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Master’s thesis

Laypeople versus Researchers: An Exploration of Mental Models of Energy Saving Behaviour

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Are there deviations of the Master’s thesis from the proposed plan?

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Abstract

Current interventions targeting household energy use are largely ineffective. One explanation might be the focus on top-down approach within research and intervention design. Mental models provide a way to integrate top-down and bottom-up research approaches to create more complete and effective theories and interventions. This study investigates mental models of Dutch laypeople (*N* = 101) to explore which factors they consider important for their own energy saving behaviour. Patterns and important factors within the mental models, as well as the influence of attribution bias on the mental models, were investigated. The findings show that participants' mental models differ from theoretical models used in environmental psychology. Participants consider both internal and external factors to be strong and direct drivers of their energy saving behaviour. Moreover, attribution bias did not seem to influence participants' mental models. These findings suggest that bottom-up research should be integrated into current theory creation and intervention design.

Introduction

Climate change is one of humanity's biggest challenges today. It is caused by a range of human behaviours, one of which is excessive energy consumption, and the emissions that result from it (IPCC, 2023). It has been estimated that of the total worldwide energy consumption, 27% of energy is being consumed by households (IEA, 2019). Subsequently, this consumption accounts for over 10% of the CO_2 emitted by humans globally every year (Gordic et al., 2023). This means that targeting household energy behaviours can be an effective path towards reducing energy consumption and CO_2 emissions.

Household energy behaviours include a wide variety of behaviours, ranging from installing (energy-efficient) appliances, to turning lights on and off, to changing the temperature on the thermostat. These behaviours have been investigated within environmental psychology and have been targeted by policies and interventions with the aim of decreasing domestic energy use. However, in order to design effective interventions, factors need to be identified that influence citizens' energy behaviours. In research there are two general approaches to achieve this: a deductive, top-down approach, and an inductive, bottom-up approach. The first approach starts with a theory, and aims to confirm hypotheses using data, whereas the second approach aims to generate theories based on participants' views and themes identified within the data (Creswell & Plano Clark, 2007; Soiferman, 2010). Currently, factors are mostly identified through top-down research, whereas bottom-up research is lacking within environmental psychology (Sovacool, 2014).

Despite the efforts to reduce energy use, current interventions and policies targeting these behaviours are often ineffective (for an overview see Abrahamse et al., 2005, or Van den Broek et al., 2019) and an "energy efficiency gap" has been observed (Allcott & Greenstone, 2012; Koopmans & te Velde, 2001), meaning that the energy saved by households resulting from these policies and interventions is generally not as high as expected, even if saving energy would be beneficial for the household (e.g., because of financial benefits). Although the reason for this energy efficiency gap is not clear (Gerarden et al., 2017), one of the causes might be the sole focus on top-down research.

While research findings point towards certain factors as being the most influential in guiding pro-environmental behaviours (PEBs), this might not present the complete picture. Some mechanisms or factors that influence energy behaviours might be missed, causing interventions to be incomplete and ineffective. For instance, current interventions are mostly based on theoretical research that focuses on antecedents and correlations between factors, which means that no emphasis is placed on people's experiences and explanations of their own behaviours (Nielsen et al., 2021). The latter can be done by considering bottom-up research when designing policies and interventions. Combining insights from both approaches might help to close the energy efficiency gap by integrating findings from existing theories with citizens' everyday experiences.

One way to integrate top-down and bottom-up research findings is through the use of mental models. Mental models capture "internal representations of the external world consisting of causal beliefs that help individuals deduce what will happen in a particular situation" (Van den Broek et al., 2021, p. 1). By providing a framework of why things happen, mental models can explain why people (do not) engage in certain PEBs using both top-down theories and bottom-up knowledge and experiences of participants. Moreover, by comparing mental models of energy behaviours to existing models in environmental psychology, any disconnects or misperceptions can be identified (both in the theories and mental models) and suggestions on how to improve these models can be made. Additionally, influences of biases on people's mental models – as well as on their subsequent behaviours – can be tested and used to explain why current interventions might not be effective.

Therefore, the goal of the current study is to investigate mental models created by laypeople and compare them with dominant models in environmental psychology, as well as investigate the influence of bias on mental models. The following research questions will be answered in order to investigate this topic: 1) *How do Dutch people's mental models about energy use compare to the general PEB models used in environmental psychology?* 2) *How do Dutch people's mental models about energy use differ based on their own current behaviours?*

General Research Approaches

As presented previously, very generally speaking there are two ways to conduct research, which greatly inform the steps and decisions made throughout the research process. One approach is a theory-driven, top-down approach (also referred to as the deductive method; Flick, 2017). For this type of research, the starting point is a theory or hypothesis, and the data collection functions to support or reject the assumptions made in the theory. Within this type of research, the factors that make up a model are chosen based on pre-existing reasoning and theory, after which they are supported or rejected based on the data that is collected.

The second type of research is a more person-driven, bottom-up method (also called the inductive method; Flick, 2017). This research is often of a more explorative and qualitative nature, and much less prevalent within (environmental) psychology (Haig, 2013; Sovacool, 2014). Although usually some assumptions are made at the start of the research process, this approach is mostly data-driven, meaning that researchers go in with few assumptions and predictions about the results. This means that the direction of the research is mostly influenced by the participants and the researchers merely analyse what they are presented with in the data. Based on this data the researcher will try to detect and explain phenomena and recognize patterns (Babbie, 2021; Haig, 2013).

Both approaches can build on knowledge obtained by previous research, although they do so in their own way. Whereas top-down research usually adds support to or expands on previous research or theories (as with the VBN, which served as an updated version of the NAM), bottom-up research tends to identify gaps within the existing knowledge and tries to include different perspectives in the existing literature (Haig, 2013). Moreover, whereas factors identified through a top-down approach are often relatively general and psychological in nature, the factors identified within bottom-up research tend to be more concrete and contextual.

Naturally, both approaches have their own advantages and disadvantages. The top-down, theory-driven method allows for easier generalisation of findings to more general populations (Creswell & Plano Clark, 2007; Soiferman, 2010). One of the key elements of this type of research is random and representative sampling, which allows for generalisation from a specific sample to the larger population (Polit & Beck, 2010). The data from this representative sample is then investigated using statistical methods that allow researchers to make inferences about the strength of relationships between specific factors (Soiferman, 2010). Because of this, top-down studies allow for the creation and validation of theoretical models that provide a general understanding and explanation of a certain behaviour. However, this focus on the general, in terms of behaviours, psychological constructs, and samples, means that top-down models can only draw conclusions about general patterns and relationships, and they are very likely to not be applicable to individual situations or specific behaviours, as these factors are often not taken into account.

