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My Fault or Default—Household Behaviors Living in a Climate-Smart Building

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Abstract: Decreasing climate impact of households is a concern for many actors. One way to address this challenge is to focus on household behaviors related to energy use and consumption. Another is to construct climate-smart houses that encourage households to utilize smart functions that reduce emissions. This article examines the link between these two strategies and investigates how living in a climate-smart house affects household behaviors, by conducting interviews with households before and after they moved into a climate-neutral house. Results indicate that overall, emissions decrease after the move, mostly due to the features of the building itself rather than changes in behavior. Unintended effects were also observed, calling into question which strategy is most effective in reducing a household's climate footprint.

Keywords: household consumption; energy use; climate-smart; climate emissions; sustainable behavior

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1. Introduction

Currently, much focus is aimed at finding potential ways to reduce households' contribution to greenhouse gas (GHG) emissions. Understanding household behavior requires a perspective that includes both a physical/technical perspective, as well as social and behavioral aspects [1]. Starting with the latter, research into the role of values and attitudes related to the environment has been the focus of previous research [2–5]. In addition, studies have also focused on the combination of household practices and the physical structures of buildings, providing a holistic approach to investigating household behaviors, rather than focusing on one behavior at a time [4,6]. Adopting Passivhaus standards to new residential houses is one example, where the building itself has a specific design to minimize the environmental impact and households can make active choices that influence their energy use. Other initiatives of green guidelines in construction, such as LEED (Leadership in Energy and Environmental Design), are also possible to apply to new or already existing residential houses [7]. This approach, where the use of practical solutions that engage households to make adjustments to their behavior can be a fruitful avenue to explore as this combination can increase the likelihood of decreasing household GHG emissions. For example, using specific building materials, the design of ventilation systems and exterior design features to optimize the use of solar heat can help to minimize household energy consumption [8,9]. Other initiatives that have been developed to help households reduce their GHG emissions include introducing electronic gadgets that provide users with real-time feedback on energy or hot water consumption in the attempt to raise awareness of consumption patterns [10,11].

The aim of this article is to explore the intersection where pro-environmental behaviors interact with the built environment. Put differently, the focus is to explore what expectations households have on how climate-smart services provided in their residential building will contribute to decreasing household emissions. This study follows a number of households before and after moving into a climate-neutral house, and investigates expectations were

before moving in and if these were met after the move. Using this approach makes it possible to better understand how households perceive their own behavior in relation to decreasing their carbon footprint and how interacting with climate-smart solutions affects that.

Background

Social sciences' interest in understanding households' attitudes and behaviors in relation to a sustainable lifestyle has a long tradition (see [12] for an overview). Numerous studies have attempted to show how individual, as well as group values and attitudes affect pro-environmental beliefs, and how this is linked to behavior [13–16]. Examples of pro-environmental behaviors include consuming less meat, engaging in car-pooling, insulating one's house to conserve energy, and switching to low-energy lamps for the same reason. From this field, it can be concluded that human behavior is complex and multifaceted. Some studies indicate that information can have an impact on behavior and that households can adjust their behavior when given information or feedback that provides them with information on how their behavior is affecting factors such as energy consumption [10,17]. However, even if there is some evidence that information can be used to justify unsustainable behaviors, as factual information challenging current lifestyles can be disregarded to protect one's identity [18]. Other studies indicate that there is a weak connection between attitudes and behavior, questioning the linear assumption between attitude and actions. These argue that behavior needs to be seen as embedded in a larger societal context where it is not only the individual choice that determines how people act [5,17]. To further complicate matters, behavior can be linked to specific goals—depending on the situation-specific context at one moment in time. Lindenberg and Steg (2007) demonstrate that people can have strong pro-environmental values that in some situations makes a specific behavior normative—to do the right thing. In these situations, the goal is to behave in a way that is aligned with pro-environmental attitudes. However, in other situations there might be another goal that has the most influence over our behavior, such as avoiding extra effort or not wanting to spend more money than necessary on something. These goals are then hedonistic or goal oriented, and can stand in direct opposition to engaging in the most environmentally friendly behavior [19]. This means that many values, goals, and motives are present at the same time, and that values other than environmental ones can have the most influence over a decision on a particular situation. As if this was not enough, behavior is largely a function of habits that can be difficult to change [20,21].

