

# Designing Persuasive Applications to Motivate Sustainable Behavior in Collectivist Cultures

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## ABSTRACT

Until now, many kinds of persuasive applications have been developed, and most of which are used by individuals for personal benefits, example includes better healthcare, better lifestyle and so on. However, one application area that is yet to be explored effectively is persuading users for preserving shared resources including environmental conservation. Unlike existing persuasive applications, these applications do not aim personal benefits and consequently requires radically different persuasion techniques. In this paper, we apply knowledge of cross-cultural understanding to this kind of persuasive applications. We introduce five design strategies for persuasive applications that could be used especially in collectivist cultures. These strategies are *organizing group*, *anonymity*, *mutual surveillance*, *development of mutual aid*, and *combine use of positive and negative feedback*. By sharing our experiences of building persuasive application for reducing CO<sub>2</sub> emissions named *Ecolsland*, we expose how these five design strategies could be applied in persuasive applications. The application encourages users to do eco-friendly activities for reducing CO<sub>2</sub> by offering game like feedback. The results of our experiment that recruited 6 families / 20 persons and took 4 weeks show that two design strategies, *mutual surveillance* and *combine use of positive and negative feedback* worked effectively based on the number of eco-friendly activities one participant in each household reports and questionnaires.

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Keywords: *individualist, collectivist, behavior change, persuasive technology, green activity, sustainability, cultural difference.*

Paper Received 30/04/2010; received in revised form 20/11/2010; accepted 30/11/2010.

## 1. Introduction

As we have known that it is difficult for human being to govern himself, there have been developed many ways to motivate behavioral change. Parenting is one of the most ancient methods to shape children's behavior. Health maintenance issue

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Cite as:

Kimura H., Nakajima T. (2011). Designing Persuasive Applications to Motivate Sustainable Behavior in Collectivist Cultures. <i>PsychNology Journal</i> , 9(1), 7 – 28. Retrieved [month] [day], [year], from <a href="http://www.psychology.org">www.psychology.org</a> .
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including dieting and discontinuation of smoking is one of the biggest applied areas in recent years. One of the biggest difficulties to change human behavior is that there has been large temporal gap between users' action and its consequence. For example, even though every people understand that smoking increases the risk of developing lung cancer, they tend to continue smoking because their lungs do not get worth immediately. Nowadays it has been popular to use computers in order to change human behaviors. For instance, computers make people know future possible events (e.g. lung condition) by using simulation techniques. This approach is sometimes known as *captology*, using computers as persuasive technologies (Fogg, 2003).

In many cases, people often need incentives to change their own behavior, and there have been sought various types of incentives for that. Needless to say, material or economic incentive is one of the powerful and familiar one. Credit card reward program is generally designed for encouraging consumption. The widespread use of digital money using near-field communication (NFC) shortens the transaction time and prevents miscalculation at cash registers by providing consumers with airline miles or cash-back (Mainwaring, March, & Maurer, 2008). Yamabe and colleagues (2010) proposed two economic incentive models to change behavior using electric payment systems. Psychological incentive is another one to provide motivation for changing behavior. Praising a pupil for his outstanding accomplishment is a good example. S/he may be filled with a feeling of accomplishment and be motivated to study harder. Other pupils who watched the praised pupil might study hard also to be praised. Moreover, setting a goal has a strong persuasive effect to encourage desirable behavior. When a user defines an explicit goal, s/he pays an attention and makes an effect for encouraging desirable behavior. Locke et al. described that tight deadlines lead to more rapid work pace than loose deadline in a student's lab work (Locke & Latham, 2002). Midden and colleagues (2007) discusses the use of goal setting in persuasive applications, and they reported that the effect is very strong for persuading environmentally sustainable behavior. A large number of existing persuasive applications use goals as a persuasive technique. These applications give rewards when users meet the goals for increasing their motivation. UbiFit Garden (Consolvo et al., 2008) is a mobile, persuasive application to encourage users to maintain the desirable level of their physical activity in everyday life. The application shows attractive pictures on a display when the user reaches a certain goal. Another example of psychological incentive is applying social factor. When someone else is watching, a person performs better at a task (Zajonc, 1965). This effect has been demonstrated in

many persuasive applications. Gasser et al. (Gasser et al., 2006) proposed a mobile lifestyle coaching application, which intended to improve the user's healthy behavior. When there is a strong competitor for a person, she may rouse herself to defeat the competitor. This is also a typical feature used in serious games, which are games designed for a purpose other than pure entertainment, such as education, scientific exploration, and so on (Bergeron, 2006; Chen, 2005).