The opposite is true for the bottom-up, person-driven approach. This type of research excels at taking individual context and experiences into account, as it gathers information directly from individuals on which to base theories inductively (Creswell & Plano Clark, 2007). This means that models based on this type of research tend to be more applicable to a certain context or population, but less to the general population. That is, in order to gain more predictive power, this type of research loses generalisability. Moreover, bottom-up models allow researchers to investigate specific variables and create an in-depth understanding of these variables, but, due to its frequent reliance on qualitative data and data analysis methods, it does not easily lend itself to (statistically) testing the strength of relationships between variables.

Interestingly, these two types of research do not always seem to yield the same – or even similar – results (Koopmans & te Velde, 2001). As most research on environmental psychology models is conducted using a top-down approach (Sovacool, 2014), one could ask whether it accurately shows the whole picture of what influences PEBs. This becomes problematic when policies and interventions are based only on results and findings from one type of research. Indeed, most interventions and policies are based on top-down research as they can provide people with a general overview of which factors play a role in a certain behaviour (Van den Broek & Walker, 2019). However, in practice, these interventions do not turn out to be as effective as initially predicted, leading to the previously mentioned energy efficiency gap (Allcott & Greenstone, 2012). One of the explanations for this energy efficiency gap is the difference in results of top-down and bottom-up research (Koopmans & te Velde, 2001). Whereas top-down modellers predict that energy use will only grow more rapidly, bottom-up modellers expect energy use to increase much less rapidly. Koopmans and te Velde argue that these results can be (partly) reconciled using a model with a top-down structure that utilises bottom-up information. That is, they argue that these two types of models combined can provide new avenues for looking at and solving this problem.

General Environmental Psychology Theories

Several theories exist within environmental psychology to explain and predict pro-environmental behaviours (PEBs), including domestic energy use. The theories posit that a host of factors determine – either directly or indirectly through other factors – whether someone does or does not engage in a PEB. Some of the most well-known and well-used theories (Oreg & Katz-Gerro, 2006) are the norm activation model (NAM; Schwartz, 1977), the theory of planned behaviour (TPB; Ajzen, 1985), and the value-belief-norm theory (VBN; Stern, 2000). All of these theories were created using a top-down approach and will be used to illustrate the issue with making use of only one approach to research.

The norm activation model was originally created to explain prosocial behaviour (Onwezen et al., 2013; Schwartz, 1977), but has since been used in countless studies on pro-environmental behaviours (Klöckner, 2013). The model centres around personal norms. When activated, personal norms manifest as feelings of moral obligation that lead to engagement in a certain action (Schwartz, 1977; Steg & Nordlund, 2019). Thus, in order to generate pro-environmental behaviour, personal norms need to be activated. This theory posits that these norms are activated by four factors. A person first needs to be aware of the problem (e.g., CO_2 emissions due to domestic energy use are contributing to climate change; *problem awareness*) and they need to feel that they are personally responsible for this problem (*ascription of responsibility)*. Then, only when the person feels like their actions can have a positive impact on the problem (*outcome efficacy*) and like they are able to engage in actions to reduce the problem (*self-efficacy*) will their personal norms be activated and will they act pro-environmentally (Steg & Nordlund, 2019).

The value-belief-norm theory has built on the NAM to create a more elaborate theory that incorporates values and ecological worldview. The VBN poses that values, general goals that guide people's decisions throughout life (Schwartz, 1992), are the main drivers of PEBs. In turn, they influence one's beliefs about humans' impact on nature (*ecological worldview*), which determines a person's *problem awareness*. Similar to the NAM, if awareness of the problem leads to *ascription of responsibility*, personal norms are activated, which leads to engagement in PEB. The VBN assumes that all variables are causally related to the next variable in the chain, but that variables might also influence those further down the chain (Steg & Nordlund, 2019).

Lastly, the theory of planned behaviour includes similar factors as the NAM and VBN but proposes a different relationship between these factors. The TPB assumes that before behaviour takes place, intentions to engage in this behaviour need to be present (Steg & Nordlund, 2019). To establish these intentions several factors are required: a favourable attitude towards the PEB (*attitude*), a perceived social norm that supports the PEB (*subjective norm*), and the belief that the behaviour will have an impact on the environmental problem at hand (*perceived behavioural control*, similar to self-efficacy, Ajzen, 1985). These factors all directly affect intentions, but do not influence each other. Both perceived behavioural control and intentions, in turn, are assumed to directly affect behaviour.

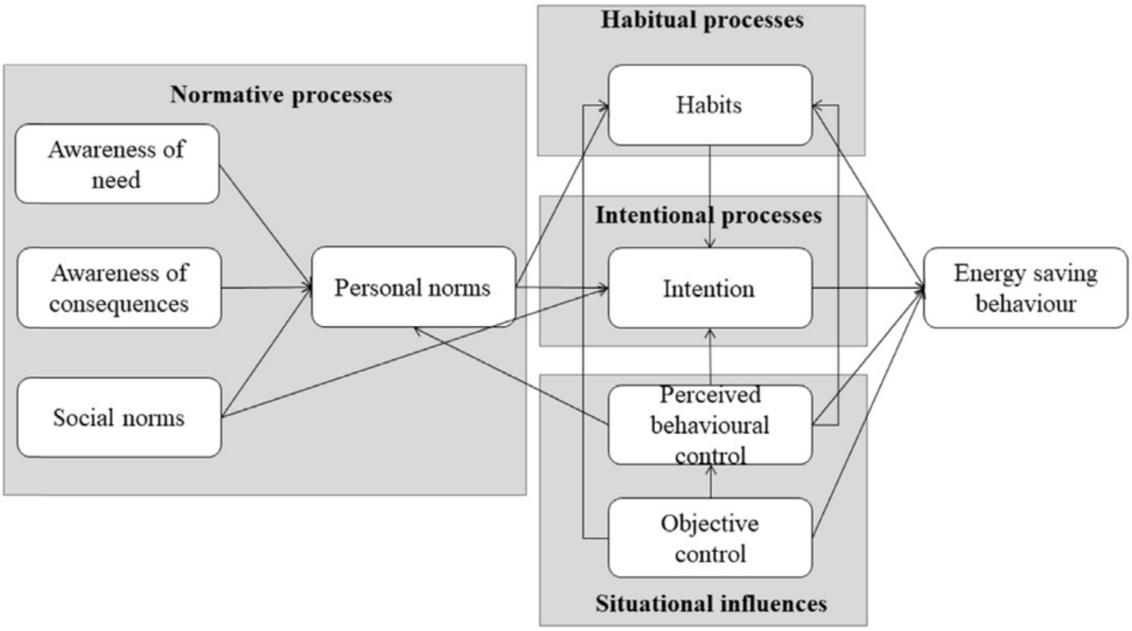
When comparing these theories considerable overlap can be found, mostly regarding the predictors. Several predictors appear in more than one model, and overall, all predictors can be more or less grouped into categories including norms, awareness, and efficacy. These factors predominantly represent inner processes, and contextual factors seem to be absent from these models (Oreg & Katz-Gerro, 2006). Additionally, a commonality of these theories is the way that the factors influence each other – mostly through direct or mediation effects. These similarities likely stem from the fact that all of these models were created using a top-down research approach.

