Student accommodation, environmental behaviour and lessons for property managers

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Abstract

Purpose – Despite awareness of climate change for over 3 decades, per capita energy and water consumption increase and environmental impacts grow. The built environment contributes around 40% of total global greenhouse gas (GHG) emissions; action is vital. Whilst building code standards have increased, rating tools and technology to reduce energy and water consumption are developed; environmental impact grows because of human behaviour. In the tertiary education sector, student accommodation constitutes a large part of the property portfolio, contributing significant amounts of GHG emissions and environmental impact. Property Managers can educate and install systems and technologies to improve behaviour if they understand it.

Design/methodology/approach – This exploratory study used a questionnaire survey to explore how student's worldviews vary and the possible limitations to behaviour in respect of climate change. In total, 71 responses from international university students living in residential accommodation on campuses in Stockholm were analysed.

Findings – The results show different perceptions about the environment and actions that are needed, and this leads to different behaviours. Limited knowledge and inability to relate environmental consequences to one's own actions, effective communication and risk averse behaviour, are critical in mitigating climate change. A deeper understanding of participants worldviews and the different resulting behaviours was achieved.

Research limitations/implications – This pilot study involved a small number of participants and future studies should expand participant numbers, including those with more varied backgrounds, education levels and age groups.

Practical implications – If property managers gain a deeper understanding the different behaviours of their residents, they can develop effective strategies to facilitate action that will lower the environment impact and GHG emissions of student accommodation.

Originality/value – The knowledge gained about environmental attitudes and human behaviour can help property and facility managers, policy makers and regulators to develop more effective strategies to deliver improved sustainability outcomes.

Keywords Behaviour, Sustainability, Climate change, Environment, Action

Paper type Research paper

1. Introduction

Though we have known about climate change and greenhouse gas (GHG) emissions for over 3 decades, in Australia per capita GHG emissions and water consumption have increased, and our environmental impacts, such as waste, grow (Hunt and Watkiss, 2011; Preston and Jones, 2006). During this period the built environment industry, professions, regulators and stakeholders have taken many actions. There have been increases in energy standards in building codes, enactment of planning policies, development of sustainable building rating tools for all property types, as well as voluntary actions. The Australian Green Star rating tool covers various building types in the "as designed" and "as built" phases of building lifecycles. The best opportunity to consider and enhance building performance lies at the

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initial design and building operation stages (Kibert, 2016). The technology exists to reduce energy and water consumption and to ensure optimum air quality and IEQ metrics are delivered. Furthermore, this technology continuously improves and equipment specified today, is better than what was available even one to two years ago.

Allouhi *et al.* (2015) analysed past International Energy Agency (IEA) data and looked at forecasts for future trends of energy consumption. The 2013 IEA report presented a figure of world final energy consumption and world CO_2 emissions from 1971 to 2011 and concluded global energy consumption and CO_2 emissions approximately doubled during the period (Allouhi *et al.*, 2015). Although the latest statistics suggest that CO_2 emissions curve has flattened, the change is slow and varies significantly between regions ("International Energy Agency (IEA) Global CO2 emissions", 2013).

Allouhi *et al.* (2015) concluded total energy consumption is growing faster than global population (2.75% compared to 1.4%). The growth is due to increasing needs for individual energy and per capita energy consumption had grown by 11.18% in the 10 years from 2001 to 2011, due to improvements in comfort levels and the growth of human activities. CO_2 emissions had relatively higher growth rates, with a 33% increase during this period (Allouhi *et al.*, 2015).

The report "International Energy Outlook 2013" by the Energy Information Administration (Sieminski, 2013) predicts world energy consumption will grow 56% from 2010 to 2040 with significant environmental impacts expected. Although the growth is predicted mainly in non-OECD countries, OECD countries such as; Australia and Sweden, will increase their consumption and will be affected by the environmental impacts. The case for changing environmental behaviours is clear; however, a deeper understanding of how people are acting is needed.

It should follow with improvements in technology, rating tools and efficiency gains that lower per capita energy and water consumption would result, and therefore, given the reported increases, something is wrong. It may be over-optimism at design stage, or during construction corners are cut, or insufficient/inadequate inspections are undertaken to ensure energy efficiency results. Another aspect to consider is the commissioning of building services (Xiao and Wang, 2009). If there are the means to design, build and operate better performing, more sustainable buildings; why is it not happening to a greater extent and to the extent needed to mitigate climate change? Part of the issue is behaviour; human behaviour (Stevenson and Leaman, 2010).

The literature shows various interventions can be employed in the built environment in order to stimulate behavioural change (Abrahamse *et al.*, 2005; Allcott and Rogers, 2014; Carrico and Riemer, 2011; Gynther *et al.*, 2012; Hammink *et al.*, 2019), whereas some interventions suggest improvements, the long-term effect on behavioural change is uncertain (Abrahamse *et al.*, 2005; Allcott and Rogers, 2014).

Property managers are in a good position to influence change within the buildings they manage. Property managers are employed in the private and public sector and are responsible for effective management of their properties. The properties they manage can be commercial, retail, industrial or residential. Residential stock is of interest because occupants spend a lot of time in the properties and their environmental behaviours contribute substantially to environmental impacts of the building.