Moving from the broader field of values and pro-environmental behavior in general, and examining energy use in particular, it has been found here that pro-environmental values might have little or no effect on actual emissions from household energy use. Here, research has demonstrated that "comfort, convenience, and cost factors" have a larger effect on household behavior than values and attitudes [14], p. 1129. If changing behavior is perceived to be too expensive, too cumbersome, or just not possible to do, then obviously, the behavior will not be carried out. In addition to these restraints, socioeconomic factors are also an important influence on personal attitudes when it comes to energy consumption, as high-income households tend to use more energy than low-income ones [22]. The incentives for low-income households to emit less GHG is thus not necessarily motivated by more deeply held pro-environmental values, but a result of lesser resources to spend on GHG emitting practices, whereas more affluent households have other consumption patterns. This calls attention to the larger context in which households operate, where including additional layers of household characteristics can add further information on what actual role individual values play in decision-making contexts. However, there are also unifying conditions, as different kind of lifestyles can have similar energy demands but completely different underlying motives [23]. This makes it difficult to target interventions or provide information that is intended to change energy consumption, or any other changes in lifestyle for that matter, on a broad front [24].

For households to engage in energy-saving projects, it requires much engagement and knowledge [25]. If it is not intuitive or meets the user's needs, it will not be well understood or used [6,10]. This suggests that residents will not change their behavior, or change it for a short period of time, making long-term changes in behavior difficult to achieve by simply providing households with new innovations or gadgets. Technological interventions are therefore not a guarantee that households will change their energy consumption patterns, as studies evaluating technical solutions to energy reduction report mixed results [1].

This short overview illustrates that household behavior is complex and the relationship between values, attitudes, and behavior is not linear, as households can act in ways that go against what they know or believe is the most environmentally friendly way to act [26]. On the one hand, attitudes and values are important for engaging individuals to acknowledge the importance of and committing to reducing GHG emissions. Still, values and attitudes alone are not enough to make households behave consistently in an environmental manner. If behavior is determined by a combination of what we believe and values we hold, our socioeconomic status, but is also influenced by a specific situational context, it can be very difficult to determine which behaviors can be affected and by which measures. Scholars have pointed out that consumption should not be viewed as an individual choice, but that consumption—like most practices that we engage in—is a social activity [5,27,28] and should not be reduced to an individual choice. Instead, behavior is set in a context where rules and regulations set by other actors than the consumer themselves greatly influences behavior [27]. This contribution focuses on this interaction and examines how pro-environmental attitudes and values are manifest (or not) in interactions with the built environment.

2. Materials and Methods

The specific building used in this case study is a residential house constructed in the south of Sweden in 2016. The house is certified as a Passivhaus, meeting the gold environmental standard for construction and was commissioned by the municipality of Malmö (see https://www.ncc.com/sustainability/certifications, accessed on 9 January 2022). The building has 44 residential units and one student corridor with 12 rooms. Examples of climate-smart solutions are solar panels on the roof that supplies the building with electricity, providing a bicycle garage (rather than a car garage), a home-away button (shutting off ventilation and electricity), and large glassed-in balconies in every apartment with space to cultivate vegetables and herbs. In addition, the building has many common areas where residents can engage with each other in joint projects. The average rent for a one-bedroom flat, 70 m^2, was approximately €980. We selected 18 households to follow for the study to represent a broad range of residents: different ages, genders, marital, and family statuses. We interviewed all 18 households before moving in and conducted follow-up interviews with 14 of these, where 2 were done in writing and the rest face-to-face. Three households ended up not moving into the Greenhouse, one did not have time for a follow-up interview within the time frame for the follow-up session, and it was only possible to add one household to try to compensate for the attrition. As the building has 44 apartments, we conducted interviewed with about one-third of all the households, making the results generalizable for this population. The list of participating households is presented in Table 1.

