

Planning interventions on a theoretical basis. Application of a new integrative influence model of pro-environmental behaviour to promote energy efficient behaviour

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Abstract

Although psychologists have investigated a great variety of intervention strategies, we still lack a theoretical framework which could be used to inform an optimal selection and combination of strategies to reduce energy consumption. In the paper at hand, an integrated influence model of pro-environmental behaviour is introduced and used for the development of a tailored intervention to change energy use behaviour in a work context. The target group consisted of staff members of a German university. Prior to intervention planning, motives and cognitive variables concerning energy use were recorded in two randomly chosen sub-samples of the target group ($n = 99$; $n = 87$). Intervention techniques were selected and designed in consideration of model variables. Intervention impact was evaluated on the basis of consumption values, behavioural indicators, and self-report ($N = 966$). Implications for further intervention planning are discussed.

Keywords

Intervention techniques, energy consumption, theory driven intervention planning

Planning Interventions on a theoretical basis. An application of a new integrative influence model of pro-environmental behaviour

Although psychologists have investigated a great variety of intervention strategies over the last 30 years (for an early overview see Geller, Winnet and Everett, 1982; Dwyer, Leeming, Cobern, Porter and Jackson, 1993) we still lack a theoretical framework which could be used for the development of an optimal combination of strategies for a given case. This is in particular true for the development of interventions in the field of energy consumption in households and organizations.

In the following, an integrated influence model of pro-environmental behaviour is introduced and used for the development of a tailored intervention to change energy use behaviour in a work context. The suggested model and procedure is illustrated by an intervention carried out at a German university (Ruhr-University Bochum). Aim of the intervention was to motivate efficient energy user behaviour among university staff members.

1. From explaining to altering behaviours: What do we know about intervention planning?

In the field of promoting environmentally protective behaviour, intervention research has now been conducted for almost 40 years. Many different intervention techniques have been developed and applied in order to promote environmentally protective behaviours. In the early years, popular strategies consisted of those based on the applied behaviour analysis approach (ABA) such as prompts, rewards, competition, feedback or manipulation of the situation (see Geller, Winnet & Everett, 1982). Subsequently, more complex and “social” strategies such as commitment strategies, the foot-in-the-door technique, or the block leader approach have been applied (overviews provided by Geller, 1989; Dwyer, Leeming, Cobern, Porter & Jackson, 1993; Gardner & Stern, 1996). However, existing structuring and reviews of intervention techniques are still based on the ABA approach, which differentiates mainly between antecedent and consequence strategies (see Geller, 1989; Dwyer et al., 1993; also Abrahamse, Steg, Vlek, & Rothengatter, 2005). This situation leads to problems, as

Abrahamse and colleagues have put it “Most studies reveal only to what extent interventions have been successful, without providing insight into the reasons why“ (Abrahamse et al., 2005).

On the other hand, since years there have been given recommendations for intervention planning by psychologists. Some of them were explicitly designed for practitioners (e.g. Gardner & Stern, 1996; Kals, 1996; Matthies, 2005; McKenzie-More, 2000). In contrast to the review literature, those recommendations and guidelines are all based on newer theories or integrative models. I see several reasons why it makes good sense to develop intervention techniques on theoretical grounds: First of all, we need a theoretical foundation of techniques for a more appropriate evaluation of intervention techniques. Moreover, having a theory makes it also easier to communicate recommendations to practitioners, who want to understand why they should apply which kinds of techniques. And last but not least, as Kurt Levin has put it: “there is nothing so practical as a good theory”.