Klöckner and Blöbaum (2010) saw the need to integrate these models into a structured, comprehensive framework, which was possible due to their overlap. Therefore, they created the comprehensive action determination model (CADM; Figure 1). This model has been used to predict energy behaviours and to investigate which factors play the most important roles in encouraging energy saving behaviours. The CADM is separated into four different processes:

normative processes, habitual processes, intentional processes, and situational influences. These processes all encompass one or more specific factors. For example, normative processes include *awareness of need*, *awareness of consequences*, *social norms*, and *personal norms*, factors that are all included in prominent environmental psychology models. However, Klöckner and Blöbaum (2010) also added two new predictors: *Habits* and *Objective control*. They identified these predictors as being underrepresented but nevertheless important in the study of PEBs. And indeed, a study by Van den Broek and colleagues (2019) found that situational and habitual processes were stronger predictors of energy saving behaviours than normative and intentional processes. The study also showed that the CADM has reasonable predictive power.

Figure 1

The Comprehensive Action Determination Model applied to Energy Saving Behaviour



Note: From "Drivers of energy saving behaviour: The relative influence of intentional, normative, situational and habitual processes" by K. L. van den Broek, I. Walker, and C. A. Klöckner, 2019, *Energy Policy, 132*, p. 812 (https://doi.org/10.1016/j.enpol.2019.06.048).

One of the reasons for creating the CADM is that an integrative model can be beneficial from both a theoretical perspective and from an interventionist perspective:

> "[An integrated model] may result in one theoretical framework that might apply to all behavioural situations by describing all relevant factors influencing behaviour […]. An integrative model is also beneficial from an interventionist perspective: by integrating all potentially relevant predictors of behaviour into one model, it would be easier for planners to include all relevant aspects in their design of intervention strategies." (Klöckner & Blöbaum, 2010, p. 575).

However, the inclusion of factors into this integrated framework is still solely based on top-down research. In order to construct a comprehensive theoretical framework, findings from bottom-up theories should also be integrated. One way to integrate top-down and bottom-up research is through studies on mental models, as these studies allow participants to guide the model making process, whilst using factors that were identified by top-down research to influence the target behaviour. In the next section, more will be said about the importance of mental models.

Mental Models

Just as psychology has models to explain behaviour, so do individuals. These models are called mental models and are described as "internal representations of the external world consisting of causal beliefs that help individuals deduce what will happen in a particular situation" (Van den Broek et al., 2021, p. 1). These models are used to explain experiences or predict future events (Jones, 2014) as well as to guide behaviour, attitudes, and decision making (Van den Broek et al., 2021; World Bank, 2015). Not only do mental models inform personal behaviour, they have also been shown to drive mass opinion and societal behaviours (Goldberg et al., 2020). For this reason, it is vital to consider them when designing and implementing behaviour change interventions.

Additionally, as previously mentioned, mental models lend themselves well to a mixed research approach using aspects of both top-down and bottom-up research. Studies on mental models provide participants with predictors of a target behaviour that have previously been identified as important by top-down research (e.g., De Ridder et al., 2022). This way, the study starts out with some predictions and leading theories. However, participants can also be given the opportunity to suggest predictors of the outcome behaviour (mostly in the form of a pilot study, as recommended by Aminpour et al., 2020), which they can then include when creating their own mental model. Moreover, participants are entirely free to suggest relationships between the variables, without being influenced by existing theories. This way, both bottom-up and top-down elements are integrated in this type of study, making it an excellent example of how to conduct a mixed approach study.

Mental models provide a way to bring to light people's perceptions and experiences as well as provide a direct comparison of those perceptions with the current theoretical models. In practice, laypeople might have vastly different (mental) models of behaviours compared to theoretical models. For instance, laypeople are unlikely to have full knowledge of the factors that appear in scientific models. In addition, a previous study found that laypeople tend to point to situational factors as the main drivers of their (pro-environmental) behaviours (Hansmann & Steiner, 2017), whereas the prominent theories in environmental psychology tend to put a lot of emphasis on individual or internal factors (e.g., self-efficacy, awareness of consequences, etc.). Moreover, laypeople's thinking is likely influenced by several biases that might cause them to draw relationships where there are none and vice versa (for instance, due to the common cause fallacy or an underestimation of social influence; Korteling & Toet, 2020). This means that laypeople's models are likely to be different and less complex than the current theoretical models.

Attribution Theory

Another reason to study laypeople's mental models and their differences with prominent theoretical models is to identify misperceptions held by participants. It is well-known within psychology that biases influence the ways people think and reason (Korteling & Toet, 2020). Therefore, while the use of mental models to inform interventions could be very significant, it is important to account for mental processes and biases when interpreting mental models. One such process is attribution bias (also called the self-serving bias, for more information, see Schmitt, 2015). The attribution theory drives people to overestimate the importance of internal factors when they succeed, whereas they tend to overestimate the importance of external factors in case of failure. The bias likely functions to boost or protect one's self-esteem (Riemer, 1975; Schmitt, 2015). When applied to energy saving behaviours, the self-serving bias could influence someone to attribute their energy saving behaviours to the effort they put in or their strong environmental values, whereas in the case of excessive energy use, one could attribute this to monetary incentives or descriptive norms, especially if they do value saving energy. Since this bias affects people's reasoning about why things happen, it likely also affects people's mental models.

Current Study

The current study will use mental models in order to test several hypotheses. Mental models can be measured in various ways and contexts, and the measure can either be indirect, for instance, the mental model can be inferred from interviews, or direct, where participants create "a visual representation of their [mental] model themselves" (De Ridder et al., 2022, p. 3). This latter method presents an easy way to create a clear picture of a someone's personal model of the target behaviour (i.e., energy saving behaviours). Therefore, this study will use an online tool that allows participants to create visual representations of their mental models that can be compared and aggregated to create a general model.

In this study, mental models will also be compared to existing theoretical models, with a focus on the complexity of the models and the type of factors included in these. Moreover, the effect of the self-serving attribution bias on the mental models will be investigated. Based on previous research, several hypotheses have been created and will be tested in this study.

Hypothesis 1: Mental models are less complex than the prominent theoretical models.