All but two interviews were conducted face-to-face and lasted between 60 and 90 min, were transcribed verbatim and coded using NVivo software. Two semi-structured interview guides were used, one before and one after moving in. The first investigated current attitudes towards environmental issues, lifestyle choices relating to the environmental in general, and food and transportation choices in particular, and motives for and expectations on moving into the Greenhouse. Follow-up interviews focused on general impressions of living there, a recap of previous expectations, specific technical solutions used, and perception of possible changes in lifestyle and effect on GHG emissions. The first round of interviews was conducted in 2015 and follow-ups in 2017 after the households had been

living there for one year. In this article, the focus is on expectations on the building itself and what the households believed the move would mean, in terms of potential behavioral changes, and how this turned out.

Table 1. Participating households.

Household A	Couple, no children at home, 50's	Pre-interview only
Household B	Couple, no children at home, 50's	Pre- and post-interview
Household C	Single, 30's	Pre- and post-interview
Household D	Single, 30's	Pre- and post-interview
Household E	Couple, no children, 30's	Pre- and post-interview
Household F	Couple w children, 30's	Pre-interview, post-interview in writing
Household G	Couple w children, 30's	Post-interview
Household H	Couple, no children, 30's	Pre- and post-interview
Household I	Couple, no children, 30's	Pre- and post-interview
Household J	Couple w children, 50's	Pre-interview, (did not move in)
Household K	Couple w children, 30's	Pre-interview, post-interview in writing
Household L	Single mother, eldest son, 60's & 30's	Pre- and post-interview
Household M	Single,70's	Pre- and post-interview
Household N	Single, 30's	Pre-interview (did not move in)
Household O	Single, 30's	Pre- and post-interview
Household P	Couple w children, 50's	Pre-interview (did not move in)
Household Q	Single, 60's	Pre- and post-interview
Household R	Single, 60's	Pre- and post-interview

3. Results

On a general note, all households demonstrated a great involvement in environmental issues. A majority already were engaged in a climate-friendly lifestyle, such as being vegetarians or vegans, particularly the younger households, and many of them had tried to make environmentally conscious decisions in their everyday lives. Thus, the environmental values can be seen as high already among the households even before moving in.

3.1. Expectations

Most households had very pronounced expectations that the move into the Greenhouse would provide them with real-time feedback on what environmental impact their everyday behavior had. As the building had been marketed as a unique opportunity for "leading a climate-smart lifestyle", it was perhaps not surprising that this is what had been the most compelling reason for the move. For most households, having an overview of their energy and hot water consumption was difficult in their current place of residence. There were two main reasons for this: either they did not have that information since the utility bill did not specify this, or because they got the information on their bill for the past months' consumption, but this was not used to influence their behavior if the information was perceived to be too late.

The cost of rent is usually more expensive in a newly constructed house than in an old building, but this was motivated as an investment in the environment. Paying a high rent would be rewarding, as it showed the commitment the households had invested in their green lifestyle. The move was seen as making a conscious choice to invest in the environment—and probably serve as a signal to others. Many stated that it would be good to be able to commit to reducing their environmental impact, as it could be easy to either ignore environmental problems or make excuses for one's behavior or choices:

> *"Because as soon as you're aware, it feels like you made a mistake. And as soon as you get into that, you have two choices—to deny or do something about it. [ ] So you feel, ok, we did something wrong but the most important thing is to take responsibility for that and move on and do something better. Because then, you give concrete solutions on how that can be done, like Greenhouse is [one solution]".* (Household A, pre-interview)

For the households, moving into the Greenhouse was their contribution to addressing larger, societal environmental concerns—and they were prepared to pay an increased rent to do so.

The increased cost of rent was also seen as providing the households with motivation to pay more attention to their energy and water consumption, since this was billed separately from the rent. One respondent expressed it as if he/she was to get feedback on how much water and energy was used in real-time, it would then serve as motivation to take steps to decrease this consumption and thereby save money. Many households echoed that expectation—that being provided with feedback on the water and energy use, as well as learning the weight of their waste, would give them incentives to change their behavior. The information would guide their choices by raising their level of awareness and increasing their knowledge about how their everyday actions contributed to the environmental impact. Having an overview of how much energy was produced by the Greenhouse solar panels and how their individual household usage was, were seen as a feature that the households were looking forward to making use of. Though it was rarely made explicit, it implied that this direct link between production and consumption would influence the households to reduce their own consumption. The same logic was implied for the waste, as all household waste that was not recycled would be weighed and that this would be communicated to the households. In addition, as increased awareness of how much households threw away was thought to provide incentives to reduce the amount of waste.