In order to develop effective persuasive applications, it is important to choose appropriate incentives and to provide users with the incentives in the proper manner as well as to design right user interfaces. Recently some researches proposed design strategies for persuasive applications. For example, Consolvo, McDonald and Landay (2009) proposed eight design strategies that use psychological theories and experiences from prior persuasive applications. In fact, different cultures have different ways of thinking, which is a common sense in cross-cultural research. This must hold true for persuasions. In particular, there must be a significant difference in the persuasion technique that uses social factor (e.g. relationship between others in a community). Fogg and Iizawa (2008) reported different techniques that are used in two social networking services popular in two different societies, Facebook in the United States and Mixi in Japan. However, most of the existing researches about persuasive technologies have been carried out based on American culture, one of typical individualistic one (Khaled, Biddle, Noble, Barr, & Fischer, 2006).

Thus, in this paper, we discuss the differences between individualist culture and collectivist one from the standpoint of the persuasion, and then propose five design strategies for persuasive applications that could be used in collectivist societies. The rest of this paper is structured as follows: In Section 2 we show the difficulties in changing behavior for society or unrelated persons and the differences between individualist society and collectivist society. In Section 3 we discuss persuasion techniques for promoting public interests that could be used especially in collectivist societies and propose five design strategies. In Section 4, in order to demonstrate how to apply the five design strategies, we introduce a persuasive application for encouraging users to reduce CO<sub>2</sub> emission designed especially for Japanese, a non-individualist country, which is named *EcoIsland*. After that we present lessons learned from the application. Finally we discuss directions for future research.

## 2. Background

In this section, we describe following two background of our research for designing the five design strategies: 1) difficulty in changing behavior for society or unrelated persons, 2) comparison between individualist society and collectivist society.

### 2.1 Difficulty in Changing Behavior for Society or Unrelated Persons

In many cases, existing persuasive applications motivate persons to change their behavior for personal benefits. For example, a persuasive application aiming to convince individuals to quit smoking persuades their behavior change by highlighting the benefits of good health. Even though such a behavior change does not always take an immediate effect, users already know the importance of the behavior change. In other words, they understand that the accumulations of his action will take effect ultimately. Thus, it is imperative for such persuasive applications to provide users with a sense of achievement by showing what s/he has done and how close to his/her goal in order to keep him/her from getting discouraged (Fogg, 2003).

However, it is easily imagined that people are scarcely motivated for behavioral changes aiming at public benefits such as environmental protection. One of the difficulties to change users behavior for this purpose is that it does not make any sense for a person to change his behavior if others do not act in concert. Generally resources shared by a number of unrelated persons tend to deteriorate quickly in a process, which is called the tragedy of the commons (Hardin, 1968). One of the current solutions of the tragedy of the commons is governmental regulation. For instance, introducing environmental tax is expected to reduce greenhouse gas emissions or waste of resources. This is a typical example of the *economic incentive* that we mentioned in Section 1.

Previously there have been very few persuasive applications that use psychological incentives for this purpose. However, we believe that persuasive technologies have applicability to these kinds of problems by using social factors.

### 2.2 Collectivist Society

Hofstede (1996) mentioned in individualist societies are the societies *in which the ties between individuals are loose: everyone is expected to look after himself or herself and his or her immediate family only*. He also referred that the United States ranked 1st (most individualistic country), the United Kingdom ranked 3rd, and France

ranked 10th among 53 countries and regions in which IBM branch office were located. People in individualist societies are more self-centered and emphasize mostly on their individual goals. They tend to think only of themselves as individuals and as “I”. They prefer clarity in their conversations to communicate each other more effectively.

In contrast, collectivist societies are the societies *in which people from birth onwards are integrated into strong cohesive in-groups, which throughout people’s lifetime continue to protect them in exchange for unquestioning loyalty*. Most of Asian countries are collectivist countries (Japan ranked 22nd, Singapore ranked 39th, South Korea ranked 43rd), and Hofstede (1996) added the remark that collectivist countries are more common in the world than individualist countries. Collectivistic cultures have a great emphasize on groups and think more in terms of “we”. Harmony within a family or society is very important and should always be maintained, and confrontation should be avoided. Saying “no” means to destroy the harmony in the group. Triandis (1995) mentioned that it is important for people in a collectivist society to fulfill duties that have been built consensus in the society in order to accumulate virtues. They have self-identities that are strongly linked to attributes of their group. It is discouraged to behave differently from each other.