This paper examines various types of human behaviour identified by environmental psychologists in respect of sustainability and actions and the crucial relationship in the delivery of better outcomes in building performance (Gifford, 2015); here in university residential accommodation. Buildings and their occupants are in symbiosis and the final output in respect of sustainability performance depends on both equally, this paper focuses on building residents and how human action in the built environment can be supported and consequently; pro-environmental behaviour can be enhanced. As a result there are lessons for

property managers to use to reduce environmental impact though a greater understanding of residents behavioural characteristics.

2. Human behaviour and environmental action

Human behaviour in context of climate change has generated extensive discussion among the research community. Prominent scholars have presented reviews and proposed various research agendas on the subject (Doherty and Clayton, 2011; Gaspar, 2013; Gifford and Nilsson, 2014; Steg and Vlek, 2009; Stern, 2000). The following discussion on pro-environmental behaviour is based on the work of environmental psychologists who have researched the lack of environmental action and found 29 Dragons or, "drag-ons" of inaction, grouped into seven categories (Gifford, 2011). Environmental related inaction has three phases; genuine ignorance is first, phase two, where various psychological processes interfere with effective action; and finally, phase three, where some action is taken (Gifford, 2011). Often this action quickly fades to inaction, as action taken makes too little transformation to the individuals' environmental footprint or, is counter-productive as witnessed in the 2018 disclosures about ineffective, bogus and non-compliant recycling and landfill practices (MacKenzie, 2018).

Overall, there is a lack of data, awareness and understanding or limited cognition, about issues relating to advice that could be given at the design stage in respect of lifecycle building performance and, during construction to reduce environmental impact and improve operation (Osmani *et al.*, 2008). This information/knowledge gap covers waste, water usage, lowering of GHG emissions, use of green building rating tools or; options of exceeding the minimum standards contained in the Building Code of Australia (BCA); all of which could future proof the development against environmental obsolescence (Ding, 2008). Limited cognition comprises seven categories of behaviour listed below;

1. Limited cognition	1.1 Ancient brain
	1.2 Ignorance
	1.3 Environmental numbness
	1.4 Uncertainty
	1.5 Judgemental discounting
	1.6 Optimism bias
	1.7 Perceived behavioural control

"Ancient brain" (Ehrlich and Ornstein, 1989), asserts human brains have not advanced greatly over millennia and that 21st century climate change is too recent a phenomenon for humans to react to. Ignorance, not knowing there is a problem or, not knowing what to do, limits their action and behaviours (Bord *et al.*, 2000). Other researchers (Gifford, 1976; Gifford and Chen, 2017; Pelletier *et al.*, 2008) identify environmental numbness, where people are inundated with too much information and becoming selective about what data can be assimilated. If issues, such as investigating the best performance options over a building lifecycle do not lead to direct difficulties because clients do not seek this guidance, it follows that behaviours are unlikely to alter. Conversely; when humans see repeated information attention and action shrink rapidly too (Burke and Edell, 1986; Newig, 2004).

Apparent and real uncertainty diminishes pro-environmental behaviour, vindicating inaction and well intentioned efforts of scientists, industry bodies, to quantify the level of certainty can be counter-productive (Hine and Gifford, 1996). Another behaviour; "judgemental discounting", is where future risks are discounted. In a survey, respondents

in 15 of 18 countries believed environmental problems were worse elsewhere, with the result of less motivation to act locally (Gifford *et al.*, 2009). A sixth drag on action is "optimism bias", which is where personal risks are discounted to the impairment of a person's/peoples own wellbeing; "she'll be right"; a well-known Australianism, is an example of optimisation bias (Weinstein *et al.*, 1988). The final limitation on action is "perceived behavioural control and self-efficacy"; which occurs when a person believes they cannot do anything as "an individual" and so; do nothing (Olson, 1989).

The second group of drag on behaviours is "ideologies" and has four components listed below;

2 Ideologies	2.1 Worldviews 2.2 Suprahuman 2.3 techno-salvation 2.4 System justification (Martin *et al.*, 2011; Gifford *et al.*, 2011)

People's worldviews predict their action and behaviour, an example, is faith in capitalism. The Freedom Of The Commons worldview has led to devastation of fisheries, forests and other landscapes (Heath and Gifford, 2006). With the suprahuman powers ideology, the belief is that Mother Nature will do what it wants; humans are powerless (Mortreux and Barnett, 2009) and; consequently, action is futile. Techno-salvation is a technocentric perspective of the world which is a barrier for some, as they believe people can be saved through technological solutions (Gifford, 2008). An example of this view is faith that geo-engineered artificial trees will save us. System justification is the defence of the status quo. Whereas climate change mitigation requires humans to modify behaviour, such as focussing more on lifecycle performance of buildings, investing in sustainable design and procurement and changing behaviour and the way humans occupy, operate and manage property (Feygina *et al.*, 2010).

Comparison with others, the third group of behaviour restricting actions comprises three categories, is where people compare their actions to others.

3. Comparison	3.1 Social comparison 3.2 Social norms and networks 3.3 Perceived inequity

Social comparison is referred to as the Theory of Planned Behaviour (Ajzen, 1991) or the Value Belief Norm Model (Stern, 2000). The rationale is, if your peers do not take action; neither do you. In other ways, with social norms and networks, though there is potential for progress, they permit regression (Thøgersen, 2008). An example occurred in a residential power use study, where residents modified actions and energy use to fit the "norm", resulting in overall consumption increases (Schultz *et al.*, 2007). A further drag on behaviour is perceived inequity or; "why should I change, if others do not?" studies concluded cooperation declined where inequity was perceived. The question is; if people can acknowledge these tendencies, is it possible to be proactive to encourage positive behaviour?