As can be seen, there was an expectation that living in the Greenhouse would provide the households with relevant and precise information on their environmental impact, in particular in relation to energy and water usage, as well as waste production. This information was seen as crucial as it would act as a receipt or validation on how much their lifestyles had changed and that their impact on the environment and GHG emissions were lower than what they were before moving in. Another way in which this became visible was that for some households, the role of information filled a different function as it excused or explained past sins. For the households that had older children that had now left home, there was often a retrospective aspect. Had they known then, what they were about to learn now, on exactly how much hot water their children had used while living at home—that information could have been used as an argument to conserve water.

The role of feedback on household behavior and their consequences were perceived as an issue of receiving information and then adjusting behavior. Most households did not elaborate past this point in terms of what that would mean for their everyday behavior. However, some reflected that this knowledge was not only important in order to adjust the households' behavior while living in the Greenhouse, but some identified it as a lesson for life. One household expressed it as "learning for the next move" as routines of everyday life would change while in the Greenhouse, and then be carried to the next place of residence. Forming new habits that were more pro-environmental was seen as a big benefit.

Other expectations were connected to the large balconies and "communal-like" living environment that Greenhouse promised to provide. Many looked forward to growing their own herbs and vegetables on their balconies, as all households expressed an interest in cultivation. Many expressed that they looked forward to interacting more with the neighbors and taking responsibility for the joint spaces and social activities. Some also said that a fair amount of competition between households of similar sizes could be used to encourage an even bigger decrease in energy and water consumption if they were to compare numbers.

3.2. Meeting the Expectations

All households interviewed in the follow-up interviews enjoyed living in the Greenhouse and had utilized the opportunity to grow plants, flowers, herbs, and vegetables on their large balconies. There seemed to be a vibrant and lively community in the house, where many joint activities were contributing to the communal spirit of the house. The social promises were fulfilled for most of the households, and the interaction between the residents contributed to a sense of well-being. When asked about their contribution to the decrease of their environmental impact, households expressed a general sense of accomplishment or satisfaction:

> *"Yes! And that's what's so good. That you can sit in your home and think "I've made a conscious choice".* (Household C, post-interview)

However, not all expectations were met, as closer examinations of the technical solutions revealed. Feedback on household consumption of hot water and energy, as well as statistics over how much energy was produced by the solar panels on the building, was presented on an electronic pad that were mounted on the wall inside the individual apartments. However, these functionalities suffered several challenges in the first year. These problems caused households to quickly tire of the malfunctions:

> *"I think it disappeared a little then, when it was so messy and stuff. Like "Oh, it's working again? No? Ok . . . " and so . . . then it kind of disappears, like, a little away from you. So, I'm more like this: that I try to save energy by turning off all the lights and keeping a lower [indoor] temperature, try to think when I go shopping and not showering for too long and sort my waste and all that, but the [pad] it kind of disappeared somewhere".* (Household G, post-interview)

For the majority of the households, the expectations that the feedback would be readily available for them when they moved in and turned out not to be, was implicitly expressed as a missed opportunity. It was something that they would have used, but since it was not present at the very beginning, it was in a sense over, even after the initial problems had been worked out. This is interesting since it suggests that households perceived the move as an opportunity for change but that the space for change would disappear if it was not exploited at one crucial point in time.

The information that was provided was not well understood by most households and the interface was seen as not being user-friendly. For example, it was unclear whether the weighing of the waste reflected individual households or the entire building (with all 44 apartments) and what could be considered as high or low waste production. This made it unclear to the households what the number really meant and what they could do with that information. Some households removed the pad from its original positions since it could cause problems both when arranging furniture and that members of the households wanted it more easily accessible. A few households admitted to hacking the device and using it to stream movies rather than using it for feedback on their energy and hot water consumption.

In addition to the electronic pad that provided the households with information on their energy and hot water usage, there were also some additional smart solutions in the apartment. Two of these were mentioned frequently: a button on the water taps and the "home-away" function. The first was a button that was placed on the back of the faucet that had to be pushed in, in order to move the lever to allow for hotter water to flow. This was mentioned as a feature that made households think about their hot water usage, and in a way, kept them from using hot water in a non-conscious way. This friendly reminder gave the households the impression that they really were decreasing their hot water usage, rather than receiving feedback on the actual level of consumption.