As we expect laypeople's models to take into account personal context and be influenced by biases, we expect these models to be different from the models used in psychological research. Mostly, participants' models are expected to be less complex than theoretical models, as theoretical models tend to include a range of different factors. For example, the CADM includes a total of nine factors, some of which can be divided into several subfactors (see Figure 1). As laypeople are unlikely to have in-depth knowledge of the factors that appear in scientific models and how they might influence their own behaviour, it seems unlikely they will include all of these factors in their models. Thus, we hypothesize that participants' mental models will include fewer variables in total than the prominent PEB models (*Hypothesis 1a*).

Prominent theories in environmental psychology tend to put a lot of emphasis on normative factors (e.g., social norms, awareness of consequences, etc.), whereas situational factors are underrepresented. In contrast, laypeople tend to focus on situational influences (Hansmann & Steiner, 2017). Moreover, since bottom-up research often involves more specific and contextual factors (Soiferman, 2010), we expect that participants' mental models will include more external factors than the prominent PEB models (*Hypothesis 1b*).

Lastly, scientific models tend to include several mediating relationships between the drivers of PEB (e.g., TPB, NAM, etc.). When it comes to laypeople's models, on the other hand, we expect them to include more direct relationships, as opposed to mediating or moderating relationships. As mentioned, this could be caused by misinformation and biases, for instance, the common cause fallacy, which involves the belief that two events have a causal relationship because they happened at the same time (even though they are in truth influenced by a third factor; Manninen, 2018). Since people tend to infer direct causal relationships between factors, we hypothesize that participants' mental models will include fewer mediating relationships than the prominent PEB models (*Hypothesis 1c*).

Additionally, hypotheses were created based on the self-serving attribution bias.

Hypothesis 2: Participants' mental models will be influenced by the self-serving attribution bias.

Since people's reasoning is influenced by attribution biases, their mental models will be as well. More specifically, this translates into the expectation that a participant's mental model will include more internal factors if they find saving energy important and they perform energy-saving behaviours, compared to if someone who does not perform these behaviours (*Hypothesis 2a*). Since the participant values saving energy and successfully does so, they will most likely attribute this success to factors that are internal. From this follows that people who do not save energy, even though they value saving energy, will judge this as a failure and will likely attribute this failure to external factors. Therefore, their mental models will include more external factors (*Hypothesis 2b*). Lastly, we hypothesize that attribution bias will have no effect when a participant does not value saving energy, as the self-serving attribution bias will not be active in this case. Thus, the mental models of participants that do not ascribe any importance to saving energy will not differ based on whether they do or do not perform energy saving behaviours (*Hypothesis 2c*).

Method

Sample

The sample was recruited via the Dutch panel company Panelmannetje. It originally consisted of 220 participants, but after the cleaning of the data only 101 participants with complete data remained. No demographic information (e.g., gender, age, ethnicity) of the participants was collected, as this was not deemed relevant to answer the research questions associated with this study, since the focus was on the content of the models created by participants. Therefore, there were no inclusion or exclusion criteria with regards to participation, except for a proficiency in Dutch, as the study was only available in Dutch. All participants completed the study online. After consenting to participate, they were asked to create mental models of their own domestic energy behaviours. After which they were presented with a questionnaire.

Procedure and Materials

Before the current study, a pilot study took place in order to identify factors that were important for energy (saving) behaviours according to laypeople (as done in previous mental model studies such as De Ridder et al., 2022; Murken et al., 2024; Van den Boom et al., 2023). The pilot was in the form of a survey and made use of a convenience sample. In the pilot study participants were asked to indicate which factors they think influence their own household energy use. Next to the factors highlighted in this pilot study, factors included in the most prominent models within environmental psychology (i.e., the NAM, VBN, TPB, and the CADM) were included in the mental model task. This way, important factors were identified using both a bottom-up and a top-down approach (for an overview of the drivers, their description, and their classification as internal or external, see Appendix 1).

To construct the mental models, *M-Tool* was used (see Van den Broek et al., 2021, for more details). This tool was created by Van den Broek and colleagues (2021) and was designed to facilitate direct elicitation of mental models. Before participants were allowed to create their own mental models, they were introduced to *M-Tool* through an instruction video, after which they were asked to recreate a practice model. Next, a video was shown that introduced the 17 predictors of energy saving behaviour that participants could use to construct their model. After watching the video participants were able to create their own model using the predictors that were just presented to them. They were instructed to only include factors that they considered relevant to energy saving behaviour. Predictors were represented by icons and accompanied by a verbal description that could be accessed at any time (see Appendix 1). Thus, *M-Tool* presented participants with a list of pre-selected icons and participants were free to connect any predictors to others or to the outcome variable (*energy saving behaviour*) using one of three directed arrows, with the size of the arrow representing the relative influence of one factor on another. Participants could not indicate whether relationships between variables were positive or negative, since this was not relevant for the goal of this study which focused mostly on the content of the models.

After completion of the mental model task, participants were asked to fill in a short questionnaire consisting of two parts. During the first part, participants were asked about their experiences with *M-Tool*. Since *M-Tool* is a relatively new tool that is continuously being updated, these questions were included in order to evaluate participants' experience with the tool, to gauge the difficulty of using the tool, and to understand what specific energy saving behaviour participants had in mind when creating their models. In the second part of the survey, participants were presented with existing scales and items in order to be able to test hypothesis 2. This part included items to measure participants' environmental identity, values, the importance they ascribe to saving energy, and their current energy saving behaviours.

Measures

Experience with M-Tool

First, participants were presented with several open-ended questions about their experience with using M-tool and making a mental model. These questions included 'Was there a specific behaviour you were thinking about when making your model?', 'Could you tell us how easy or difficult you thought making the mental model was?', and 'Do you have any suggestions or comments to make this experience easier and/or better?'.

Values

Biospheric, egoistic, and hedonic values were measured using the Environmental Portrait Values Questionnaire (E-PVQ; Bouman et al., 2018), which is based on the Schwartz Value Survey (SVS; Schwartz, 1994). This questionnaire presents participants with descriptions of people (e.g., "It is important to [him/her] to protect the environment") and asks them to indicate how much they are like this person on a 7-point Likert scale (1 *Not like me at all*, 7 *Very much like me*; *alpha* = 0.64, *M* = 5.67, *SD* = 0.60). Biospheric values were measured with 4 items (*alpha* = 0.88, *M* = 5.58, *SD* = 1.28), egoistic values were measured by 5 items (*alpha* = 0.74, *M* = 3.00, *SD* = 1.48), and hedonic values were measured by 3 items (*alpha* = 0.71, *M* = 5.67, *SD* = 1.17). Items to measure altruistic values were not included, as this factor was not included in the mental models.