Sunk costs are the fourth category of behaviours impacting actions with three components;

4. Sunk costs	4.1 Financial investment 4.2 Behavioural momentum 4.3 Conflicting values

With financial investments, once a person has invested in something, dispensing with it is more difficult (Arkes and Hutzel, 2000). An example is car ownership; people are loss averse and do not want their investment to be wasted; that is "you've bought it, so use it". This may affect some contractors who invest in equipment to deliver developments using certain materials and methods, and this is their preferred specification when tendering. Behavioural momentum habit is closely aligned (Gifford, 2015). Looking at water and energy use in homes as an example, occupiers may choose the familiar behaviours over ones which may offer greater sustainability and better performance. Within households there are conflicting values, goals and aspirations that are often incompatible (Stern, 2000). Cost and quality of building materials and building services and appliances all have impacts on performance outcomes, for example, some materials have higher amounts of embodied energy compared to alternative materials. Lack of place attachment is associated with lower pro-environmental behaviour (Clayton, 2003), and people in rented homes and/or from outside a local area, may not be interested, or able, to invest in behaviour or equipment that might deliver better performance over the property lifecycle.

The fifth group of drags on behaviour is discredence, which has four components;

5. Discredence	5.1 Mistrust 5.2 Program inadequacy 5.3 Denial 5.4 Reactance

Trust is easily broken and when damaged, the chances of adopting pro-environmental behaviour declines (Terwel *et al.*, 2009), this applies to building occupants. Many environmental building programmes have been developed to encourage improved performance, though few are mandatory or sanction non-compliance. Sometimes, the programme fails to achieve objectives and consequently trust diminishes, green building programmes such as the 1,200 Buildings Program in Melbourne in the mid 2000s is an example of this (Wilkinson, 2018). Another example is the realisation in 2018/2019 that recycling programmes were not working and recycled waste is ending up in landfill rather than being recycled (National Waste Report, 2018). A consequence can be cognitive dissonance, when people decide a programme is not good enough for them and justifies their non-participation. It follows that denial in the form of uncertainty, mistrust and sunk costs can lead to denial of the problem (Norgaard, 2006). An example is climate change deniers (Dunlap and McCright, 2010), who are more outspoken than those who believe otherwise. With reactance, there is evidence that many do not trust messages from scientists and governments (Earle, 2004) and evidence that fossil fuel industries encourage this view (Hoggan and Littlemore, 2009). Facebook and Cambridge Data Analytica allegations of interference with elections (Guardian, 2018) add credibility to this assertion. The end result is that some people mistrust messages about acting in environmentally positive ways.

Perceived risk (Schiffman *et al.*, 2006), the sixth group has six variables that reduce actions;

6. Perceived risk	6.1 Functional risk 6.2 Physical risk 6.3 Financial risk 6.4 Social risk 6.5 Psychological risk 6.6 Temporal risk

Consider an innovative technology such as ground source heat pumps or algae building technology, property managers would want to know; the functional risk (will it work?), the physical risk (is it safe?), the financial risk (what is the payback period and is the energy provided cheaper than alternatives?), the social risk (what will my colleagues/contemporaries think?), the psychological risk (will people tease me?) and the temporal risk time involved researching the technology (will it be wasted?). These perceived risks encourage people to stick with familiar specifications and appliances in housing and to adhere to familiar behaviours (Martin *et al.*, 2011). With housing providers adhering to tested specifications and technologies ensures that risk taking for improved building performance using behaviour change is a low priority. The incentive is absent, as any interest in building performance ends when the property is completed and sold to others. However, this is not the case for property managers of residential property such as student accommodation.

The final, seventh group is labelled limited behaviour which has two components;

7. Limited behaviour	7.1 Rebound 7.2 Tokenism

Once individuals get past all the "drag-ons" and think they can act; which actions are most likely? Some actions are easier than others and these are chosen more often than harder, but more effective, ones. For example, separation rubbish for recycling might be straightforward but altering behaviour to lower energy and water consumption, and monitoring it, is harder (Grifford, 2011). Eliminating plastics is a tougher option to achieve compared to recycling plastics.

The rebound effect or Jevons Paradox (Jevons, 1865) is another important consideration, where the savings made are subsequently lost in other actions (Grifford, 2011) BedZed housing, a sustainable UK development where substantial energy and water savings were realised by occupants. The occupants spent the money saved on utilities on other things including higher than average amounts of international travel (Lombardi and Trossero, 2013; Rode and Burdett, 2011). The total GHG emissions related to their additional air travel exceeded the GHG emission savings realised in the BedZed homes and indicates the need to be aware of retaining the savings made in sustainable building performance (Herring, 2011).

3. Materials and methods

This research examined the psychological barriers for taking action towards climate change. Following Gifford's categorisation of barriers to climate change mitigation and adaptation (Grifford, 2011), a questionnaire survey to test the manifestations of the psychological barriers was developed. This is qualitative research which seeks to gain a deeper understanding of the barriers to environmental action (Patton, 2002). The literature review generated the survey questions.

