Exploring Past Home Improvement Experiences to Develop Future Energy Saving Technologies

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Abstract
This paper describes a participatory data collection tool designed for use within a multi-disciplinary energy research project. The tool was designed to encourage participants to narrate the story of their past home improvement experiences. The User Centred Designers within the team then used these stories to extract user requirements for use by engineering specialists within the project team.

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Introduction
Carbon reduction research, particularly in the domestic sector, requires multi and interdisciplinary approaches, to take account of the many economic, technical, social and behavioural factors and the often complex interactions between them [1, 2]. Technology in many forms is being developed to help reduce energy use and hence carbon emissions, but many of these technologies take little account of user requirements and so fail to achieve their maximum potential. Some technologies, like energy efficient appliances or heating control smart phone apps involve regular interaction from the consumer and so provide an easier opportunity to research. However, the user requirements for other technologies, particularly those

that are large, occasional purchases, such as heat pumps or high performance insulation, are not so easy to obtain. The products are not particularly engaging and there is a long time period between purchase of one system and the next. However, being able to ensure that new technologies are fit for purpose and meeting user needs is critical for successful development.

Challenge: Designing future technologies

Designing future technologies can be difficult as it is not possible to draw on current use and interaction with users. The rapid growth in energy saving technology development means that there are many new technologies coming onto the market, but little feedback on their success. Innovative exploratory methods are needed to draw on past related experiences in order to predict reaction to new technologies. As many home improvement activities relate to energy saving, for example replacing a boiler, fitting new windows or carpets, draught-proofing or adding loft insulation, an exploration of past home improvement activities allows for a grounded exploration of the requirements for future technologies.

Challenge: Engaging users

Energy saving is an important global issue but for the ordinary householder, their interest extends little beyond their thermal comfort and their rising energy bills. To research in this area, methods that are engaging and interesting to the participants are crucial. We describe in this paper a participatory timeline tool that was specially designed to encourage participants to recount their experiences of home improvement.

Challenge: The home as a holistic system

We recognize that the home is a holistic system; changing the heating system may change the way in which the home is used and how people interact within it, how they socialize, where they spend their time. Technology development is often considered in isolation of these factors. The timeline tool was designed to encourage participants to reflect on what they value about their homes and to consider what motivated them to make the improvements they had undertaken.

Challenge: Working within an multi-disciplinary team

This research was conducted within a multi-disciplinary project. Technologists had very specific questions that they wanted answering e.g. a need to understand how much hot water a family might use in a day so the capacity of a heat pump could be specified. A key role for us as human factors specialists was to understand how the everyday practices of the householders would ultimately impact on the specification of the technologies under development. A key issue for the technologists was the order in which people choose to make energy saving improvements as this order impacts on the overall energy efficiency of the house. The timeline tool allowed this data to be collected as people recounted their stories of past home improvements and used recollection of life events to prompt recollection of when these changes were made.

The research

The research formed part of the wider research project CALEBRE, funded by the Research Council's UK Energy Programme and E.ON. This multidisciplinary project aimed to establish a validated, comprehensive refurbishment package for reducing UK domestic

carbon emissions that is acceptable and appealing to householders, specifically targeted at solid-wall properties [3]. An initial study was carried out with householders in their homes to explore any home improvement activities they had undertaken, as well as their attitudes to energy saving and some of the new technologies being developed within the project [4].

Method: Timeline tool

Householders were asked recollect through storytelling their home improvement activities since moving into their house. This storytelling approach allowed the householders to recall, home improvements that they had undertaken, either as a do-it-yourself job or with the aid of professional tradespeople since they had purchased the property. A magnetic white board was used by the researchers to record key home improvements along a timeline, through the use of annotations and magnetic cards (see Figure 1). As various activities were identified, the researcher prompted for more details – why did you have this work done? Who did it? How did you select the tradesperson? What was the cost? How much disruption was there? Did you have to move out? etc. Creating this rich narrative of home improvement activity allowed the householders to recollect details about their experiences in considerable detail - for example, a female householder could recall decorating whilst being heavily pregnant, so was able to accurately identify the time of the activity and, often, could recall the associated emotions that surrounded it.

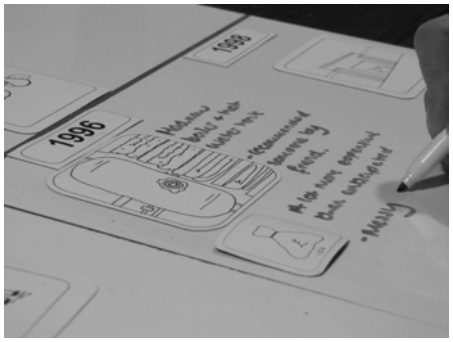

Figure 1. Annotating the timeline as it evolved

A bespoke set of magnets was produced for this exercise to make the task amusing and visually interesting, but also to allow for fast visual scanning of the timeline and reordering as additional events were remembered. Magnets were developed in several categories; dates, life events, home improvements, cost, shown in Figure 2.

Figure 2. Magnetic cards used with the timeline board

The shared development of the timeline allowed the participants to see the data being collected, to feel confident about the level of detail being recorded and to prompt where mistakes or omissions had taken place.

Evaluation of approach

This research utilized a participatory storytelling tool to collect data relating to people's long term relationship to their homes. The method was designed to keep the participants interested and engaged with the research but also enabled them to maintain control over data collection, a requirement raised by Crabtree and Rodden [5]. Householders relished the opportunity to reminisce and reflect on what had been achieved in their home, particularly those who had lived there for a substantial amount of time. They were encouraged to follow their own interest leads, for example, uncovering photos and quotations for work from past home improvements. The quality of recollection however was greatly dependent on whether the participants could relate the improvement to a significant life event, e.g. the birth of a child. In some cases the participant's narrative contained trauma, e.g. the death of a close relative or painful divorce. Although the participatory nature of the tool enabled the participants to only talk about events they wanted to disclose, the acute need to be sensitive to people's personal circumstances during domestic research was often apparent.

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