2. Using an integrative model for intervention planning: The case of energy use at the Ruhr-University Bochum

There are two psychological model traditions which have been applied in order to explain environmental protective behaviour: the *theory of reasoned action*, or its further development, the *theory of planned behaviour*, and various forms of *norm activation theory*. In the last years, efforts have been made to apply these models to several domains of environmentally relevant behaviours (for an overview see Bamberg & Möser, 2007). In our research group we have used a modified norm activation model as a theoretical frame work for developing intervention strategies (Matthies, 2005; Matthies, Klöckner & Preisner, 2006). The model was originally developed by Schwartz and Howard (1981) to explain altruistic/moral decision making. Although it focuses on the activation and influence of personal norms on behaviour, it explicitly takes into account that a moral motivation has to be balanced against other, *competing motivations* (e.g., to save monetary or behavioural costs, or to fulfil expectations of others), and so individuals frequently do *not behave in accordance*

with their personal norms. The competing motivations reflect external influences (e.g., comfort, price of behaviour, social expectations), thus the model is able to integrate internal and external factors. A further characteristic of the model is the assumption that the decision to not behave in accordance with one's norms activates defence mechanisms like *denial of responsibility* or *redefinition of the situation* (e.g., negating the problem or abilities). Because of these characteristics, the model may help to identify constraints and possible risks of implementing soft measures (Matthies & Blöbaum, 2007). Coming from a research tradition in travel mode choice, we integrated the *concept of habit* in the model (Klößner & Matthies, 2004, see Figure 1). We used this model to develop a bundle of intervention techniques in order to reduce energy consumption at the Ruhr-University Bochum.

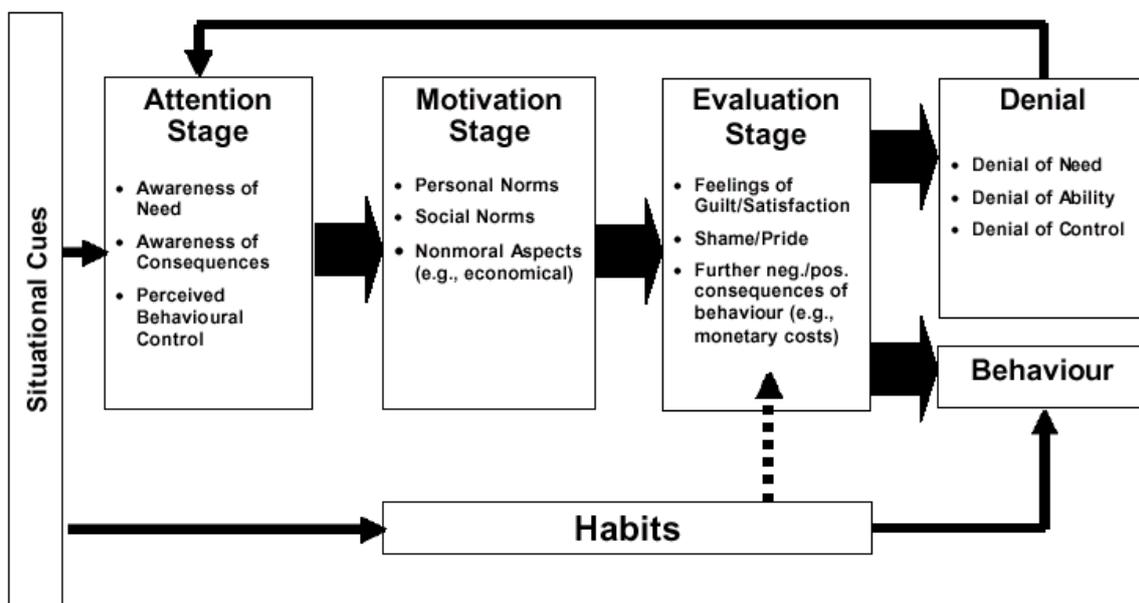


Fig. 1: Modified norm activation model (Matthies & Blöbaum, 2007)

3. About the setting: Ruhr-University Bochum

The Ruhr-University has currently about 33.000 students and 5.000 employees. It was founded in the sixties, when the use of fossil fuels was no problem yet. It has a comparably high energy consumption of approximately 110,000 MWh/ a (only heat energy) which

produces costs of about 7 Mio €/a (heat energy) and about 25,000 tons of CO₂. Already in the late nineties RUB-engineers had done an analysis of the situation, they sampled several technical solutions to the problem and stated that 1/3 of the total energy savings potential could be reached by behaviour modifications of university staff members alone (e.g. correct airing behaviour). In the beginning of 2006 the administrative head of the university contacted the workgroup for environmental psychology at the Ruhr-University and asked for support. In the same year, we started a theory driven planning process for a heat energy reduction campaign among the university's staff members. A campaign focusing on electrical energy followed a year later.