### **3. Persuasion For Promoting Public Interests in Collectivist Society**

As we mentioned earlier, it is difficult to motivate person to change his/her behavior for public interests, such as environmental protection. Besides, it does not make any sense for a person to change behavior if other persons do not act in concert. For example, if you find that many other persons litter a park with bottles and cans, you might neglect to keep the park clean.

When you think about the environmental protection, while technological solutions to reduce greenhouse gas emissions such as improving energy efficiency and developing clean energy sources are broadly applied, we still need dramatic changes in our human behavior to avoid the catastrophic climate change. World Wide Fund For Nature reported that the Ecological Footprint, which tracks the area of biologically productive land and water required to provide the renewable resources people use, and includes the space needed for infrastructure and vegetation to absorb waste carbon dioxide, exceeded the Earth’s biocapacity. It takes 1.5 years for the Earth to

generate the renewable resources used in 2007 (World Wide Fund For Nature, 2010). Naturally, there are a lot of things that ordinary citizens can do. The resource recycling to realize a zero-waste society is a good example. Separating trash to some extent enhances the resource recycling and saves a lot of energy costs of the refuse incineration. Also many airline companies including All Nippon Airways, the second largest airline company in Japan, offer carbon offsetting programs to air travelers in order to neutralize the effects of their flights on the environment<sup>1</sup>. Besides, Japan's Environment Ministry encourages every workers to wear light clothing such as short-sleeved shirts without ties, and to set air conditioners at 28 degrees Celsius (82 degrees Fahrenheit) or higher in their offices from June to September. Surprisingly, the last example works better than the second one in Japan. By referring the characteristics of collectivist society, this can be interpreted that a person cannot make sure that other people do the same in the former case. On the contrary, what made the latter case successful is that the behavior has been recognized as a good behavior in the society and a person understands others also do the same.

These examples reveal that we need to consider the characteristics of collectivist society for motivating collectivist people to change their behavior for personal benefits. From the characteristics, we have defined following five design strategies for persuasive applications that promote public interests in collectivist societies.

### **3.1 Organizing Groups**

If there is no group yet where the target behavior is recognized as a good behavior, the persuasive application must organize a virtual group where the target behavior is recognized as a good behavior. In other words, the application convenes members who are interested in the target behavior but do not move into action yet because they do not want to stray from the current group they belong to. This makes a member feels that the target behavior is acceptable in the group, and it breaks his psychological barriers to act the target behavior.

### **3.2 Anonymity**

In a horizontally egalitarian society, there is a possibility that an application user antagonizes others who belong to the same "real" group (e.g. same society) because the target behavior is not widely accepted yet as recommended behavior. Not to

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<sup>1</sup> [http://www.ana.co.jp/wws/us/e/about\\_ana/corp\\_info/pr/2009/09\\_use\\_005.html](http://www.ana.co.jp/wws/us/e/about_ana/corp_info/pr/2009/09_use_005.html)

make waves among the real group, it is advisable to provide users with anonymity on persuasive applications.

### **3.3 Mutual Surveillance**

#### *Monitored by Others*

As we mentioned, when someone else is watching, a person performs better at a task (Zajonc, 1965). Moreover, the person will perform even better if the task has been recognized as recommended behavior in the group. The important point for the person is to make others aware that the person is now accumulating virtues for the group.

#### *Watching Others*

A person in collectivist society tends to avoid isolation from the group. So watching others and confirming that other people do the same activities would lessen the person's feeling of isolation.

#### *Comparing Others*

The feature of *watching others* reveals a person's contribution in the group. When the contribution is smaller than others, the person feels the pressure to contribute more. Of course if the person feels the pressure too much, s/he would give up to contribute and to use the persuasive application itself. Thus we suggest the necessity of "mutual aid" in order to subdue the effect.

### **3.4 Development of Mutual Aid**

When a person knows someone else in the same group is placed in predicament, s/he tries to help the person. Similarly, when a person knows another person in the same group cannot contribute enough in a persuasive application, s/he would try to contribute also for the person. The most important point for the people in collectivist society is to maintain the total degrees of contribution in the group.

### **3.5 Combine Use of Positive and Negative Feedback**

Fogg (2003) emphasized that positive punishment in operant conditioning should be avoided due to ethical reasons. Consolvo and colleagues (2009) also pointed out that offering negative reinforcement or positive / negative punishment should be avoided in

order to sustain the individual's interest without making her feel too bad or it runs the very real risk of being abandoned.

