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# Family Interaction for Responsible Natural Resource Consumption

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**Abstract**

In this paper we propose a novel approach to persuasive technology, based on children-parent interaction, to be implemented in a smart pad ludic application; to contribute to the natural resource consumption problem, not only by raising awareness, but by encouraging informed decisions on their use. We conducted a survey to see which natural resources are more relevant to Japanese society. We designed an attractive multimedia tool, considering the family interaction, that uses eco-visualizations, a narrative and cartoon characters. If successful, we would achieve better informed consumption of food and other natural resources, reinforcing positive attitudes within the family.

**Keywords**

Persuasion through children-parent interaction; family-centered design; sustainability; natural resource consumption; persuasive technology.

**ACM Classification Keywords**

H.5.2 [User interfaces]: User-centered design.

**General Terms**

Design, Human Factors

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## Introduction

This paper describes a novel approach to persuasive technology, based on children-parent interaction, to take advantage of the prime role that families represent on the final equation for reaching an endurable lifestyle as individuals. Persuasive technology is technology designed to change the attitudes or behaviors of users, through social influence, without coercion [4], and is known to support environmental sustainability [7]. For our research, we conducted a background study, to learn about Japanese family habits related to resource consumption. We designed an interactive multimedia tool for smart pads, for children (ages 4 to 12) and parents, that makes use of attractive characters, a narrative and eco-visualizations to facilitate and encourage children-parent cooperation to achieve sustainability through informed consumption. Our research differs from Bartram's work [1] on the fact that our approach is based on the family bonds rather than on the response of individuals, ours is designed for small children and parents, we do not use electronic sensors, and we cover the food wasting problem. Although there is a large number of literature regarding the role that individuals play in sustainability, and the importance of parents to influence children to achieve sustainability at home, little has been devoted to the impact of children influencing their parents and their perspective on the matter [5]. We chose to develop a game, because ludic applications have been proven to support behavioral change [4, 8].

Ecological policies, lifestyles and standards have been developed, providing technology development fertile new grounds of focus. While issues such as alternative energy generation, electricity consumption regulation, affordable natural supply utilization at big scale, etc.,

have taken the spotlight on the research community, in contrast, the at-home reasonable use of non renewable resources remains still a fairly unexplored area, with some exceptions [7,8], and particularly little has been done about at-home food utilization [4]. The case of food wasting attracted our attention, specially after famine in Africa has increased over the last months. A concern we had, when deciding the attributes and functionality of the application, was the difficulty to appeal to both children and parents as individual users in the long term, due to their different characteristics. One cannot talk about sustainability without making considerations for the perpetuation of a good conduct over a considerable amount of time. Therefore, we envisioned a game [3,8] to contribute to the food waste problem, to make the learning a fun experience.

## Background study

To learn about Japanese family dynamics – both as individuals and as a collective, regarding natural resource consumption, a multiple choice survey and interviews were conducted. Our intention was to get a clear idea about which goals families establish as units, and which activities encourage them to play active roles in the formation of their members. The questions on both were divided into two sections: about the subject's habits, at home and on public, and about their attitudes towards natural resources and their involvement in having an eco-friendly house. Our participants consisted of 31 subjects, 22 males and 9 females, Tokyo Metropolitan area residents, from ages 18 to 57. Each has at least 3 family members, with few exceptions – one who lives both with parents and grandparents, a couple with no children, and with more than one sibling. Those with the most interesting results were called to the interview session.

The first section gave us a portrait on the subject's regular use of food, electricity, oxygen and water, etc. Over 87% of the participants responded that they do not eat all the food in the refrigerator, and 52% admitted to throw away leftovers. Regarding electricity, 97% make from moderate to heavy use of their microwaves at home, and 48% utilize their washing machine more than 4 times per week; about water use, 68% said to spend over 10 minutes to take a bath. When asked about what space, public or private, is most important to save natural resources and to have a nature friendly attitude, 49% considered their house, over 16% for public spaces such as parks or public buildings, 16% for university and schools and 19% for work spaces. It is important to notice that just one participant wrote 'factories' to option E (others).