4. How did the model guide our analysis?

Looking at the activation and motivation stage we can derive from the model that information strategies are necessary for the activation of personal norms but that a moral motivation alone will be too weak to cause a behaviour change if other strong motives are given, for example when behavioural costs are too high. The model also yields a possible risk of using solely norm-focused intervention strategies. If norms are activated but cannot be translated into behaviour due to strong competing motives or blocking habits, this may lead to a denial of responsibility and redefinition processes. Therefore the implementation of such strategies should be contemplated carefully. In order to check those preconditions, we carried out several staff surveys before we *selected specific target behaviours and designed the intervention package*. The questions in the surveys focused on constructs in the attention stage and motivation stage of the model. Main questions were: What did the target group know about the collective and individual energy use at the university (awareness of need and awareness of consequences), what did they think about the efficiency of specific reduction behaviours (awareness of consequences), and how did they perceive their abilities to adopt new behaviours (perceived behavioural control or difficulty)? Moreover we confronted them with a variety of possible motives for engaging in energy efficient behaviours (social, moral), and recorded assumed behavioural costs of pre-selected behaviours (seven behaviours

were suggested by engineers on the basis of their saving potential for the Ruhr-University). Also, we asked staff members to report their current behaviour (e.g. airing behaviour, PC-Powermanagement). Additionally, we asked about effective and preferred ways of information spreading, and our colleagues had the possibility to suggest further relevant energy efficient behaviours.

5. Selection of Behaviours

Based on the results of a first staff survey (questionnaires were mailed to 200 randomly selected internal addresses; n = 99) we conceptualized the intervention. We focused primarily on behaviours that were considered to be easy, were assumed to have a high potential for conservation, and were associated with low perceived behavioural costs.

