USING GAME ELEMENTS TO MOTIVATE ENVIRONMENTALLY REPONSIBLE BEHAVIOUR

ABSTRACT

This paper describes the application of game elements to improve environmentally responsible behaviour in domestic energy consumption. A product that implements game elements was designed for families with children. The product is based on a larger project called SOFIA, which aims to connect the physical world to the information world through smart objects. SOFIA is the enabling factor of the functionality descibed in this paper. An short evaluation was done on the relevance of applying game elements to improve environmentally responsible behaviour. The evaluation showed that the design had a positive effect on raising the awareness of children about their ERB .

INTRODUCTION

People are leaving an increasingly noticeable environmental footprint on the planet. The causes and effects of this footprint have been the subject of many scientific studies, but remain a source for much debate and development. A study by Burgess et al (2008) indicates that of all the energy that people consume, 30% is consumed in a domestic setting. Further it states that roughly 30% of domestic energy consumption can be attributed to behavioural choices. By stimulating more Environmentally Responsible Behaviour (ERB), our energy consumption can be reduced by up to 10%. The purpose of the work presented in this paper is to look for new ways to improve people's ERB through product design.

This paper aims to contribute to both the fields of serious gaming and motivating people for ERB. During the last couple of years a number of very popular multiplayer network games have emerged. MORPGs (e.g. World of Warcraft), are very well designed for attracting and sustaining people's interest and providing them with the motivation to play for many hours a day. The qualities of such games could be used in other situations to stimulate certain behaviour in people (McGonigal, 2010). A possible way in which game elements can be applied in the area of ERB will be described next. The contribution of this paper is to suggest a new application of game elements in design, in order to improve people's motivation for ERB.

DESIGN

The work presented in this paper is part of the ongoing research in the context of the SOFIA project[1]. SOFIA (Smart Objects for Intelligent Applications) is a European research project addressing the challenges of the Artemis sub-programme 3 on Smart Environments. The overall goal of this project is to connect the physical world with the information world, by enabling and maintaining interoperability between electronic systems and devices. Our involvement in the project includes developing smart applications for the smart home environment, and by developing novel ways of user interaction (Van der Vlist et al, 2010). In this context, devices in a home environment can be connected to each other and exchange information. The SOFIA project provides the middleware infrastructure for these connections, enabling device interoperability and information exchange (Niezen, 2010). This enables us to use existing interaction data in the environment as well as information captured by various sensors as input to our design.

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[1] www.sofia-project.eu

2.1 Design description

Using these advances as enabling technologies,a product was designed for such an environment that would improve people's ERB by raising awareness of energy consumption. The product consists of local feedback devices and a central feedback device. The local feedback devices give direct feedback to the user on their consumption and the central feedback device gives overall feedback on ERB of the different people in a household. The overall feedback is represented by a tree and the trees are placed together in a "garden". These trees consist of building blocks and each individual user can construct their personal tree in any way they want. There are 3 different kinds of building blocks (straight, angled and split pieces) and they provide endless building possibilities. The amount of building blocks and thus the size of the tree represents the user's personal effort on reducing resource consumption. The user can earn building blocks with good ERB and direct feedback on ERB is given by the local feedback devices (triggers). These triggers show when the user earns points for ERB by changing shape and standing upright. These points are represented by lights in the building blocks for that person's tree. When all building blocks are lit up, the user can add a piece to it.
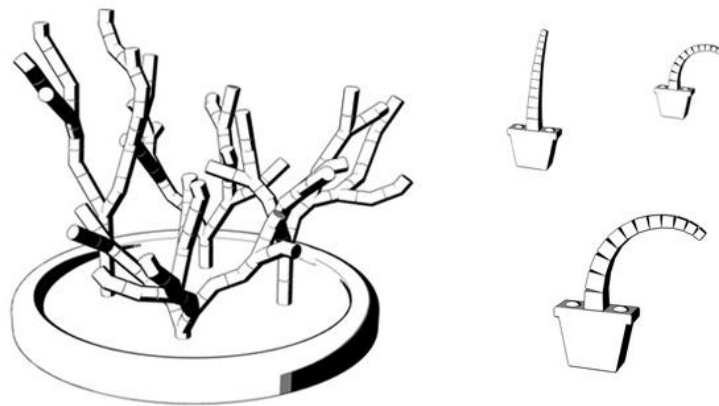

Figure 1. A garden with several (personal) trees and several triggers

The target group of this design are families with young children (8 - 12 years old). Children at the age of 8 are getting to a stage of cognition where they can make sense of cause and effect of their actions (Schlottman, 1999). The involvement of the entire family adds to the social aspect of (extrinsic) motivation. The aesthetics of the design are based on a plant/tree metaphor. This metaphor is associated with our natural environment and the better the ERB of the user, the larger the tree will grow. Each domestic device connected to the SOFIA platform can communicate information on who is using it, and how much resources that person consumes. This is the foundation for the interaction with the design. The input for user interaction will be everyday interaction with domestic appliances (e.g. shower or television). The feedback is facilitated by the design as is explained in Figure 2.
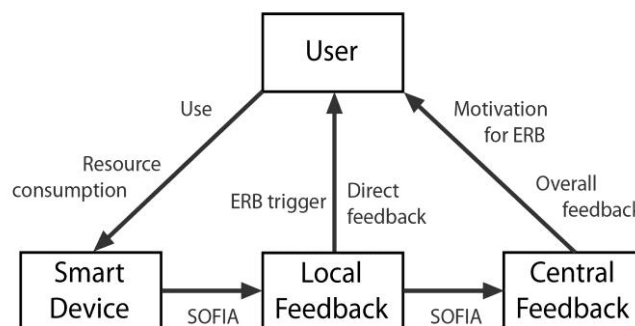