3.1 The questionnaire

The survey tested six of the seven drag ons: limited cognition, ideologies, comparisons with others, sunk cost, discredence and limited behaviour. The target group in this study is students living in university accommodation and given the respondents' lifestyle situation, the researchers excluded the category perceived risk from the questionnaire.

The questionnaire included 23 statements reflecting 23 specific barrier manifestations. In addition, questions were added to measure respondents' perceptions of their own environmental behaviours. A total of 34 closed questions were included in the survey. The

survey finished with an open question enabling respondents to leave comments freely. This paper focuses on general barriers only and their specific manifestations, the questions and adopted scale are presented in Table 1.

3.2 Data collection

Data for this pilot study were collected in February 2019. The questionnaire was emailed to 309 international students studying in Sweden, living on the university campus in university students' apartments at KTH, Stockholm.

Since building and occupants are in a symbiosis, the final performance depends on both the building's sustainable conditions and the residents' behaviour. To gain a better understanding of residents' actions and their environmental profile, we conducted a study among residents in a building with a very high sustainability performance. The underlying assumption is that living in a house that has very good environmental performance has the best conditions for acting in an environmentally friendly manner. Therefore, we can assume that it is the individual's drive and psychological barriers that largely determine the behaviour of the residents.

A survey was conducted among students who lived in a student housing that is built as a plus-energy house. The student house has a very energy-efficient heating system and very good building insulation. The house is newly built and the first occupants have moved in in 2018. The recycling station is located in the close proximity to the building. Students have access to a laundry room with energy-efficient dryers and washing machines.

Each student received an email inviting them to take part in a survey, with a reminder sent out 10 days after the first invitation. The online questionnaire was open for one month. As a token of appreciation, students were offered a voucher for food/coffee of approximate value of 3 Euro. 71 completed responses were received (23%).

General barriers	Specific manifestations	Gender	Continent
1. Limited cognition	1.1 Ancient brain	0.61	0.53
	1.2 Ignorance	0.44	0.01
	1.3 Environmental numbness	0.03	0.04
	1.4 Uncertainty	0.70	0.13
	1.5 Judgemental discounting	0.57	0.00
	1.6 Optimism bias	0.28	0.87
	1.7 Perceived behavioural control	0.81	0.95
2 Ideologies	2.1 Worldviews	0.47	0.83
	2.2 Suprahuman	0.44	0.04
	2.3 techno-salvation	0.75	0.85
	2.4 System justification	0.84	0.03
3. Comparison	3.1 Social comparison	0.29	0.72
	3.2 Social norms and networks	0.51	0.09
	3.3 Perceived inequity	0.80	0.20
4. Sunk costs	4.1 Financial investment	0.94	0.09
	4.2 Behavioural momentum	0.82	0.01
	4.3 Conflicting values	0.32	0.00
5. Discredence	5.1 Mistrust	0.84	0.47
	5.2 Program inadequacy	0.79	0.42
	5.3 Denial	0.99	0.58
	5.4 Reactance	0.92	0.00
6. Limited behaviour	6.1 Rebound	0.89	0.15
	6.2 Tokenism	0.93	0.01

Source(s): Authors

Table 1. Kruskal–Wallis test, $p < 0.05$

3.3 The analysis

The questionnaire provides responses on 23 barriers. Descriptive statistics are used to present the results. Difference in responses depending on country of origin (defined as continent of origin and categorised as: Asia, Europe and America) and gender. Due to the ordered nature of the data, the Kuskal-Wallis, a post-hoc Dunn's test, the Benjamini–Hochberg comparison method was applied where relevant. A post-hoc Dunn's test, Benjamini–Hochberg comparison method, was used computed to test statistical significance for pair comparison between groups. The post-hoc test allows for comparison of responses between groups with adjustment for multiple testing (Thissen *et al.*, 2002). Benjamini–Hochberg procedure tests difference in responses between the groups and control for the false discovery rate in multiple comparison (Thissen *et al.*, 2002). In order to perform the statistical tests, scores were allocated for each answer: strongly agree (5), agree (4), neither agree or disagree (3), disagree (2) and strongly disagree (1); for questions regarding social comparison, the answers were ranked as follows: yes (5), no (1) and do not know (3). The analysis was conducted using statistical package STATA 14.

4. Results

4.1 Respondents

Of the 71 completed responses, 59% identified as male and 41% as women. The majority (94%) of respondents were postgraduate students, with undergraduate students comprising 6% of respondents. Most respondents were aged between 21–24 years (65%), a quarter were aged between 25–28 years and 10% were more than 28 years old. All respondents were international students from 33 different countries, with most coming from Germany (17%), France (13%), China (7%), Spain (7%) and India (7%). To test differences in responses, a variable "continent" was created, which included three groups: Europe (44 respondents or 64%), Asia (19 respondents or 28%) and America (North and South) with 9% of respondents. Respondents studied different subjects from mathematics, computer science and industrial economics to architecture and built environment. Therefore, the respondents are highly educated, mostly aged 21–24 years and all international students, mostly European, studying a broad range of subjects in Sweden. It is acknowledged that different groups of respondents may hold different views (Macias, 2015; Vaughan and Nordenstam, 1991).

4.2 General barriers to behaviour and action

4.2.1 Limited cognition. Gifford's (2011) categorisation of the psychological barrier *limited cognition* includes seven manifestations (biases): ancient brain bias (Ehrlich and Ornstein, 1989), environmental numbness (Gifford and Chen, 2017), ignorance (Bord *et al.*, 2000) , uncertainty (Hine and Gifford, 1996), spatial discounting of environment (Uzzell, 2000) optimism (Weinstein *et al.*, 1988), perceived behaviour control and self-efficacy (Olson, 1989). Those manifestations correspond to seven variables in the data set.