The second solution, the "home-away" function, allowed households to shut off electricity and bring ventilation to a minimum when they left the apartment. A few, specially designated outlets would still work, for necessary appliances to continue. This means that the households needed to know which these were and adjust how they arranged

their living spaces in order to accommodate that. For example, routers or devices with stand-by functions would need to be attached to the specific outlets so that they would not reboot every time the main electricity was turned back on. This was a major challenge for the households, resulting in very low use of this function. In addition, having a pet also decreased the use of this function, since ventilation was needed to provide a good environment for the pet even if the owner was away.

However, some behavioral changes that were aligned with previous expectations did occur. Most often, households had changed their behavior around showers, decreasing the use of water after seeing the difference between taking longer or shorter showers, or turning the water off while shampooing. The button on the tap, as mentioned previously, also contributed to households perceiving that they were using less hot water—which is difficult to know without having something to compare their use to.

Unintended effects also occurred, with one example relating to the "home-away" function, and energy use in general, was that all households were engaged in cultivating plants or flowers, where some stuck to traditional varieties and others experimented more with rare species. Regardless of type, the early stage of cultivation lead households to use heat lamps in their apartments, giving the plants lots of light for them to grow. This meant, in practice, that some lamps were never turned off for long periods of time. In particular, those households engaged in hydroponics, growing plants without soil, expressed a need for extensive use of heat lamps. In addition, for younger households with no children, the move into the Greenhouse usually meant moving into a bigger apartment than they had previously lived in. Thus, having a larger refrigerator and freezer resulted in a higher consumption of food than before the move—just because they could fit more foodstuff into their fridge. This increase was justified, however, with making fewer trips to the store.

The results indicate that most expectations had been fulfilled, that living in the Greenhouse was perceived as being satisfying and that households felt they were contributing to reducing climate emissions by simply living where they lived. However, most "climate-smart" solutions were not used. Generally, the impression was that these were clever interventions that had a great opportunity for influencing others' behavior—but not the households themselves. When asked to describe or show the interviewer examples of climate-smart solutions in their apartments, many responses were general and referred to either the building material or appliances (i.e., that the building and kitchen appliances were certified) or described in general terms what solutions there were, but without providing details on how themselves engaged with them. This suggests that the experience of engaging with everyday practices to reduce climate emissions was done implicitly, but that the solutions provided were good for others to actively engage in.

4. Discussion

The Greenhouse is a unique building, where both social and environmental sustainability lived up to the households' expectations. The contribution of climate-smart housing to social sustainability, that is, the well-being and comfort of residents, that has been found elsewhere [29] was also confirmed here. From an emissions point of view, one evaluation of GHG emissions from the Greenhouse suggests that most households decreased their GHG emissions, and that this was a result of the lessened climate impact of the building itself (i.e., the use of solar panels and climate natural heating used in the Greenhouse) and not primarily from changes in household behaviors [30]. It is also clear from the results that all households felt a personal sense of responsibility related to GHG emissions. This is in line with the high level of pro-environmental attitudes held among the population in general in Sweden [31] and suggests that households are willing to take responsibility for their actions and make changes to their lifestyles. Since all residents made this conscious choice to move into the Greenhouse, this can greatly influence the social and environmental sustainability as households interact both in a social context and a built environment that encourages and reinforces pro-environmental behavior. However, these behaviors need to be considered in context, as changes in behavior were not without complications.

The results presented here suggest that households perceived the move itself as contributing to reducing emissions in relation to climate change. From one perspective, this is true—living in an "environmentally certified building" does decrease household emissions from primarily energy use. Despite this benefit, this decision might mask a rebound effect—where households increase their emissions on one sector, motivated by a decrease in another [24]. This calls attention to the complex trade-offs that households engage in on an everyday basis—or to different goals with ones' behavior. Households seem to have made one large decision with a normative goal-framing [19] to move into a climate-smart house, to begin with, and this might have led to other goals (such as hedonistic or gain-framed) taking priority other decision-making contexts. The cost of rent in the Greenhouse was more expensive compared to living in older residential houses the households could have chosen to live in (as newly constructed residential properties often have higher rent) and this could cause residents to invest their money in items or activities that are more emission intense. This balancing act needs to be further investigated and added to the growing literature on household consumption so that studies—and interventions—are designed to address this complexity.