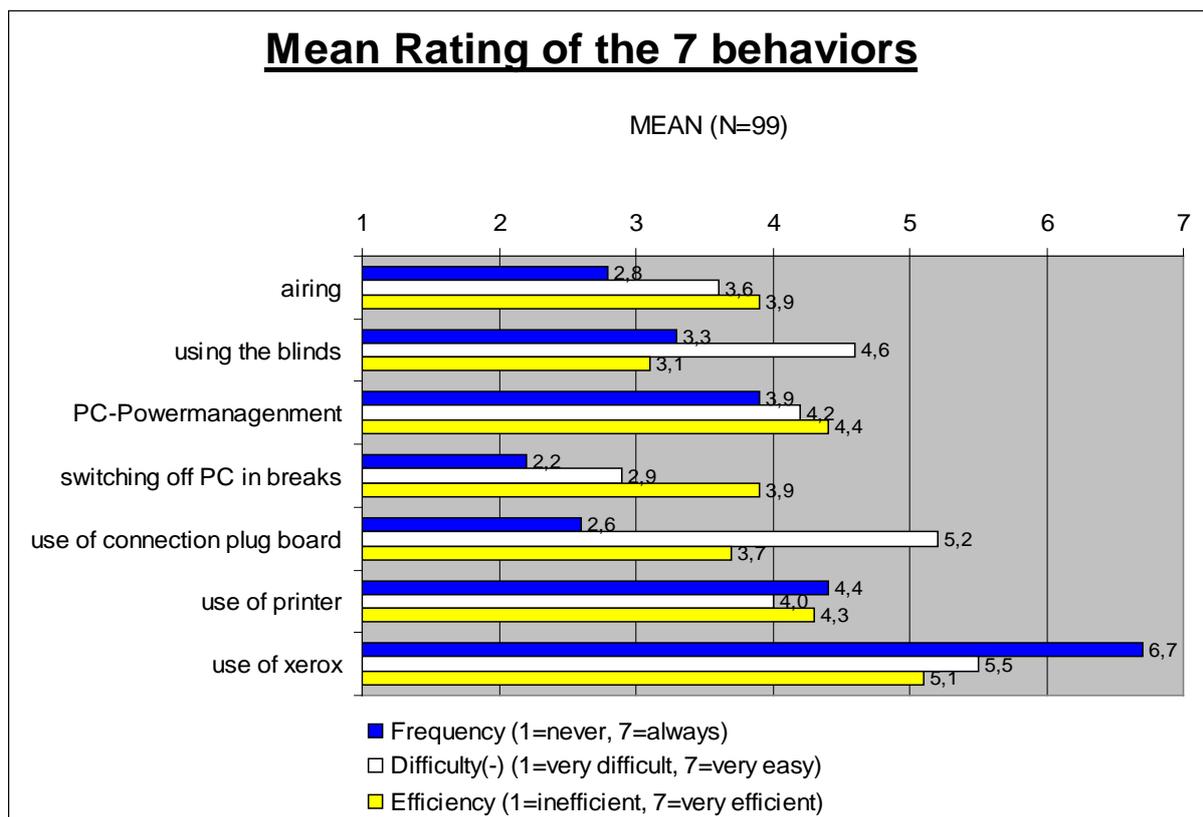


Fig. 2: Assumed efficiency, difficulty and self reported frequency of energy efficient behaviours

Thus, the main behaviour in the domain of heating was the *correct airing in winter time* (open the windows wide for only a few minutes instead of permanent airing). The main behaviour in our campaign on saving electricity was using a connection plug board. Other behaviours we focused on in the heat energy campaign were behaviours suggested by staff members in the first survey, i.e. *turning off the heating when being off* for more than a day, and *moving the furniture from the heating*.

6. Selection and design of intervention techniques

In a first step, we developed information material to provide staff members with action knowledge, and knowledge about the efficacy of the suggested behaviours. Aspects of the background information were designed with respect to possible relevant motives. To record those possible motives, we carried out another staff survey (a telephone interview, 200 numbers were randomly selected from the telephone register; $n = 87$), and confronted staff members with several possible motives for conserving energy at their workplace and asked them to indicate which motives that were relevant for them. The most frequently named motives for conserving energy at the university were: To help the university to avoid further cutbacks (63%) and to contribute to climate protection (56%). Interestingly, only 3,5% took up the motive “because colleagues would expect it from me”, thus social norms seemed not to be of relevance, or even counterproductive here. Against this background, we chose a slogan that focused primarily on the monetary motive to avoid further cutbacks. The slogan “Sparen am richtigen Ende” means “saving money, but in the right place”. In brochures and on posters we presented the monetary saving potential for each of the three promoted behaviours. According to the fact, that climate protection motives were also relevant, we additionally gave information about the possible reduction of CO₂ (see Fig. 3). Taking into account that the strongest motive was to support the university we took care that every staff member at the university got a personal letter from the university president and head of administration. With respect to the dislike of a social motive (expectations of colleagues), we restrained from “social” techniques like competition or group goals. Instead we installed a

commitment strategy (staff members could send back a small sheet of paper, indicating which behaviours they wanted to try out or keep on within the intervention period. In order to consider a possible habitualization of the main behaviour (correct airing), we also developed a prompt that reminded of the correct airing behaviour.



Fig. 3: Poster informing about the target behaviour

7. Implementation

In the first week of November in 2006 we started the intervention with a “kick off week” with information booths in the central cafeteria, with banners on the university campus and with a distribution of flyers. In the second week we had hung posters with the three main behaviours in all university buildings (correct airing behaviour, turning off the heating when being off for more than a day, moving the furniture from the heating, an example is given in Figure 3). In the second week all 5000 staff members got a personal letter from the university

administration with an information package containing an information brochure, prompts for correct airing and a leaflet to participate in a commitment intervention. Additionally, we had a website in the intranet, and some media coverage; see Fig. 4 for an overview of activities.