The survey results suggest that students are prone to perceived behaviour control and self-efficacy bias and ignorance bias. Most respondents (55%, Table 2) agreed with statement: Individuals can affect climate change. Action does not have to be at government and national levels, indicating potential bias towards perceived behaviour control and self-efficacy suggesting a weakened belief in collective actions that can solve the climate change problem (Olson, 1989).

Around 40% admitted that they *need to know more to take action to mitigate climate change* (Table 2), suggesting respondents perceived they have limited knowledge about how to act to mitigate climate change, or understanding about consequences of various behaviours. Ignorance bias stops people from making active choices and conscious decision about their own behaviour (Bord *et al.*, 2000), in the context of climate change.

General psychological barrier	Specific manifestations/ variables	Survey question	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. Limited cognition	1.1 Ancient brain	*Climate change is distant and not related to my everyday life or family and close friends*	1%	3%	3%	54%	39%
	1.2 Ignorance	*I need to know more to take action to mitigate climate change*	8%	32%	18%	30%	11%
	1.3 Environmental numbness	*Climate change is never out of the media, on the television, in the newspapers and on the radio. I get sick of hearing about it*	3%	6%	17%	39%	35%
	1.4 Uncertainty	*The Inter-governmental Panel on Climate Change says 2 degrees of warming is "likely" – I'm not sure what that means*	3%	14%	14%	35%	34%
	1.5 Judgemental discounting	*I believe that the effects of climate change are worse in my home country compared to other countries*	15%	14%	30%	32%	8%
	1.6 Optimism bias	*I believe my actions will stop climate change*	3%	27%	35%	27%	8%
	1.7 Perceived behavioural control	*Individuals can effect climate change. Action does not have to be at government and national levels*	18%	37%	15%	24%	6%
2. Ideologies	2.1 Worldviews	*I believe in capitalism*	6%	18%	46%	15%	14%
	2.2 Suprahuman	*What ever actions humans takes, mother nature will do her thing*	8%	24%	18%	31%	18%
	2.3 techno-salvation	*Humans will find a technological solution to climate change*	6%	25%	25%	35%	8%
	2.4 System justification	*Things are OK as they stand, that's why I do not need to take any action on climate change*	0%	4%	3%	32%	61%
3. Comparison with others	3.2 Social norms and networks	*If I was told that my energy usage was higher than my friends that would prompt me to reduce it to a comparable level*	31%	41%	24%	4%	0%
	3.3 Perceived inequity	*Why should I take action when others do not*	0%	7%	7%	34%	52%
4. Sunk costs	4.1 Financial investment	*If I own a perfectly good car, it would be irrational to take public transport*	1%	1%	18%	38%	41%
	4.2 Behavioural momentum	*If taking action on climate change depends on me changing my daily routine quite a bit, it's not going to happen*	3%	8%	15%	42%	31%
	4.3 Conflicting values, goals and aspirations	*I believe climate change is real, but I am unwilling to pay higher taxes to tackle it*	3%	18%	15%	45%	18%
5. Discredence	5.1 Mistrust	*I do not trust government departments and their reports on environmental matters*	4%	25%	31%	31%	8%

(*continued*)

Table 2. Questions describing 23 different manifestations of general psychological barriers.

General psychological barrier	Specific manifestations/ variables	Survey question	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	5.2 Perceived program inadequacy	*Policy makers programmes, for example incentives for solar panels, are good idea but there is too much paperwork*	11%	30%	44%	11%	4%
	5.3 Denial	*Human activity has little, or nothing, to do with climate change*	0%	0%	10%	18%	72%
	5.4 Reactance	*The government is imposing too many rules and regulations about climate change*	3%	4%	24%	41%	27%
7. Limited behaviour	7.1 Rebound effect	*After all the savings (energy, water, CO2) I have made, I believe I deserve a reward*	1%	10%	19%	44%	26%
	7.2 Tokenism	*To stop climate change, all I need is cut my energy consumption by 10%*	4%	4%	32%	38%	21%

			Yes		Do not know. Do not compare		No
3*.Comparison with others	3.1 Social comparison*	*I recycle as much as my friends do*	33%	0%	54%	0%	13%

Note(s): All questions except one (question 3.1) gave respondents possibility of 5 answers: strongly agree /agree/neither agree or disagree / disagree/ strongly disagree. Question 3.1 offered 3 possible answers: yes / no / I do not know, I do not compare

Table 2.

A third of students showed relatively high optimism (Table 2) and believed their *actions will stop climate change*. One third agreed that they *believe that the effects of climate change are worse in my home country compared to other countries*, confirming the bias of spatial discounting of environmental problems (Table 2).

Table 2 summarises the survey questions referring to 23 psychological barriers and shows the distribution of answers. All questions except one (marked) gave respondents' the possibility of five answers: strongly agree, agree, neither agree or disagree, disagree and strongly disagree. The marked question offered three possible answers being: yes, no, or; I do not know/I do not compare.