The second section was about the perception of their interaction with the environment, and their notion on Eco-friendly programs. 74% answered to have taken few to any measure at home to promote proper natural resource use, despite of the 73% who believe that their personal consumption directly affects the environment. Out of the total, 58% conceive food and water as the most important natural resources over elements for the production of energy (32%), oxygen (7%), plants and animals (3%). 81% had heard at least few Eco-friendly campaigns on different media outlets. Finally, when asked about their opinion on the use of an application to help them learn about the environment 81% answered to be very to mildly interested. The interview was conducted with four families of two or more children, except for one with only a newborn. "I always end up buying more than we need", "I always forget what I have in the refrigerator" said a interviewee, who owns a restaurant in town. A family of the suburbs,

with two boys over 18, said to value open spaces, thus have many plants at home, "Sometimes I have to go and buy the groceries", said one of the sons, "we make an effort to not spend much electricity after the earthquake, but I never thought about water or food" said the mother. "It is hard to take care of everything when having small children", mentioned a father of two when responding if their children were aware of the importance of natural resources. "I have never used the washing machine", answered a girl when asked about her role in house chores. The study gave us a good depiction of Japanese families' habits and their knowledge of the food waste problem. It also showcased other possible scenarios for persuasive application developments, on which families could learn more about how to use natural resources efficiently.

### **Sustainability in the family context**

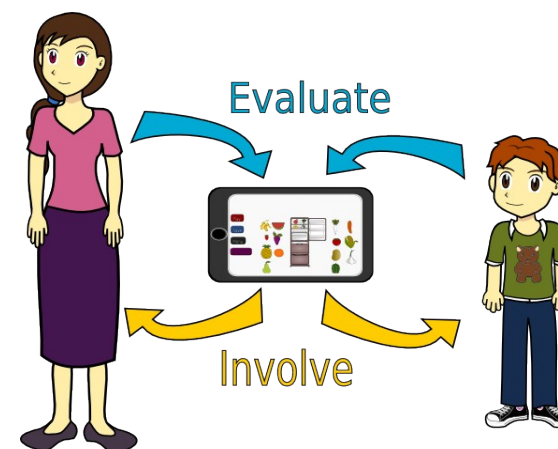
Families determine the formation of their members. The different sets of relations (parent-child, brother-sister, etc.), the various opportunities for feedback, the characteristics of every person and the establishment of group goals, all common to normal family interaction, are situations in which the use of persuasive technology can clearly have a positive effect [3,6]. However, as seen on the background study, the perception that individuals have of their own at-home habits, and its relevance to the environment, differs from the postures they take in public. In order to produce a change in attitudes and behavior, to support sustainability, we decided to use a participatory educational scheme in a game, both fun and interesting, making use of evocative displays and frequent feedback, to facilitate interaction, goal setting and learning, as opposed to only raise their awareness [1,4].

### Children - parent interaction for persuasion

We envisioned a novel approach to persuasive technology, making use of the strong bond between parents and their children, and basing its design on the way that users interact with each other and the application. Various researchers have pointed out that, despite of their differences – physical, intellectual, formative, etc., families have a strong influence over their members [3]. We decided to work with young children because we consider them to have more potential for a good eco-friendly formation. Our goal is to use children to persuade the parents and parents to persuade the children, by constant mutual evaluation, role-changing, and involvement, to learn from each other and to collectively reach mutual goals, using an educative eco-visualization format. Figure 1 illustrates the interaction of the game, designed for children ages 4 to 12 and their parents.

We propose that for every task in the game, both parent and child (one of each or more) are asked to participate actively. Instead of having the software evaluate the performance of every individual, parents are asked to evaluate their children and children must in return evaluate their parents. That is, in order to continue to the next step or section in a level, the child must ask his/her mom or dad to provide a grade and a confirmation key for completion. Whenever a parent has to do an activity, it is then the child who evaluates and gives a grade. We believe that this form of active group cooperation allows for open discussion, goal sharing, and interaction within the family. We involve children in parent activities, through role changing. For example, we ask the child to rearrange what is on the refrigerator in order to use it for the next meal, to make a shopping list, to cook, etc. We also ask the

parents to get more in contact with the way that their own children understand house chores, by requiring them to complete activities cooperating with the kids. Mutual evaluation and involvement has the potential to favor the communication between family members, as well as to increase the interest of users on the activities presented to them.