In addition to the rebound effect, the study presented here also found a few unintended effects that lead to an increase in energy use, compared to what the building constructors had foreseen. By providing the households with opportunities to explore different and new ways of cultivating and developing their gardens, some households engaged in—for urban dwellers—a more energy-intense way of growing plants. This meant that more energy was used for heat lamps in an effort to enable urban cultivation. In addition, having a larger refrigerator and freezer also increased some households' food consumption—another possible side-effect not considered when designing for household behavior. Indeed, sometimes modeling household behavior seems to be done without the knowledge of how complex behavior is [1,32]. Perhaps the living labs that are developed at many universities might do well in focusing on detecting unforeseen consequences that can lead to the opposite effect of what was originally intended—especially if it increases rather than decreases GHG emissions.

Some studies suggest that households need to interact with all the buildings' energy-reducing features in order to get the best performance [9], while others indicate that the interaction with the smart features of a home environment is short-lived [10]. In this study, it was found that households were initially interested in engaging actively with all the smart features that Greenhouse promised, but that this window of opportunity was missed because of malfunctions. Even if it is impossible to know if or how long the households would have engaged in altering their behavior in relation to the real-time feedback they would have received, it suggests that the households themselves perceived an opportunity to make changes to their lifestyles during those first weeks. However, as this opportunity did not materialize, households viewed the opportunity as lost—even if the technical issues with the feedback was resolved a few weeks later. If the move signified a new beginning or an opening to make significant changes, this opening was present only at one crucial moment in time—and if passed up, it would not return. This suggests that for households to change their behavior, this change needed to be done at a time when other significant changes were also made. More research is needed to identify what this perceived "window of opportunity" means for household behavior and if or how it can be used to achieve sustainable changes.

This study found that passive solutions or solutions where households have to engage actively, like flipping a switch, are more effective than relying on information or feedback as a source for encouraging behavioral changes, which has also been found elsewhere [6,9,10]. This implies that when constructing new residential buildings where active engagement of households is encouraged, solutions to engage households physically—to make them do something—should be a solution. Since the largest reductions in GHG emissions was as a result of the way the house was built, in particular as climate-smart solutions addressed some of the largest sources of household emissions—heating and hot water use [23]—it

would seem that a default solution that is active in the background and does not rely on the active engagement of the households is a very effective way to reduce emissions. Living in an environmentally friendly environment is not a guarantee for increasing environmentally friendly behaviors [33].

In closing, these observations open the question on which efforts are most likely to result in decreased GHG emissions: if the focus is on changing attitudes or values that will cause households to change their behavior, then these initiatives must meet the households' expectations from the start unless the households lose interest in them. In addition, the longevity of interventions is still unknown. Even if households feel a great sense of urgency and responsibility for the environment, it is still a long way to go before individual actions can have a major impact on GHG emissions [5,27,34]. Given that the time for achieving the 2-degree target of global warming is running out, it might be wise to ask the question of what strategies will make the most impact. If the main strategy is to rely on individuals to change their consumption choices—a solution that at first glance might seem reasonable [35]—research has demonstrated that behavior is a complex process that is not readily subject to change. Today, a very common message to households is that changes in our behavior are necessary as our lifestyles are unsustainable, but little is said of how households can make decisions in a complex context and what this really will lead to in terms of decreased emissions. Another approach could be to develop default options that decrease emissions in, e.g., residential houses. In particular, if households make *one* decision related to GHG emissions—to accept the default—rather than having to engage in decision-making every day, it might lead to a greater decrease of GHG emissions from household energy use. From a normative standpoint, explicit moral obligations call on individuals to take responsibility for their actions, thereby placing a large responsibility on household consumption. From a pragmatic perspective, however, the reality of decision-making is complicated and if default solutions provide a reduction of emissions, perhaps the alternative of making smart solutions the default deserves more exploration.