A test for a statistical difference in opinion depending on the country of origin and gender was conducted. Based on the results from the Kruskal–Wallis (Table 1) and pair comparison Benjamini–Hochberg test, the hypothesis of equality of means between the different continent groups for limited cognition variables: ignorance and judgemental discounting is rejected. The results suggested students from Europe are more confident in their knowledge and judgement, than students from Asian countries, about taking actions to mitigate climate change. The Kruskal–Wallis test suggested differences in responses for the variable environmental numbness, however, the pairwise comparison test indicated a weak significance level between groups, indicating that differences in answers between those groups does not differ at a significance level.

4.2.2 Ideologies. The clear barriers towards action appear when respondents beliefs affirm that the current situation cannot be changed, or give sufficient justification for accepting the situation. Four variables represent four manifestations in the "ideologies" barrier in Table 2. Every third student indicated that; *regardless of what actions humans take, mother nature will do her thing* (Table 2), confirming that Mother Nature will prevail, regardless of human actions (Mortreux and Barnett, 2009).

At the same time, 30% of respondents believed in techno-salvation, (Table 2) concurring that humans will find a technological solution to climate change (Gifford, 2008). 25% agreed with the statement; *I believe in capitalism*, which is an economic paradigm that has led to climate change and environmental damage. This indicates more students will seek other paradigms.

A small minority accepted the current situation, while 96% disagreed with statement that; *things are OK as they stand, that's why I do not need to take any action on climate change* (Heath and Gifford, 2006).

The Kruskal–Wallis and pair comparison Benjamini–Hochberg test results show (Table 1) the hypothesis of equality of means for the variables "suprahuman" and the group, continent, can be rejected, which indicates that students from Asia have a stronger belief in the power of nature than the European students. The Kruskal–Wallis test suggested differences in responses for the variable; "system justification", however, a pairwise comparison test indicated a weak significance level between the groups, therefore, it is not possible to reject the hypothesis that students' answers are equal regardless country of origin.

4.2.3 Comparison with others. Comparison with others is a strong incentive for action, but also a barrier (Ajzen, 1991; Stern, 2000). The actions may be triggered positively by social comparison and norms (Schultz *et al.*, 2007). The results suggest that students compare themselves with others, as 72% agreed with statement; *If I was told that my energy usage was higher than my friends that would prompt me to reduce it to a comparable level* (Table 2). Perceived inequity may be one of the main reasons for inaction (Schultz *et al.*, 2007). The answers indicate this is not the case here, as only 7% of respondents acknowledged that if others are not taking actions, there is no reason for their own engagement.

4.2.4 Sunk costs. Sunk costs may have effect on post-hoc rationalisation of success of an endeavour in the climate change context (Arkes and Hutzel, 2000), it suggests that financial investment in for example, a car, would prevail in favour of using other forms of transport that are less environmentally damaging. The survey results do not support this hypothesis, as 80% of students; did not find it irrational to use a public transport even though owning a car.

Weight of habit can be a problem in taking action against climate change (Gifford, 2015). Nearly 75% students disagreed with statement*; If taking action on climate change depends on me changing my daily routine quite a bit, it's not going to happen*. This indicates confidence that they are in control of their behaviour, and that they did not perceive their ability to make their own behavioural change as a problem. Approximately 65% disagreed with the statement*; I believe climate change is real, but I am unwilling to pay higher taxes to tackle it* (conflicted values) (Stern, 2000) suggesting they are happy to pay more to take action. The results indicate that the students do not perceive their behaviour is a barrier in taking action against climate change.

4.2.5 Discredence. A positive, or negative, attitude towards others views may affect development of discredence (Gifford, 2011). Success in achieving climate change mitigation depends on public trust and acceptance (Terwel *et al.*, 2009). A third of respondents agreed with a statement that they; *do not trust government departments and their reports on environmental matters* (Table 2).

Mistrust towards government officials may convert to reactance (Earle, 2004). Only 7% of respondents felt *the government was imposing too many rules and regulations about climate change* (70% disagreed, Table 2) indicating that they accept more environmental government regulations.

Implementing various programmes is a way for government to promote and engage public, however, some may find inadequacy of a programme as a justification of own inaction (Gifford, 2011). Approximately 40% survey respondents agreed with the statement that;

Policy makers programmes, for example incentives for solar panels, are good idea but there is too much paperwork.

Approximately 40% of respondents stated a neutral response, neither agreeing nor disagreeing with the statement; thus a high level of discredence was evident (Table 2). A clear majority (90%, Table 2) disagreed with statement that*; human activity has little, or nothing, to do with climate change*, 10% neither agreed nor disagreed. These results suggest these students are very aware of the human contribution to climate change.

4.2.6 Limited behaviour. Nearly 60% believed that; *to stop climate change, all I need to do is cut my energy consumption by 10%.* The responses suggested that the majority are very optimistic about the effect of their behaviour and the amount of action needed, which in turn suggested that there is a risk that the pro-environmental actions undertaken might be tokenistic at best and; totally ineffective at worst. The variable "tokenism" was found to be statistically different depending on country of origin (Kruskal–Wallis test, $p = 0.01$, respectively Table 1). Some mitigation effort might be offset by (rewarding) actions that normally would not take place. Respondents showed relatively modest answers, with only 10% agreeing that; *after all the savings (energy, water, CO_2) I have made, I believe I deserve a reward* (67% disagreed).