Environmental Self-Identity

Environmental self-identity was measured in order to approximate the importance participants attributed to acting pro-environmentally. The following three items were presented: Acting environmentally friendly is an important part of who I am; I am the type of person who acts environmentally friendly; I see myself as an environmentally friendly person (Van der Werff et al., 2013). Participants replied using a 7-point Likert scale ranging from 1 (*totally disagree*) to 7 (*totally agree*). Cronbach's alpha for this measure was 0.898 (*M* = 4.52, *SD* = 0.94).

Current Energy Saving Behaviours

To measure whether a participant did or did not engage in energy saving behaviours, participants were provided with a list of these behaviours (adapted from Van den Broek et al., 2019) and were asked to indicate how often they engage in these behaviours using a 5-point scale ranging from 1 *Never* to 5 *Every/All the time* (*alpha* = 0.64, *M* = 2.97, *SD* = 0.57). The behaviours included, for example, ‘Air-dry your laundry instead of using a tumble dryer’, ‘Turning the thermostat down by 1 degree Celsius’, and ‘Only boiling the water that you need’.

Importance of Saving Energy

Participants were presented with the question ‘How important would you say saving energy is to you?’ and replied using a 7-point scale ranging from 1 *Not at all important* to 7 *Very important* (*M* = 5.76, *SD* = 1.00). This item functioned to directly measure the importance participants ascribed to saving energy.

Make-up of Drivers of Energy Behaviours

Lastly, participants were asked to rate how influential internal (“what you find important”; *M* = 76.89, *SD* = 15.10) and external factors (“situational factors”; *M* = 62.47, *SD* = 22.08) are to their energy saving behaviour on two separate scales ranging from 0 (*not influential*) to 100 (*extremely influential*). These items were included as a direct measure of the influence of internal and external factors as judged by the participants.

Some additional measures were included in the survey but were not used in the analysis. Therefore, they will not be reported here.

Statistical Procedure

Analysis of Mental Models

After cleaning the data, the centrality and importance of the individual predictors in the mental models were assessed, as well as descriptive statistics. The mental models were treated as networks and analysed as such (as in Van den Broek et al., 2023), with the drivers and the target variables in the mental models representing the nodes in a network, and the weighted arrows representing the edges. The importance and centrality of the nodes was assessed using two measures: the in-strength of the driver and the out-strength of the driver.

The in-strength is a measure of importance of a driver within the mental model, as it represents the amount of influence a driver receives from other factors. It is computed by summing the weights (ranging from 1 *weak connection* to 3 *strong connection*) of incoming arrows. The out-strength is another measure of importance, as it reflects the amount of influence a driver exerts on other drivers or the target variable. It is computed by summing the weights of outgoing arrows of a driver.

Group Comparison

After the close inspection of the mental models, participants were divided into groups based on two characteristics (Table 1): their score on environmental identity (that is, the importance they attribute to behaving environmentally friendly) and their current energy saving behaviour. Then, the models made by these groups were compared on their selected factors and the centrality and importance these factors (as done in de Ridder et al., 2022). This analysis was done using the M-Tool data analysis script in R (Van Boxtel & Van den Broek, 2021). To compare factor inclusion between groups and determine significant differences, Welch's two-sample t-tests were used (as in Murken et al., 2024).

Table 1

Overview of the Groups as Outlined in Hypothesis 2

	High importance	Low importance
High energy saving behaviour	Group 1 More internal factors (n = 48)	Group 3 – No effect of attribution bias (n = 11)
Low energy saving behaviour	Group 2 – More external factors (n = 30)	Group 4 – No effect of attribution bias (n = 12)

Note: This table includes for each group: the group number, the prediction regarding factor inclusion based on hypothesis 2, and the number of participants in each group.

Results

Patterns in the Mental models

First, some patterns in the mental models made by participants will be described. On average, participants included nine factors in their mental model (M = 8.52, Mdn = 8, SD = 3.40). Table 2 shows the 17 factors ranked from included most to least. Overall, the most frequently included factors were *comfort* (68%), *control* (63%), *habits* (57%), and *biospheric values* (57%). The factors that were included the least were *opinion of saving energy* (30%), *what others think* (15%), and *what others do* (11%). Participants included on average about 8 connections between factors in their model (M = 8.25, SD = 4.40). Based on the strength of their incoming and outgoing arrows, *personal responsibility*, *control*, and *habits* were the most central in participants' models (M = 1.26; M = 1.24; M = 1.18; respectively). This means that these factors received and/or exerted the strongest influence on other factors. The factors that received or exerted the least influence were also the ones least included by participants: *opinion of saving energy*, *what others think*, and *what others do* (M = 0.42; M = 0.10; M = 0.09; respectively).

Table 3 shows the top ten most frequently included connections within the models. *Comfort* (38%), *control* (38%), *benefits for the environment* (36%), and *financial gains* (34%) were the most prominent direct predictors of *energy saving behaviour* (the outcome variable). One thing to note is that the most frequent connections are all direct predictions of the target variable, indicating that most predictors were believed to directly influence energy saving behaviour. Other connections that were somewhat frequently drawn were from *biospheric values* to *benefits for the environment* (13%) and from *financial costs* to *egoistic values* (11%).

Based on the patterns described above, hypothesis 1 was supported. Participants' mental models were, on average, less complex than theoretical models that explain energy saving behaviours. The mental models included less psychological factors and more situational factors compared to theoretical models. Moreover, participants almost exclusively included direct connections between drivers and the outcome variable (energy saving behaviour) in their model, in contrast to the more complex mediating and moderating relationships often found in theoretical models.

Table 2

Percentage of Inclusion and Mean Arrow Strength per Factor

Factor	Named by participant	Strength*
Hedonic values	68%	1.15
Control	63%	1.24
Habits	59%	1.18
Biospheric values	59%	1.01
Personal responsibility	57%	1.26
Benefits for the environment	57%	1.09
Financial gains	56%	0.99
Egoistic values	51%	1.15
Knowledge	51%	0.84
Financial costs	49%	0.72
Comfort costs	36%	0.63
Comfort gains	34%	0.55
Context	34%	0.51
Difficulty	34%	0.62
Opinion of energy saving	30%	0.42

What others think	15%	0.10
What others do	11%	0.09

* The strength represents the sum of the strength of in- and outgoing arrows. When the strength is zero, no arrow is present. A one means that the arrow indicates a weak relationship, a two indicates medium strength, and a three indicates participants chose the biggest arrow, signifying a strong relationship.