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Institutional Review Board Statement: All interviewees were given information about the study's aim and purpose, how data was stored, and who had access to the data (only the researchers involved). Ethical review was not conducted in line with the Swedish regulation, as the study did not involve any risks to or collecting sensitive data about the subjects (SFS 2003:460).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available on request due to restrictions. The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the privacy of the households participating in the study.

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References

1. Adua, L. Reviewing the complexity of energy behavior: Technologies, analytical traditions, and household energy consumption data in the United States. *Energy Res. Soc. Sci.* **2020**, *59*, 101289. [CrossRef]
2. Connolly, J.; Prothero, A. Sustainable consumption: Consumption, consumers and the commodity discourse. *Consum. Mark Cult.* **2003**, *6*, 275–291. [CrossRef]
3. Kennedy, E.H.; Beckley, T.M.; McFarlane, B.L.; Nadeau, S. Why we don't "walk the talk": Understanding the environmental values/behaviour gap in Canada. *Hum. Ecol. Rev.* **2009**, *16*, 151–160.
4. Tolppanen, S.; Kang, J. The effect of values on carbon footprint and attitudes towards pro-environmental behavior. *J. Clean Prod.* **2021**, *282*, 124524. [CrossRef]
5. Shove, E. Beyond the ABC: Climate change policy and theories of social change. *Environ. Plan A.* **2010**, *42*, 1273. [CrossRef]
6. Wolff, A.; Weber, I.; Gill, B.; Schubert, J.; Schneider, M. Tackling the interplay of occupants' heating practices and building physics: Insights from a German mixed methods study. *Energy Res. Soc. Sci.* **2017**, *32*, 65–75. [CrossRef]
7. Behbehani, L.J.; Prokopy, L.S. The Appropriation of Built Heritage and Pro-Environmental Behaviours: A Case Study of LEED-Certified Low-Income Multifamily Housing. *ArchNet-IJAR Int. J. Arch. Res.* **2017**, *11*, 67. [CrossRef]

