DESIGNING INTERFACES TO VISUALISE DOMESTIC COMMUNICATION PATTERNS

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ABSTRACT

In this paper we propose an approach to visualise the domestic communication patterns by designing domestic interfaces. We conduct a review of literatures on the development of interaction interfaces including the design and evaluation methods, the communication patterns in the home, and the design methods for domestic infrastructures. Following an analysis of current design approaches and interface design and evaluation, we draw some implications from a practical consumption behaviour research; a study designed an unconventional control panel interface. And the evaluation results of the study provided us an illustration of new interface effectiveness by novel design approach. The study of interface design approach indicates that the pattern visualisation stretches insights into the design and understanding for domestic communicational patterns.

Keywords interaction interface, domestic communication, pattern, interface design

1 INTRODUCTION

In the last decade the research into domestic communication with ubiquitous technologies has begun to investigate the patterns in household (Hughes, O'Brien et al. 2000; Crabtree and Rodden 2004). Today the advantages of interactive technologies in the home have convinced us that these technologies change our life perspectives especially in the terms of domestic communication. However it seems easier to understand these interactive technologies we produced rather than understanding the context of technology applied and the potential impact of the adoption (Venkatesh 1996). Domestic context across dynamics of family, friends, habits, cultures and so forth which make communication understanding even complicated than other interaction behaviours. One of the reasons why domestic communication is complicated to understand is simply due to the varieties of behaviour understanding within domestic context. Taking a domestic personal computer for example, it is in an embarrassing dilemma whether this single-user interface device is a conventional appliance or a new communication tool due to an incomplete understanding of these technologies (Venkatesh 2001).

To grasp how technology is affecting communication in the home, a number of investigations have been conducted such as mediating intimacy behaviours to uncover how to maintain strong-tie communication relationships (Vetere, Gibbs et al. 2005), and discovering communication rhythms by communicational surfaces in the home such as fridge doors (Taylor, Harper et al. 2006). But we still have not gone too far due to a shortage of interfaces to visualise domestic communication patterns. The home is deemed as a site converging interactive technologies rather than developing its own technologies such as mobile technologies and networking technologies. This situation determines the interfaces in the home a collection of multiple pattern dynamics rather than an integrated unit. Interaction interfaces of domestic communication are distributed all around sub-environments in the home relating to interactive technologies householders (O'Brien, Rodden et al. 1999), and the distribution is hardly determined only by technologies. Taking the telephones for example, today we still use century-old technologies as the primary means of communication (Hindus, Mainwaring et al. 2001). However during the evolvement the telephones unsuccessfully attempted to integrate other interactive technologies such as video.

2 DESIGNING INTERFACES IN THE HOME

Thus an approach is required to inform the communication patterns in the home. As domestic design continues to gain highlights within the domestication research and further studies in domestic routines, domestic communication patterns begin to be coordinated. More and more we find that in the domestic sphere communicational artefacts are designed increasingly complex and dynamic with convergence of

routines. Comparing to conventional computer interfaces, characters of the pattern visualising interfaces need to take account of specific patterns as the home is inhomogeneous (Horst, Bunt et al. 2004).
There are several reasons to select the interface design as the medium for domestic communication pattern visualisation. Many present interface design projects fail to achieve their goals of visualising communication patterns due to lacking attention to the specifications of interface for domestic patterns. One of the advantages using interfaces to visualising domestic communication patterns is that as an important part of usability interface evaluation has been a maturing area. This means we can adopt common interface parameters to evaluate the effectiveness of the interfaces for pattern visualising. And various usability evaluation methods such as analytical, expert heuristic evaluation, survey, observation and experimental methods can also be shared (Ssemugabi and Villiers 2007). Meanwhile, the home is full of mundane surfaces which can be developed as interfaces, such as the floor, the table, and fridge doors. We may not treat these surfaces as places in the home as normal furniture, but as display components of domestic communication (Taylor, Harper et al. 2006). Displays may be considered as a heterogeneous collection of fragmentary site as distributed patterns where displaying goes on to provide communication and the coordination of practical routines (Crabtree, Hemmings et al. 2003). Thus we may approach these surfaces as reminders of communication memories (Norman 1988).
We can find a huge number of interface design methods and models in the history of interface from command interface to multimodal interface. But not all the methods have potential to design interface for pattern visualisation. Some of these models are based on observing behaviours and describing activities; other models focus on prediction for execution times or error states of the interface design (Shneiderman 1998). Traditional interface design theory with function-behaviour-structure model pays attention to the function and structure rather than strengthen the relationship between the interfaces and design (Wang, He et al. 2002). Ethnographic observation is a method likely to gain insight into social behaviour and dynamic context. However with a purpose of changing those interfaces, ethnographic method may ignore the participants' ideas about what they are thinking. Some designers urge participatory design methods (Damodaran 1996) to design the interfaces. Participant design methods suggest collecting precise information by involving more participants. However, extensive user involvement may distract the attention to broad and incompetent opinions. For the scenario development method, one of the difficulties is the uncertainty of communication behaviours and its frequency. However, ethnographic methods can conceptualize the situations to inform system development (Hughes, King et al. 1994). However when it comes to conceptual concrete patterns, it may not be effective for better understanding of the end user behaviours. Structured approach (Casaday and Rainis 1995) divides design into interrelated components to manage the complexity but the selection of components may be difficult to handle. Therefore a motivating and heuristic interface design may approach communication patterns effectively, such as heuristic inspection (Nielsen and Molich 1990), which is a method designed for non-specialist.