Table 3

Top 10 Most Frequent Connections

Connection	% of participants	Mean weight
Hedonic values – Energy saving behaviour	38	1.95
Control – Energy saving behaviour	38	2.23
Benefits for the environment – Energy saving behaviour	36	2.38
Financial gains – Energy saving behaviour	34	2.46
Biospheric values – Energy saving behaviour	33	2.53
Personal responsibility – Energy saving behaviour	32	2.55
Habits – Energy saving behaviour	31	2.28
Egoistic values – Energy saving behaviour	23	2.29
Knowledge – Energy saving behaviour	21	2.23
Difficulty – Energy saving behaviour	21	1.82

The influence of attribution bias on mental models

Next, the effect of attribution bias on the make-up of the mental models was investigated. In order to investigate this bias a two-by-two design was used (as shown in Table 1), based on the importance participants attributed to saving energy and their current energy saving behaviour. The importance participants ascribed to saving energy was approximated using the environmental self-identity scale, as participants were slightly more evenly distributed over the groups when using this indicator. Participants who scored, on average, four (*somewhat agree*) or higher were classified as valuing saving energy, whereas participants who scored, on average, three (*somewhat disagree*) or lower were classified as not valuing saving energy. Additionally, participants who, on average, indicated to engage in energy saving behaviours *often* or *always/every time* were classified as engaging in energy saving behaviours, whereas the rest of the participants were classified as not engaging in energy saving behaviours.

Compared to participants who ascribed importance to saving energy (groups 1 and 2), those who did not find this behaviour important (groups 3 and 4) included significantly fewer factors in their model ($M = 8.80$, $SD = 3.32$ and $M = 7.74$, $SD = 3.37$, respectively, $t = 5.26$, $df = 625.46$, $p > 0.001$). The same trend appeared when investigating the number of connections drawn between factors. Whereas participants who valued saving energy drew about nine connections on average ($M = 8.64$, $SD = 4.47$), participants who did not value saving energy drew around seven connections on average ($M =7.26$, $SD = 4.14$), which was significantly lower ($t = 5.86$, $df = 720.64$, $p > 0.001$). The effect sizes of these differences, as measured by Cohen's d, were small ($d = 0.31$ and $d = 0.31$, respectively; Cohen, 1988).

In order to further test hypothesis 2, we take a more in-depth look at the factor inclusion per group. Table 4 shows the factors that were most frequently included in the mental model for each group. To test hypothesis 2, groups 1 and 2 were compared on all factors using Welch's two-sample t-test (due to unequal variances between groups), as were group 3 and 4. When comparing groups 1 and 2, only one significant difference was found. The factor *what others think* was included significantly more often in group 1 ($t = 1.97$, $df = 1236.60$, $p = 0.049$), although for both groups this factor ranked low: 16^{th} (out of 17 factors) for the energy saving group 1, and 17^{th} for group 2, that did not save energy. Moreover, the effect size of this influence, $d = 0.095$, indicates an extremely small effect.

Comparing all participants that valued saving energy (groups 1 and 2) with all participants that did not ascribe importance to saving energy (groups 3 and 4), only two significant differences were found. Participants who valued saving energy were more likely to include *knowledge* ($t = 2.27$, $df = 932.32$, $p = 0.023$) and *benefits for the environment* ($t = 2.33$, $df = 916.84$, $p = 0.020$) in their model than were participants who did not value saving energy. *Biospheric values* showed the same pattern and neared significance ($t = 1.96$, $df = 857.29$, $p = 0.051$). However, based on Cohen's d, all of these effects were extremely small (all of them falling below 0.1; Cohen, 1988). No significant differences were found at the 5% level ($p > 0.05$) when comparing groups 3 and 4 on factor inclusion, meaning that the groups that did not value energy saving behaviours included similar factors in their models.

Thus, based on these statistical analyses hypothesis 2 was mostly unsupported. Both hypothesis 2a and 2b were not supported, as few differences were found between group 1 (those who valued saving energy and did engage in this behaviour) and group 2 (those who valued but did not engage in energy saving behaviour). Moreover, the only difference between this group showed that participants in group 1 included *what others think* (i.e., an external factor) more often in their mental model than did people of group 2. This finding is completely opposite of the predictions made in hypotheses 2a and 2b, as participants in group 1 did not seem to attribute their success to (mostly) internal factors and participants in group 2 did not include more external factors in their model (compared those in to group 1). However, hypothesis 2c was supported, as no differences were found between the mental models of the two groups of participants that did not ascribe any importance to saving energy. This means that attribution bias had no effect on any of the mental models.

Inclusion of External and Internal Factors

Due to the issue of small sample and group sizes, hypothesis 2 will be tested in an additional way: the four groups were compared on inclusion of external and internal factors using proportion of inclusion and centrality of the factors. Due to the low sample size and uneven distribution of the sample over the groups, several statistical methods were rendered infeasible. However, more descriptive information can still provide insights about the differences (or similarities) between the groups.

All groups included a mix of internal and external factors in their models. Both types of factors were evenly divided in all groups. For instance, participants of group 1 included 208 (55.6%) internal factors, out of 374 total factors. Similar proportions were found for the other two groups, 52.5% of all factors were internal for group 2, and 50.6% of included factors consisted of internal factors for the groups who did not attribute any importance to saving energy.

However, when looking at the top factors (those used by approximately more than half of the groups; Table 4), there are some subtle differences between the four groups. When looking at the percentage of participants within a group who included a certain factor, it seems like in group 1 had slightly more internal factors in their top 7, whereas slightly more external factors made it into the top for the other three groups. However, the general pattern that this table shows is that both types of factors are, somewhat equally, present in all groups. Therefore, hypotheses 2a, 2b, and 2c remain unsupported.

Table 4

Top 7 Factors Per Group

Group 1			Group 2			Group 3			Group 4		
Percentage	Strength	Centrality index	Percentage	Strength	Centrality index	Percentage	Strength	Centrality index	Percentage	Strength	Centrality index
Hedonic values (69%)	*Personal responsibility* (1.58)	*Personal responsibility*	*Hedonic values* (73%)	*Habits* (1.58)	**Benefits for the environment**	**Control** (91%)	**Control** (2)	**Control**	*Hedonic values* (75%)	*Hedonic values* (1.71)	*Hedonic values*
Biospheric values (69%)	**Control** (1.30)	*Biospheric values*	**Financial gains** (73%)	**Benefits for the environment** (1.45)	**Financial gains**	**Financial gains** (82%)	*Personal responsibility* (2)	*Personal responsibility*	*Habits* (67%)	*Habits* (1)	*Habits*
Personal responsibility (69%)	*Biospheric values* (1.29)	**Control**	**Benefits for the environment** (73%)	*Egoistic values* (1.42)	*Habits*	*Personal responsibility* (73%)	*Egoistic values* (1.91)	**Financial gains**	*Comfort costs* (58%)	*Comfort costs* (0.92)	*Comfort costs*
Control (65%)	**Benefits for the environment** (1.27)	**Benefits for the environment**	**Control** (63%)	**Financial gains** (1.38)	*Hedonic values*	*Egoistic values* (64%)	**Financial gains** (1.50)	*Egoistic values*	*Egoistic values* (58%)	*Egoistic values* (0.88)	*Egoistic values*
Habits (63%)	*Habits* (1.19)	*Habits*	*Habits* (63%)	*Hedonic values* (1.32)	*Egoistic values*	*Hedonic values* (55%)	**Comfort costs** (1.18)	**Comfort costs**	**Control** (42%)	**Financial gains** (0.67)	**Financial gains**
Benefits for the environment (60%)	*Hedonic values* (1.04)	*Hedonic values*	*Biospheric values* (60%)	**Control** (1.15)	**Control**	**Financial costs** (46%)	**Financial costs** (0.86)	*Hedonic values*	**Financial gains** (42%)	**Control** (0.63)	**Control**
Knowledge (58%)	*Knowledge* (1)	*Knowledge*	*Egoistic values* (57%)	*Biospheric values* (1.05)	*Biospheric values*	*Opinion* (46%)	*Hedonic values* (0.77)	**Financial costs**	**Comfort gains** (33%)	**Comfort gains** (0.54)	**Comfort gains**