5. Discussion

5.1 Understanding and overcoming barriers

Specific manifestations which have the highest mean could potentially indicate the biases that respondents are leaning towards most. Our sample suggests that highest mean values (>3) were recorded for manifestations related to limited cognition: *ignorance*, *judgemental discounting*, *perceived behavioural,* comparison – *social norms and networks* and discredence – *program inadequacy* (Figure 1).

Respondents indicated that they have limited knowledge about how to act towards mitigating climate change, or understanding about the consequences of various behaviours. Ignorance bias stops people from making active choices and conscious decisions about their behaviours (Bord *et al.*, 2000), in the context of climate change.

There are voices in scientific community suggesting that ignorance might be related to the fact that scientists and non-scientists develop understanding about climate change in different ways (Weber and Stern, 2011). Scientists have developed their understanding about

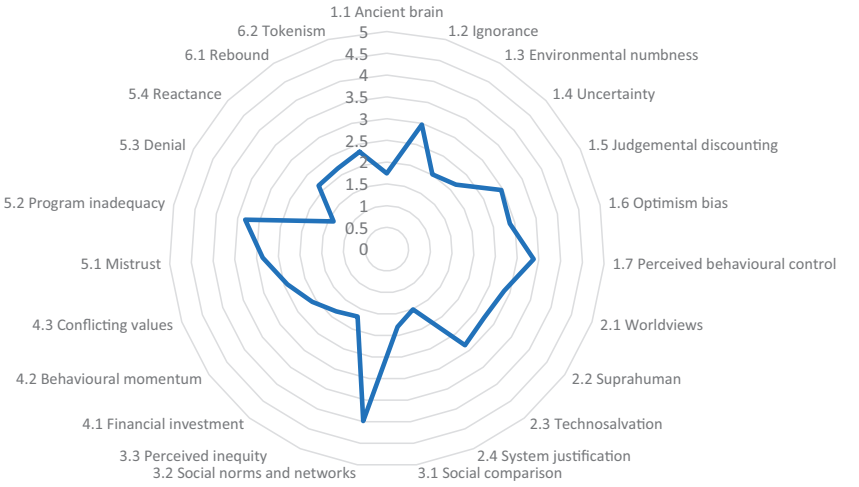

Figure 1.
Mean values for specific manifestations

climate change over generations, using various methods, for example, systematic measurements and observation, mathematical modelling and peer-reviewed research and scientific debate for years. Non-scientists are more prone to relay on personal experience (Weber, 2006), need to rely on secondary data and media coverage (Weber and Stern, 2011). Weber (2006) argues that peoples' perception of global warming, based on personal experience, will be low due to the fact that people receive insufficient feedback from their daily life or low frequency personal experience on global warming consequences. Climate processes and their impact can be difficult to comprehend and to visualise (Nicholson-Cole, 2005).

People are using experience as input to recognise risks and creating a response mechanism. However, feedback on global warming consequences is relatively weak, therefore even though the individual is presented with relevant information, which indicates existence of a problem; the individual is failing to respond in time to affect change. People ignore of the environmental problem, which means the individual behaviour stays the same, and mitigating behaviour is never really considered. It is possible that the clues about environment ignored and condemned as irrelevant to individual situation. The research has showed that the people under estimate the effects of climate change in respect of spatial and time distances (Hatfield and Soames Job, 2001; Pahl *et al*, 2005, 2014). Moreover, lack of knowledge can lead to the situation that individual is not able to produce an alternative behaviour model, due to limited knowledge on what one could do to mitigate climate change or, what the consequences of behaviour in terms of environmental impact are.

Moreover, the uncertainty about effect of pro-environmental behaviour (in the context of general climate mitigation) can increase self-orientated behaviour. Evidence of self-interest behaviours is often found in situations where individuals anticipate other people will pursue self-interest behaviours (Miller, 1999). In situations when personal responsibility is associated internally (with ones' own actions) it has facilitating attributes; however, if a person attaches that responsibility to other people, organisations or government bodies, attribution function as a barrier (Gaspar *et al.*, 2017). Research has shown that "perceived sufficiency" may function as a justification of not acting in an energy-efficient way, and a preference towards ones' own comfort and wellbeing can easily overshadow positive environmental attitude (Gaspar *et al.*, 2017). Comprehending individual responsibility and environmental self-identity may motivate towards action (Rickard *et al.*, 2014; van der Werff *et al.*, 2013).

The need for broader collective action, identified as one of the main factors contributing to a lack of motivation and environmental inaction (Pongiglione, 2014). Social norms can have a significant effect on people's behaviours, as generally people prefer to avoid the disapproval of peers (Miller, 1999).

5.2 Implications for property managers (PM)

Bröchner *et al.* (2019) point out two main opportunities in property management: digitalisation and sustainability. The authors argue that the future of management in the properties will utilise intelligent data solutions and technological advancements to provide more efficient property management, however, in doing this must acquire better understanding of users and society. Better understanding of users unlocks new possibilities of resource efficiency.

This section highlights the key implications from the survey results for property managers.

(1) Relevant knowledge

Increase knowledge on what one could do to mitigate climate change or and what the consequences of behaviour in terms of environmental impact are. Results from earlier Swedish research showed relationships between knowledge of causes of climate change and

risk judgement (Sundblad *et al.*, 2007) implying that it is not general knowledge about the state of the climate, but an understanding and possibility of visualising the consequences of climate change, that effect cognition and risk judgement.