**Figure 1.** Sketch of the interaction on the game.

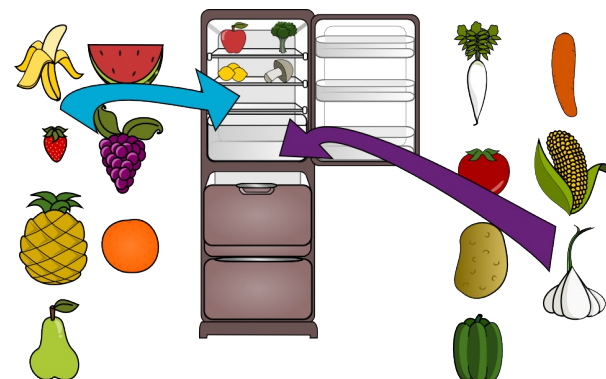
### A change of attitude

We are currently developing a game on Objective C, to be used on smart pads. The advantage that smart pads represent to interactivity, together with their ease of use, allow for a visually pleasant performance and quick feedback. As previous research points out [4,8], normal activities, and in particular persuasion, are benefited by ludic applications. Our goal with the game is to increase the interest of users on the food waste problem, by informing them about food production, distribution and its proper use at-home. We also share with the users information on how a good selection of

food for consumption has a positive impact on the health of a person, the community and on the planet [2]. With the game we do not intend to replace the normal interaction between parents and children, but to take advantage of the bond and other implications of their relationship to benefit the perpetuation of positive attitudes and to motivate the usage of the information we present. The game makes use of eco-visualizations to reflect the activities and spaces in a house that are more relevant to natural resource use. Eco-visualizations (EVs) are interactive devices that display the use of natural resources in order to foster sustainable behaviors [5]. The 'refrigerator challenge', first level of the game, is an EV for the food waste problem at home, meant to contribute to sustainability through informed consumption. Two other levels, currently under construction and usability tests, are the 'shopping quest' and the 'cooking battle'.

Figure 2 shows a sketch of the refrigerator challenge, where the child is asked to fill in a virtual refrigerator with fruits, vegetables and other products that he or she thinks are necessary in a healthy diet. When completed, the tool presents the concepts of nutrition, food production, among others. After that, the child is requested to fill in the refrigerator based on the new information. Parents are invited to supervise the actions of the child, evaluate his or her overall performance and share information on the food in question - i.e. name, interesting facts, etc. A novel characteristic of the game is that all the food stored on the virtual refrigerator has an expiration date, similar to what it would be in the real world. This allows us to teach children how food tastes better when consumed early. Any suggestion, as well as the following levels of the game, use this information to persuade the users to eat

food on time. The shopping quest is based on an informed food buying scheme [2], with the particularity that it takes into consideration the food placed in the virtual refrigerator, and expiration dates. The goal of the shopping quest is to persuade the families to buy only the necessary food to prepare specific meals, based on recipes chosen by the application, considering what is available in the virtual refrigerator.



**Figure 2.** Sketch for the 'Refrigerator challenge'

The quest consists in generating a family's shopping list – groceries only, in order to find the cheapest and least effort consuming options. Instead of having the family members compete with each other to win at every level, they are asked to cooperate to reach both the individual and group objectives [6,8]. For every task successfully completed, a visual reward is provided, such as a video, and/or points for the individual and family counter to contribute to persuasion by goal setting.

Cooking, although necessary in familiar context, can sometimes be seen as a hard task due to diverse factors [2]. To facilitate this, we seek to interest the

children in helping their parents on this activity, through the 'cooking battle'. The blueprint for this level is based on a competition between a virtual family and the user's family, with special challenges and rewards after completion. A cartoon family was designed, taking into consideration the style of Japanese animation to make the game more attractive for users. The refrigerator, as well as other cartoon elements like the fruits, vegetables, etc., are based on what is available in Tokyo, Japan. With the narrative of the game we seek to reflect the everyday life of an ordinary Japanese family. The provided interesting facts as well as the instructions, have been developed in Japanese. Other technical and functional details are still being discussed.

### Conclusions and Future work

We are developing a tool, which uses a novel form of persuasive technology approach, based on children-parent interaction, with attractive cartoon characters, a narrative and eco-visualizations. We conducted a background study, to learn about food and other natural resource consumption, and the family members' roles at home regarding eco-friendly living, in the Japanese context. We see a need for persuasive technology frameworks, that take family members and their relationships into account, considering their different preference or behavioral patterns, to contribute to ecological sustainability through education. As future work, we intend to conduct user studies and other evaluation methods to value the effectivity of our approach and its contribution to collectivist forms of persuasion, and if successful, work on a version for different cultural backgrounds. Some of the challenges we expect to have are related with the determination of a proper audience, as the activities

must be in accordance to the age of the children. We also hope to be able to develop challenges for teenagers and/or adults to play on their own, while emphasizing the importance of involving all family members to achieve goals as a group.

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