3 PATTERNS AND DOMESTIC COMMUNICATION

In order to visualise communication patterns, we have to clarify how these patterns can be uncovered. As prototyping for experiences (Buchenau and Suri 2000) and conversation (Donath, Karahalios et al. 1999), visualising domestic communication encompasses many varieties such as social issues, business strategy, and emotions. More specifically, when it turns to domestic communication activities the preliminary objective of patterns visualisation is to identify the actions anchored to surfaces and situated them into patterns (Crabtree, Hemmings et al. 2002). Current appearances of patterns can not offer much insight into the dynamics of the routines (Viegas, Boyh et al. 2004), particularly regarding diverse domestic communication patterns (Rohall, Gruen et al. 2001). Taking email for example, although the email has been one of the most widely used productivity for communication both in business and household, people still feel frustrated by using email.
To address the dynamics in pattern visualisation, multiscale interfaces which utilise structured communication measures as parameters for communication visualisation may be an option (Mandic and Kerne 2005), as communication measures have been maturely developed. Frameworks of pattern language concentrate on the potential utility of patterns as a good way to understand the context (Crabtree, Hemmings et al. 2001). Crabtree (2002) describes a pattern framework to support the design process through providing a resource conveying key routines. Communication pattern visualisation technologies such as threads, timelines, and low-resolution overviews have been proved to be useful (Rohall, Gruen et al. 2001). These technologies can be efficient for pattern visualisation research, however when it turns to realistic applying it may be useless due to householders do not have such analyzing habits. We can hardly assure the routine components which may be quite important for pattern understanding such like pause and turn-taking behaviours (Donath, Karahalios et al. 1999) would be well recognized. Thus the patterns visualised should be self-documentation in its communication routines which can keep all related routines.

4 DESIGN AND EVALUATION METHODOLOGY

We began the design process by redesigning a conventional wall mounted control panel device. The new control panel provides more immediate information and feedback between power suppliers, predicted consumption and costs, and usage patterns to reflect the energy consumption and to alter consumption behaviours (Figure 1). We developed the device with specific features such as consumption and costs display, temperature setting, status indicator and energy supplier switcher. The most prominent feature is the ability to display the predictive cost of real-time energy consumption. Then an evaluation including scenario instruction, participant tests, interviews and a questionnaire was executed. We carried out the evaluation for the first design and exploited some novel and engaging interaction patterns with which we developed another more refined design to investigate the degree of consumption behaviour changes. The second design was improved in several ways, such as precise display, intuitive buttons and more information indicators. As well we replaced the evaluation method 'teach-back' with semi-structured interviews.
Some implications of such interface evaluation can be drawn from the previous study. We found the study was useful to identify preferred features and to help us to understand interface effectiveness by the highlights of displays, key buttons and more intuitive clues. Also scenario-based evaluation method helped us to visualise the potential influences of social setting. In the terms of interface effectiveness, we can exploit implications from the original analysis of evaluation results. Firstly, all the participants admitted that visualised display of energy source and temperature as well as predicted costs made them more understandable to their energy consuming behaviours. Secondly the improved interface design revealed a progress in understanding the consuming patterns in the home comparing with the first version's discrete interface. The comparison showed that participants opted to select the improved design with intuitive elements to enhance the understanding of consumption.

Figure 1. The Left and middle interfaces are first designs. The right one is the second design.

5 CONCLUSIONS

Both the empirical studies from literature review and practical studies provide some useful pointers to possible approaches of visualising communication patterns. In this paper we presented an adaptive approach of interface design for visualising communication patterns and enhancing the understanding of the pattern understanding. This approach may also be adopted in other fields such as amusement and energy consumption in the home although relevant evaluation is still under the way. As a part of our on-going work, we are developing specific interfaces to evaluate what types of interface are better for domestic pattern understanding. And the preliminary research uncovers that explicit Interfaces visualising domestic communication patterns enable us coordinate the daily communication routines more orderly rather than haphazard.
More design and evaluation details as video can be found at http://vimeo.com/2966429.

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