8. Brunsgaard, C.; Knudstrup, M.-A.; Heiselberg, P. Occupant experience of everyday life in some of the first passive houses in Denmark. *Hous. Theory. Soc.* **2012**, *29*, 223–254. [CrossRef]
9. Zhao, J.; Carter, K. Do passive houses need passive people? Evaluating the active occupancy of Passivhaus homes in the United Kingdom. *Energy Res. Soc. Sci.* **2020**, *64*, 101448. [CrossRef]
10. Nilsson, A.; Wester, M.; Lazarevic, D.; Brandt, N. Smart homes, home energy management systems and real-time feedback: Lessons for influencing household energy consumption from a Swedish field study. *Energy Build.* **2018**, *179*, 15–25. [CrossRef]
11. Fischer, C. Feedback on household electricity consumption: A tool for saving energy? *Energy Effic.* **2008**, *1*, 79–104. [CrossRef]
12. Lange, F.; Dewitte, S. Measuring pro-environmental behavior: Review and recommendations. *J. Env. Psychol.* **2019**, *63*, 92–100. [CrossRef]
13. Dietz, T.; Kalof, L.; Stern, P.C. Gender, values, and environmentalism. *Soc. Sci. Q* **2002**, *83*, 353–364. [CrossRef]
14. Nigbur, D.; Lyons, E.; Uzzell, D. Attitudes, norms, identity and environmental behaviour: Using an expanded theory of planned behaviour to predict participation in a kerbside recycling programme. *Br. J. Soc. Psychol.* **2010**, *49*, 259–284. [CrossRef] [PubMed]
15. Padel, S.; Foster, C. Exploring the gap between attitudes and behaviour: Understanding why consumers buy or do not buy organic food. *Br. Food J.* **2005**, *107*, 606–625. [CrossRef]
16. Smiley, K.T.; Chen, Y.-A.; Shao, W. Being green in a green capital: Assessing drivers of pro-environmental behaviors in Copenhagen. *Cities* **2022**, *122*, 103538. [CrossRef]
17. Abrahamse, W.; Steg, L.; Vlek, C.; Rothengatter, T. The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents. *J. Environ Psychol.* **2007**, *27*, 265–276. [CrossRef]
18. Kahan, D.M.; Braman, D.; Gastil, J.; Slovic, P.; Mertz, C.K. Culture and Identity-Protective Cognition: Explaining the White-Male Effect in Risk Perception. *J. Empir. Leg. Stud.* **2007**, *4*, 465–505. [CrossRef]
19. Lindenberg, S.; Steg, L. Normative, Gain and Hedonic Goal Frames Guiding Environmental Behavior. *J. Soc. Issues.* **2007**, *63*, 117–137. [CrossRef]
20. Klöckner, C.A. A comprehensive model of the psychology of environmental behaviour—A meta-analysis. *Glob. Environ. Change.* **2013**, *23*, 1028–1038. [CrossRef]
21. Barr, S.; Gilg, A.W.; Ford, N. The household energy gap: Examining the divide between habitual- and purchase-related conservation behaviours. *Energy Policy.* **2005**, *33*, 1425–1444. [CrossRef]
22. Abrahamse, W.; Steg, L. How do socio-demographic and psychological factors relate to households' direct and indirect energy use and savings? *J. Econ. Psychol.* **2009**, *30*, 711–720. [CrossRef]
23. Schwarzinger, S.; Bird, D.N.; Hadler, M. The "Paris Lifestyle"—Bridging the Gap Between Science and Communication by Analysing and Quantifying the Role of Target Groups for Climate Change Mitigation and Adaptation: An Interdisciplinary Approach. In *Addressing the Challenges in Communicating Climate Change across Various Audiences*; Springer: Berlin/Heidelberg, Germany, 2019; pp. 375–397.
24. Árnadóttir, Á.; Czepkiewicz, M.; Heinonen, J. The geographical distribution and correlates of pro-environmental attitudes and behaviors in an urban region. *Energies* **2019**, *12*, 1540. [CrossRef]
25. Martiskainen, M.; Kivimaa, P. Role of knowledge and policies as drivers for low-energy housing: Case studies from the United Kingdom. *J. Clean Prod.* **2019**, *215*, 1402–1414. [CrossRef]
26. Gul, M.S.; NezamiFar, E. Investigating the Interrelationships among Occupant Attitude, Knowledge and Behaviour in LEED-Certified Buildings Using Structural Equation Modelling. *Energies* **2020**, *13*, 3158. [CrossRef]
27. Willis, M.M.; Schor, J.B. Does Changing a Light Bulb Lead to Changing the World? Political Action and the Conscious Consumer. *Ann. Am. Acad. Pol. Soc. Sci.* **2012**, *644*, 160–190. [CrossRef]
28. Warde, A. *Consumption*; Palgrave Macmillan UK: London, UK, 2017. Available online: http://link.springer.com/10.1057/978-1-137-55682-0 (accessed on 29 December 2017).
29. Zhang, D.; Tu, Y. Green building, pro-environmental behavior and well-being: Evidence from Singapore. *Cities* **2021**, *108*, 102980. [CrossRef]
30. Wester, M.; Carlsson-Kanyama, A. *Boendemiljö för en Klimatsmart Livsstil*; (E2B2) Report No. 2018:13; Swedish Energy Agency: Estoona, Sweden, 2018; pp. 1–22.
31. World Value Survey. WVS Online Data Analysis. Available online: https://www.worldvaluessurvey.org/WVSOnline.jsp (accessed on 9 January 2022).
32. Uddin, M.N.; Wei, H.; Chi, H.L.; Ni, M. Influence of Occupant Behavior for Building Energy Conservation: A Systematic Review Study of Diverse Modeling and Simulation Approach. *Buildings* **2021**, *11*, 41. [CrossRef]
33. Hamilton, E.M. Green Building, Green Behavior? An Analysis of Building Characteristics that Support Environmentally Responsible Behaviors. *Environ. Behav.* **2021**, *53*, 409–450. [CrossRef]
34. Dietz, T.; Gardner, G.T.; Gilligan, J.; Stern, P.C.; Vandenbergh, M.P. Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proc. Natl. Acad. Sci. USA* **2009**, *106*, 18452–18456. [CrossRef]
35. Newton, P.; Meyer, D. Exploring the attitudes-action gap in household resource consumption: Does "environmental lifestyle" segmentation align with consumer behaviour? *Sustainability* **2013**, *5*, 1211–1233. [CrossRef]