Note: The top 7 was determined based on the percentage of the group that included the factor, the factor's mean arrow strength, and an 'centrality index' based on percentage * strength. The factors that are bolded are external, those in italics are internal.

Discussion

This study aimed to gain insights into people's mental models of their own domestic energy saving behaviours in order to compare them to the models currently used to predict pro-environmental behaviours. Moreover, the effect of attribution bias on participants' models was investigated. In comparison to the general theoretical models used in environmental psychology to explain PEBs, participants' mental models differed on several aspects. First, participants included several external factors in their models, but largely left out drivers related to social influence. This pattern signals that, according to laypeople, saving energy is largely a personal matter, influenced mostly by a person's internal attributes and several external attributes that are unrelated to other people. Second, participants included mostly direct connections from a driver to the outcome variable, as opposed to the mediating and moderating relationships often found in EP models. However, participants agreed with environmental psychologists that values are important predictors of energy saving behaviours.

Comparing participants' mental models based on their current energy behaviours and the importance they attributed to saving energy proved to be difficult, due to limitations regarding the sample and group sizes. Therefore, the effect of attribution bias on mental models could not be tested statistically. Still, some small differences were observed when comparing the groups, however, for the most part it seemed like the self-serving attribution bias did not influence participants' mental models.

Comparison: Mental Models and Theoretical Models

As expected, participants' mental models differed from the prominent PEB models in several ways, although they were not as different as predicted. First, participants used a range of different factors to explain their energy saving behaviours, with most participants including at least as many factors as theoretical models do, if not more. One explanation for this finding is that participants were also presented with several (situational) factors that are not usually included in theoretical models of PEB. These factors were included in the study based on the pilot study where laypeople were asked which factors influence their energy saving behaviours. Several of these factors (such as *financial costs* and *financial gains*) were regularly included by participants. This finding signals the importance of including a bottom-up approach, as participants would not have been able to include these factors if only top-down factors were provided, and therefore would not have been able to make a complete model that represents their actual perceptions.

Moreover, almost all participants included at least one external factor (with most participants including many more), with the most common factors being *control*, *benefits for the environment*, *financial gains* and *financial costs*. This finding is in line with those of Hansmann & Steiner (2017), who found that participants tended to attribute their (non-)littering behaviours to situational factors. This inclusion of external factors also lends support to models such as the CADM (Klöckner & Blöbaum, 2010), which explicitly include situational influences. The consistent inclusion of (these) external factors again highlights the importance of including bottom-up research practices and points to a gap in the current theoretical models and approach to influencing energy saving behaviours. The current theoretical models leave out influential perceptions, obstacles, and drivers (such as financial costs and gains, and housing circumstances) that, according to participants' mental models, guide people's actual behaviour. This again highlights how purely top-down research can yield different results from mixed or bottom-up research, as it focuses solely on general, non-contextual processes.

Whereas participants seemed to largely agree on which factors were important drivers of energy saving behaviours, they did not fully agree on how the factors were related within the models. This was indicated by the fact that the most frequent connections (from *control* and *comfort* to *energy saving behaviour*) were included by 38% of all participants. It seems like laypeople are well-equipped to identify which factors they perceive to be important, but when it comes to the relationships between these factors, they seem to struggle more. However, participants generally agreed that the connections between drivers and the target variables were direct connections. When comparing the connections within the mental models to the those within the theoretical models, mental models present a completely different image. Whereas theoretical models often include several mediating relationships, participants drew a much simpler model in terms of relationships between factors.

This could point to a different, less complex, picture of how these processes work in practice, but it could also be attributed to cognitive biases and a lack of understanding of psychological processes by the participants. For instance, the inclusion of almost exclusively direct connections is in line with previous research on biases such as the common cause fallacy, which shows that people connect events even though, in actuality, there is no such connection (Manninen, 2018). Moreover, participants did not perceive social norms to affect their energy saving behaviour, whereas psychological literature has shown this driver to be hugely effective (Klöckner, 2013; Steg & Nordlund, 2019). This might point to a lack of awareness of social influence on the part of the participants, which is in line with several types of biases that show the lack of consideration of influence of others (for an overview see Korteling & Toet, 2020).

Attribution Bias

Unfortunately, the small sample size and distribution over the groups made most statistical testing impossible, which provided a challenge to testing the influence of attribution bias on participants' mental models. However, by investigating the mental models of people who did and did not value saving energy and who did (not) engage in this behaviour, some comparison was possible. This comparison implied that attribution bias did not have a large effect on the composition of participants' mental models, as all groups seemed to frequently use both internal and external factors. This might be because of the small sample (and group) size, but it could also mean that attribution bias simply does not affect mental models of energy saving behaviour. In fact, other factors might exert such a strong influence on energy saving behaviour that attribution bias is rendered irrelevant. This explanation is supported by comments participants made in response to the questionnaire when asked about their experience with the current study. About half of the participants mentioned that most of their energy saving behaviours is controlled by their external circumstances, with most people referring to the fact that they were renting their home, and even if they wanted to change something about this, they could not. This implies that external factors exerted an extremely strong influence, that might have rendered attribution bias irrelevant.