(2) Increasing knowledge and individual responsibility

PM should learn and inform occupants about climate footprint related to operation and usage of the property; for example where the electricity is sourced, such as the percentage that is coming from wind or solar farms and what actions increase energy consumption and the consequences for the environment;

PMs can also inform occupants about how to reduce consumption levels of water and energy and reward behaviours that reduce usage. Communicating the ecological consequences may lead towards change of consumption habits (Csutora, 2012) and nudge occupants' individual responsibility towards pro-environmental actions.

(3) Green outsourcing/procurement

In terms of energy and water and other building function related resources, PM can lead by example by purchasing green energy and installing equipment to lower usage rates. They can communicate this to residents to illustrate how they are all part of solution. As large residential buildings tend to use large amounts of resources, PM can influence power in the procurement of materials with lower environmental impacts.

(4) Green leases

Cooperation between landlord and tenant is main factor in a successful work towards pro-environmental behaviour and lifestyle. For example, the Swedish Green Lease Contract includes 16 obligatory actions and 27 voluntary actions (Fastighetsägarna, 2017), where tenants and landlords bear joint responsibility for environmental work. Even though the successful outcomes might be often due to cooperative effort, the legal binding agreement might be the incentive that helps meeting environmental targets (Rameezdeen *et al.*, 2019).

(5) Engaging tenants in social exchange

PMs can develop materials and host events to share knowledge and gain consensus to improve environmental actions as a group or, a collective.

6. Conclusions

This research examined various types of human behaviour identified by psychologists in respect of sustainability and actions. The rationale for the pilot study is that in the 32 years since the 1987 UN Brundtland Report (Imperatives, 1987) and the promotion of the concept of sustainable development, working within the limits of the planet, with the broad acceptance within the global academic community that climate change is happening; environmental action should be commonplace. However, evidence in the built environment sector (Kibert, 2016; Xiao and Wang, 2009) is that, at best, insufficient action is being taken and; at worst, actions that damage the environment and accelerate climate change prevail.

Residential accommodation offers great potential to understand occupants behaviours and attitudes and; for property managers, to use this knowledge to develop and implement strategies to reduce environmental impacts of their buildings. In the present pilot study, 71 international students responded to a survey about their environmental behaviours to benchmark against Gifford's (2011); groupings of different behaviour categories that drag on action being taken. The seven categories are; limited cognition, ideologies, comparison, sunk costs, discredence and limited behaviour. This study analysed 23 of the 29 dragons behaviour within six of the categories of action identified in the literature.

The responses provide evidence of biases of ignorance and perceived programme inadequacy; suggesting high self-belief and the tendency to justify one's own inactions by blaming others. Students perceive limitations of their own actions and do not perceive their behaviour as a barrier in taking action against climate change. Attributing responsibility externally is a barrier to taking action (Swim *et al.*, 2009). Strategic communication about climate change and accentuating individual responsibility to act might give motivation and induce reflection about connection between climate change and individual choices and behaviour (Rickard *et al.*, 2014).

The results and insights into attitudes and behaviours indicate contemporary technology opens new ways of tackling potential lack of knowledge, for example, for PMs to use just in time notifications and reminders. New technological solutions, together with better understanding on how environmental knowledge can be framed and timed, can help to reduce barriers arising from information processing, misjudgement of risk and loss aversion.

The results indicated that there is a difference in perceptions, depending on respondents' country of origin, which means that different populations may respond to messages and policies in different ways; and, to different degrees (Ceglia *et al.*, 2015). Those findings are in line with previous studies which have found effect of culture on environmental performance (Roy and Goll, 2014). Future studies, conducted on larger samples, will give more insights into the effects of other socio-demographic factors.

The questionnaire survey tested self-perceived behaviour, meaning that there is a possibility for a gap between self-perceived behaviour and actual actions (Kollmuss and Agyeman, 2002; Newton and Meyer, 2013) and this is a limitation of the research methodology to some extent. More studies are needed to examine the difference in the perception of one's own behaviour and the evidence of actual choices, actions and habits. Applications of digital solution enables collection of data in built environment that opens new possibilities for understanding human behaviour and cross-data analyses, e.g. energy consumption, indoor environment, spatial movement, real time recorded actual behaviour and even individuals health data.

The results revealed variation in attitudes and evidence of biases that can impact effective action and have deepened our understanding of the underlying reasons affecting effective action. The findings suggest that limited knowledge and ability to relate environmental consequences to one's own actions, as well as effective communication and risk averse behaviours, are critical factors in mitigating climate change. Those findings are in line with previous studies (Chaplin and Wyton, 2014; Hay *et al.*, 2019; Horhota *et al.*, 2014). It follows that property managers and also policy makers, regulators, home owners and occupiers all need to increase their self-knowledge of the important relationship between peoples' worldviews and how that impacts on their behaviours and taking effective environmental actions.

This research highlighted some of the complex, interactive barriers society faces in taking effective action to address climate change. This well-educated group of young people displayed very varied responses to the many of the dragons of behaviour. These findings suggest the urgent need to look more closely at finding ways to encourage positive behavioural change in all populations before it is too late. Positive behavioural action in the built environment could lead to, much needed mitigation of the significant impact of this sector.

The study contributes to a better understanding of the complex relationships between environmental attitudes and environmental behaviour. Further studies into the relationships between worldviews and human behaviours and reducing environmental impacts of buildings during their lifecycle are much needed.

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