	Oct. `06	Nov. `06	Dec. `06	Jan. `07	Feb. `07
Intervention Technique	Article in University Newsletter	<ul style="list-style-type: none"> • Kick-off-Week • (Information Booths, Banner, Flyer, Give Aways) • Posters • Website • Article in University Newsletter • Intervention Package 	<ul style="list-style-type: none"> • Circular Letter • Lottery (Written Commitment) 	<ul style="list-style-type: none"> • Article in University Newsletter • Emails • Idea-Pool "Power-Saving" 	
Treatment		X			
S. Reported Behaviour	O ₁				O ₂
Behaviour Monitoring		O ₁ O ₂ O ₃ O _x
Energy Data CfWI	O _{E10/06}	O _{E11/06}	O _{E12/06}		

X = Treatment, O = Measurement of Behaviour/Energy

Fig. 4: Overview of activities and evaluation design

8. Evaluation design and results

With regard to three different dependent variables (self reported behaviour, observed behaviour/behavioural traces, energy consumption) we had a mixed evaluation design (see Fig. 4). We had a pre- and post measure of self reported behaviour for a sample of (n = 539 and n = 427), a monitoring system concerning airing behaviour over a period of 4 months (we simply registered for all 11 university buildings how many of the windows were "tilted" which was an indicator for incorrect airing behaviour). For this dependent variable we also had a control group, which is not shown in Fig. 4 but in Fig. 6. Additionally we had energy consumption data on a monthly level for the whole university (weather controlled).

We had a significant change in self reported behaviours, e.g. a dramatic change in airing behaviour (see Fig. 5). Whereas before the intervention only 17 per cent of the staff

members always aired correctly, it was 48 per cent after the intervention. This result is in line with our behaviour observation. We had a reduction of tilted windows from seven to two per cent in the four months of intervention. In the same period of time, there was no reduction in the two control buildings (see Fig. 6). And we had a reduction of the weather controlled energy use in the five months of our campaign (November to March) of about 6 %.