Theoretical and practical implications

One of the main findings of this study was that laypeople's mental models differ considerably from the theoretical models currently used to predict and influence energy saving behaviours. This supports the observation that results from top-down research differ from those found through bottom-up research. Whilst top-down research shows that internal factors such as social norms, a sense of responsibility and efficacy, and values are important drivers of energy behaviours (e.g., Klöckner, 2013; Van der Werff & Steg, 2015). This mixed approach study showed that both psychological and situational factors inform people's energy behaviours. This includes factors such as *control*, *habits*, *benefits for the environment*, *financial costs* and *financial benefits*, which are not generally included in top-down models. This implies that conducting and combining both types of research, as done in the current study, can be extremely insightful and beneficial. Whereas bottom-up research is not always suitable for developing theories or models, it can lead to new insights and promising avenues for revising existing theoretical models (often based on top-down research) and practical interventions.

A second implication of this study is that, based on their own ideas and models, laypeople do not need different interventions based on their current energy saving behaviours and the importance they ascribe to saving energy. More important than focusing on these differences between individuals is the consideration of external factors when designing interventions. By excluding these factors, a large part of the process of energy saving is missed, and therefore not targeted by current interventions. This again highlights the point made by Oreg & Katz-Gerro (2006): to create a more complete model of PEB, social and structural context should be considered. By including individual contexts, theories and interventions will be more comprehensive and effective.

Lastly, this study shows that mental models can be used for several purposes. Whilst they cannot be used to generate entirely new, empirical psychological models, they can provide feedback about the current models and ideas within psychological research and serve as inspiration for updating and expanding these models. Moreover, they can be used to identify gaps within the literature, or, conversely, to identify misperceptions held by laypeople (as also shown by de Ridder et al., 2022). Finally, mental models can also help identify existing barriers that might not be obvious from merely observing behaviours and analysing questionnaires.

Strengths and Limitations

The biggest limitation of this study was the sample size. As mentioned previously, the distribution of participants over the four groups was extremely uneven, making most analyses unusable. Before the data cleaning, the dataset included 220 participants. However, after cleaning the data, only 101 participants had complete data, which was a significant reduction in sample size and power, as well as in generalizability of the results. Fortunately, participants were able to provide honest feedback on the study, which provided insight into a possible reason for such a high rate of incompletion. The feedback showed that about half of the participants that finished the mental model tasks were unhappy with certain aspects of the study. This finding was echoed in de Ridder et al. (2022), who concluded that their high drop-out rate was due to using the online tool, as opposed to the task of creating a mental model. Some specific aspects that could have been the source of dropout in the current study were frustration with the way the tool works (e.g., how to place factors), the freedom that this method allows in combination with abstract concepts, frustration with not being able to explain one's model, and not understanding what exactly certain predictors represented.

Paradoxically, this study's biggest weakness is also its biggest strength. Using *M-Tool* provided a useful and practical way of eliciting mental models, thereby gaining insight into information and processes that normally stay implicit and under-researched. However, it also produced some important limitations. In previous studies, *M-Tool* has been used to create models about several different topics. However, all these topics – and their predictors – were less abstract than those of the current study (e.g., the spread of COVID-19, de Ridder et al., 2022; or farmers' investment decisions, Murken et al., 2024). The complex and abstract nature of the outcome variable (energy saving behaviour) and several of its predictors (e.g., values, context, social norms) proved to be challenging to convert into *M-Tool* and make accessible for participants. This was reflected by the comments of numerous participants, who mentioned that some terms were difficult to grasp or that the outcome variable was difficult to predict in this kind of model. However, there could be a way to alleviate this issue.

Future Research

Some suggestions for future research follow. The results of the current study suggest that, when using *M-Tool*, participants might benefit from being assisted by a research assistant. Originally, *M-Tool* was developed to be used with people with low education or who would need help with participating in such a study (Van den Broek et al., 2021). Therefore, the original intention was for the participant to make their mental model with the assistance of a researcher. Since participants seemed to have struggled with the current study being conducted online and individually, in combination with the particular topic, they experienced difficulties while making the mental model. Thus, this study might have benefitted from being completed in the presence of a research assistant (as also recommended in de Ridder et al., 2022). A replication of this study should be done with a larger sample, where participants are assisted by a research assistant, who can help them understand how to use the tool and explain the procedure or concepts that might be unclear to participants.

Moreover, future research should be done to investigate how mental models compare to different types of methods. For instance, a direct comparison between a survey and a mental model task on the same topic, using the same predictors, might add insight into why these two methods might deliver different results and which processes they elicit within participants. An additional recommendation for future studies that make use of *M-Tool* is to provide participants with an option to comment on their experience using the tool and to provide feedback on the tool, in order to improve *M-Tool* for future use.

Secondly, studies on mental models can bring light to laypeople's own perceptions and struggles when it comes to saving energy. Future studies should investigate how the factors that participants indicated to be important could be integrated into current PEB models and interventions. Specifically, control, habits, benefits for the environment, financial costs and financial benefits should be taken into account when trying to predict energy saving behaviours. A final suggestion would be to investigate what people's mental models would look like when they are trying to predict other people's behaviour (as opposed to their own). This could shed light on the difference between perceptions of one's own behaviour and that of others and might give insight on different kinds of biases that influence mental models.

Conclusion

Laypeople's mental models significantly differ from theoretical models used in scientific research on energy saving behaviours. These differences should be considered when creating and applying these theoretical models, for instance when designing interventions. This can be done by conducting research following a bottom-up approach and integrating the resulting findings with top-down research findings. Thus, these findings emphasize the importance of conducting research using a mixed approach, for instance through the use of mental models.

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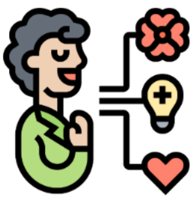
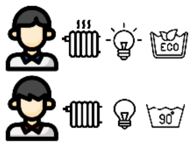
Appendix 1

The 17 concepts that participants could use to create their mental model of energy saving behaviour

Icon	Driver	Definition	Internal or external
	Benefits for the environment	The positive consequences of your energy saving behaviours on the environment	External
	Biospheric Values	The importance you ascribe to the environment and your surroundings	Internal
	Context	The influence your circumstances have on your energy saving behaviour	External
	Control	The possibilities that are available to you to save energy	External
	Comfort costs	The effort and discomfort that come with saving energy	External
	Comfort gains	The ease and comfort that come with saving energy	External

	Difficulty	How difficult or easy you find saving energy	Internal
	Egoistic values	The importance you ascribe to money and possessions	Internal
	Financial costs	The extent to which saving energy costs you money	External
	Financial gains	The extent to which saving energy brings you money	External
	Habits	The energy behaviours that you are used to doing	Internal
	Hedonic values	The importance you ascribe to living comfortably	Internal
	Knowledge	The extent to which you know how to save energy	Internal
	Opinion of energy saving	What you think of saving energy	Internal

	Personal responsibility	How responsible you personally feel to save energy	Internal
	What others do	The energy behaviours that other people engage in	External
	What others think	The extent to which other people (do not) value saving energy and find it (un)desirable	External