Figure 2. Model of the User interaction with the design

2.2 Game elements

The design contains game elements, which are derived from on the work of Chatfield (2010). Chatfield has abstracted the qualities of games into basic elements that make (online multiplayer) games so engaging to play. These elements were implemented in this project to create motivation for ERB:

- Gaining levels: the size of the tree represents the level of good ERB from a person.
- Long and short term goals: A trigger represents a short-term goal and the illuminated building blocks and size of the tree represent the long-term goals.
- Always reward effort: users get rewarded for trying to behave well.
- Rapid, clear and frequent feedback: A trigger responds to each resource consuming event.
- An element of uncertainty: The user does not know what kind of building block (s)he will get next.
- Involving other people: users can compare their trees and compete for the best building results.
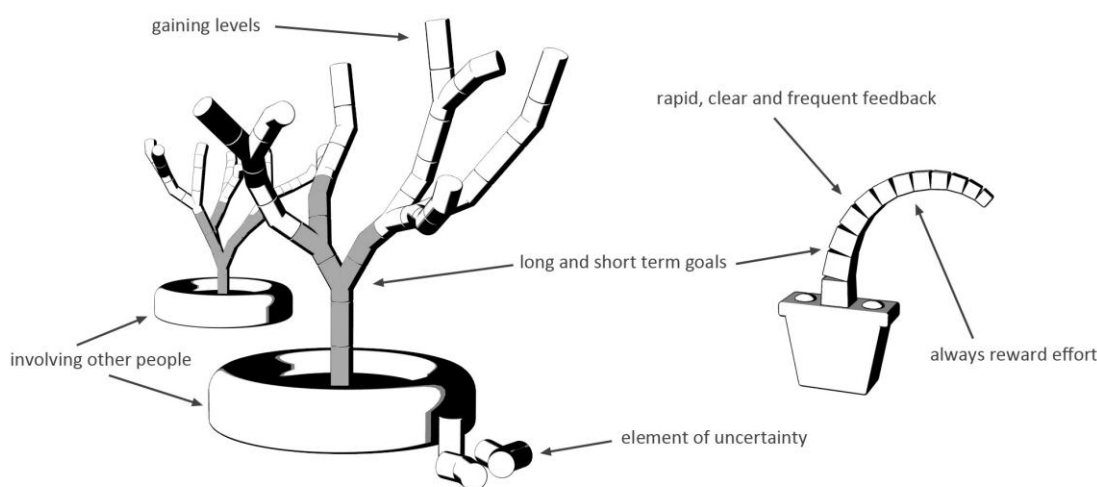

Figure 3. Visual representation of the implementation of game elements in the design

USER EVALUATION

3.1 Setup

A small-scale user evaluation was executed to evaluate two main motivating aspects of the design: competition with other people and building a personalized tree. The evaluation was done with 5 people from the target user group (children between 8 – 12 years old). These children were all Dutch and either in the final years of primary or the first years of secondary school. The evaluation was performed in a home situation and the results were recorded with a camera and by taking notes of events and comments. The evaluation was performed with a prototype of the tree that allowed the participants to build a tree out of building blocks. This prototype consisted of a base unit and 30 building blocks, which allowed for complete freedom to build a unique tree.

3.2 Procedure

The test started with an introduction to the design and how the participants could build their own tree later in the test. The purpose of this introduction was to test whether the prospect of building this tree (later in the evaluation) would motivate the participants to think about ways in which they could improve their ERB. The

competition element was evaluated by having each participant build their own tree and compare them in the final discussion. The next step was a questionnaire about ways to improve ERB. Each right answer would result in a point, and for each point a participant would get two building blocks to build a tree with. After the questionnaire each person was asked to build a tree, and in the end the child with the nicest/biggest tree would "win". Judging the beauty or quality of a tree is arguable, but for this test its purpose was to create the element of competition between the participants. In the discussion the nicest tree would be chosen by voting.

Figure 4. Different building results of combining the 3 basic building blocks

3.3 Results

Five children participated in the test and their correct answers are shown in table 1.

Table 1. Results of the questionnaire about ways to improve ERB

Participants	Age & Gender	ERB improvements
Mario	11 Y/O; male	**7** points
Siem	9 Y/O; male	**9** points
Evi	10 Y/O; female	**9** points
Huub	10 Y/O; male	**8** points
Dimme	11 Y/O; male	**9** points

Building the trees was a fun experience for all the children. It was a social process, where they advised and commented on each other's trees. Every participant tried to make their tree unique and as different from the others as possible. The prospect of earning building blocks and building their own tree was a big motivation for the children and they were very concentrated on thinking of ways to improve ERB.

CONCLUSION

4.1 Advantages
The way in which the game elements were implemented in the design was engaging for the children. Both the competition and the building of the tree were a good stimulation to get children to think about ways they could reduce their environmental footprint.

4.2 Limitations
The preliminary evaluation performed was informal and it could not be used as hard evidence that the game elements really improved ERB and if so, to what extent. Whether this would really lead to significant and sustained behaviour change is something that needs more research. This is a work in progress and a more formal study on these issues is scheduled for the coming months.

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