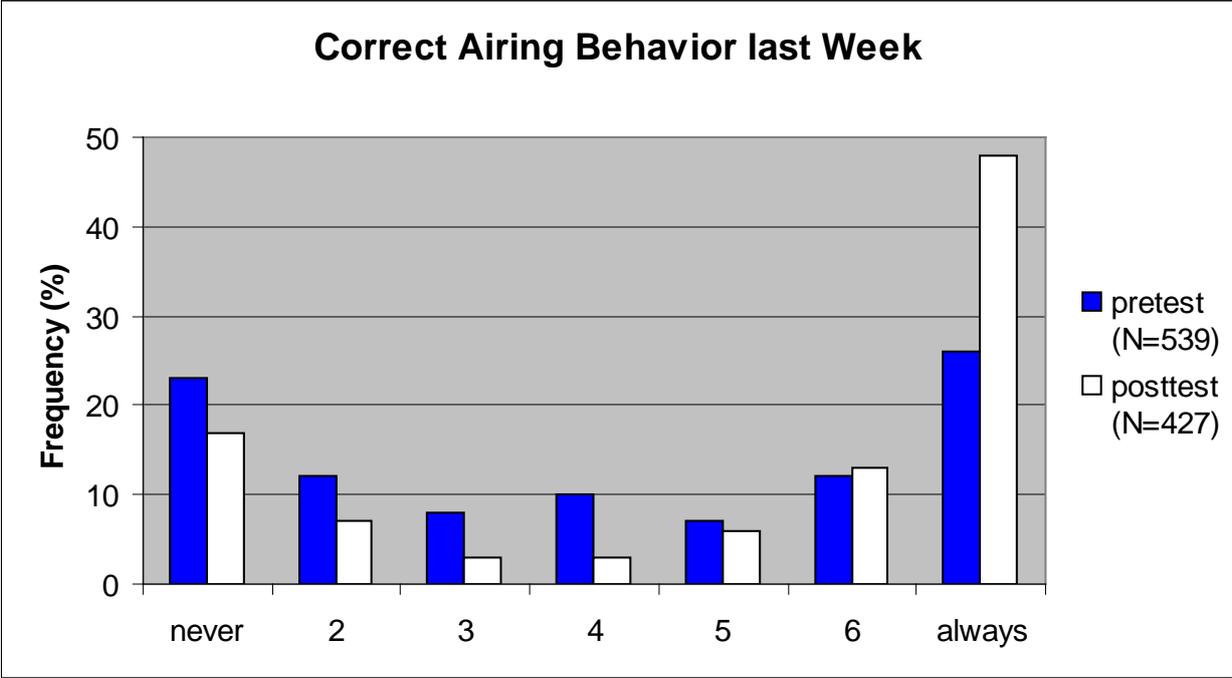


Fig. 5: Self reported airing behaviour before and after the intervention

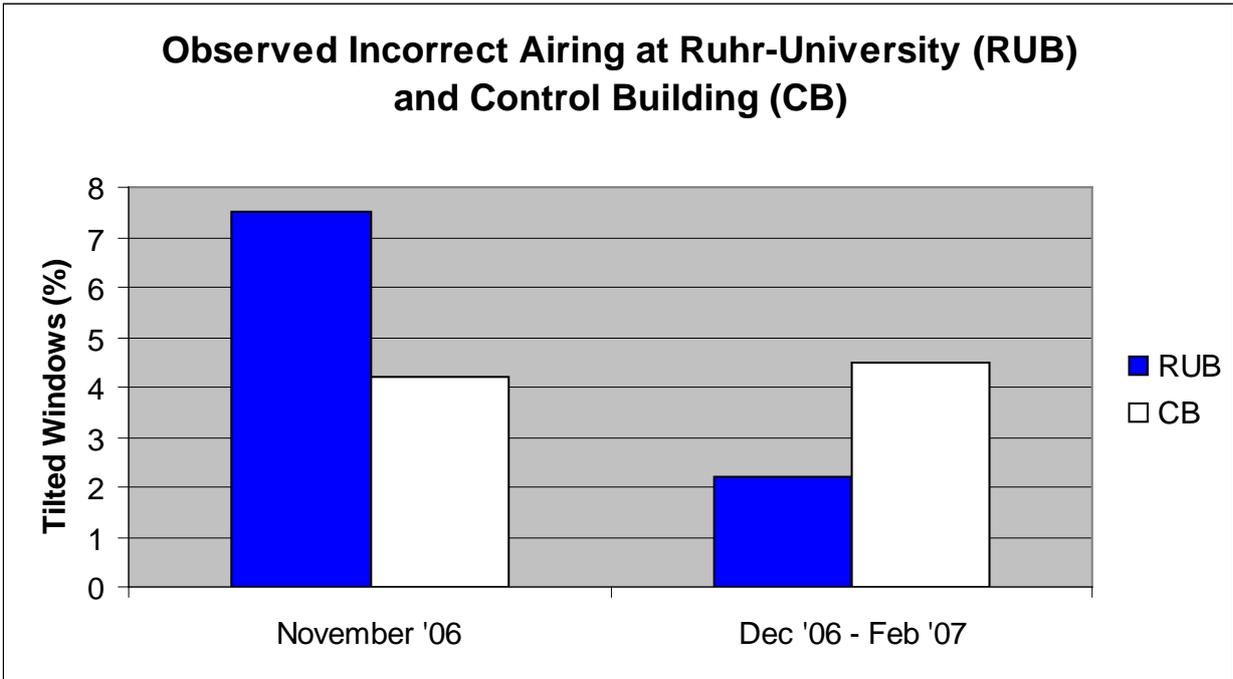


Fig. 6 Observed airing behaviour over the period of three intervention months

9. Conclusions

From the perspective of practitioners, our intervention was quite successful: A reduction of 6 per cent of the heating energy over the whole year would result in a saving of about 400,000 Euros. Thus we could show, that user behaviour is a potential that is worth being considered by decision makers, and that using a psychological frame model could inform intervention planning in an effective way.

However, from the scientists view several questions remain unanswered: Was the theory based approach really useful, i.e. were changes in behaviour mediated by model variables, or were changes caused by specific intervention techniques? Such questions can only be answered within a broader framework of an intervention study including a theory driven evaluation. The requirements of those study designs (e.g. repeated recording of mediating variables, a stepwise introduction of intervention elements) however often are in conflict with the requirements of a practical context, and so it was here. For the future it would be desirable to carry out and evaluate more interventions informed by the theoretical frame model.

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