.556	1.950
	Constant	4.376	3.072	2.030	1	0.154	79.523		
Open/close windows	Motivation	-0.124	0.438	0.080	1	0.777	0.883	0.375	2.082
	Ability	-0.079	0.451	0.031	1	0.861	0.924	0.382	2.237
	Opportunity	-0.126	0.303	0.173	1	0.678	0.882	0.487	1.596
	IEQ	-0.585	0.373	2.453	1	0.117	0.557	0.268	1.158
	User Control	0.683	0.303	5.091	1	0.024	1.979	1.094	3.581
	Constant	3.055	3.081	0.983	1	0.321	21.218		
Open/close internal doors	Motivation	-0.634	0.416	2.327	1	0.127	0.530	0.235	1.198
	Ability	-0.148	0.410	0.131	1	0.717	0.862	0.386	1.925
	Opportunity	-0.004	0.272	0.000	1	0.988	0.996	0.584	1.697
	IEQ	0.259	0.372	0.484	1	0.487	1.295	0.625	2.685
	User Control	-0.382	0.283	1.823	1	0.177	0.683	0.392	1.188
	Constant	5.290	2.915	3.293	1	0.070	198.366		
Adjusting clothing	Motivation	-0.607	0.425	2.038	1	0.153	0.545	0.237	1.254
	Ability	0.493	0.404	1.485	1	0.223	1.637	0.741	3.615
	Opportunity	-0.509	0.298	2.926	1	0.087	0.601	0.335	1.077
	IEQ	-0.408	0.380	1.154	1	0.283	0.665	0.316	1.400
	User Control	-0.365	0.276	1.750	1	0.186	0.694	0.404	1.192
	Constant	5.650	2.970	3.620	1	0.057	284.333		

a. Variable(s) entered: Motivation, Ability, Opportunity, IEQ, User Control.