However, it is unavoidable for these kinds of feedback in persuasive applications for collectivist societies because users have negative feelings when they feel not like the others. We have no guideline to know what kinds of feedbacks strike users as "negative" feedbacks. When a user neglects to do desirable behavior, of course we could design that an application does not offer "negative" feedback – for example, feedback unchanged. But the user still feels negative because s/he knows his/her neglect cause the feedback unchanged. Furthermore, giving negative feelings while training such as scolding is widely accepted in collectivist societies. Hofstede (1996) noted this is a typical characteristic of many collectivist countries.

In addition, Midden and Ham (2009) reported that negative social feedback provided by an embodied agent, iCat, had the strongest persuasive effects even though the experiments were conducted in an individualist country, Netherlands (ranked 4th).

#### **4. Ecoland: An Application For Encouraging Users to Reduce CO<sub>2</sub> Emissions**

In order to confirm that our design strategies work effectively, we developed a persuasive application for encouraging users to reduce CO<sub>2</sub> emissions. The target users were people living in Japan, a non-individualist country.

There have been some existing persuasive applications to reduce ecological footprints. For example, Mankoff and colleagues (2007) designed a social networking site to motivate individuals to reduce ecological footprints. However, this application was not explicitly designed for collectivist cultures even though it also used social incentives to motivate users.

*Ecoland* is a game-like application intended to be used as a background activity by ecologically minded families in the course of their normal daily activities. The application was designed for being installed in the living room or another prominent place in a household.

##### **4.1 Basic Concept**

Some experts say that greenhouse gas emissions, such as CO<sub>2</sub>, contribute significantly to global warming. They also believe if current trends continue, global sea levels will rise by a meter or more by the end of the century. Needless to say, the

Japanese people understand that rising seas pose serious threat for their country because Japan is an island country. Therefore most Japanese know that we need to reduce quantities of the greenhouse gas that are released into the atmosphere. The application mimics this situation.

The objective of the application is to save virtual island from loss of land through rising sea levels by reducing the amount of greenhouse gas that each household emits. To give a responsibility to all users, we designed that each household owns one virtual island, and the family members are represented as avatars on the island (Figure 1). Each household sets the amount of greenhouse gas to be reduced, and the application tracks the approximate current amount of greenhouse gas by using self-reported data. If they fail to reduce the emissions enough, the sea level around the island rises corresponding to the excess of the emissions. Users can report their own green activities via their mobile phones or PC web browsers. On the phones or browsers, users have a list of activities that take to reduce the emissions: turning down the air heater by one degree, taking a train instead of a car, and so on. After reporting activities, the sea level reacts accordingly. Users can see nearby islands and activities as well as their own islands. Then they can list sell and buy offers for emission rights on a marketplace. Trading is conducted using a virtual currency *EcoPoints* earned by reporting green activities. The credits are also used to buy virtual items to decorate their islands. So successful sellers can afford to decorate their island more, while heavy emitters have to spend their allowance on emission rights.



Figure 1. Ecoland main window.

#### 4.2 How Each Strategy Applied

In this section, we describe how we applied each design strategy to the application in detail.

### *Organizing Groups*

Ecoland was designed for the families who were interested in environmental activities. We informed participants that other participants were also ecologically minded in our experiment. Moreover, this application brought a participant into line with other family members to save an island, which means they shared a common goal. Thus participants were able to report ecological actions at ease.

### *Anonymity*

Each household can name their island as they want, and the island name is shown on the display. Each family member in a household is represented on the island as an avatar. Even if the household behaves differently from others, others cannot identify them in real world.

### *Mutual Surveillance*

The application shows a number of islands owned by the families participating in the application. A family can observe the degree of ecological behavior of their neighbors through the visualization of the sea level of the neighbors' islands. Moreover, when a user reports several ecological behaviors, a speech bubble that describes what the user has done, appears over the corresponding avatar. Other family members as well as other households can read this speech bubble (Figure 1). Also, contribution of each family member is shown in a pie chart. The pie chart is concealed from other families (Figure 2). Also, the speech bubble inhibits users from cheating on the self-reporting. If a user reports many activities at once, other users will suspect the user of cheating because of the unnaturally expanded speech bubble. Then clicking on an avatar along the pie chart shows an activity history page as shown in Figure 3. This page shows each member's eco-friendly activities within a 24-hour period.

### *Development of Mutual Aid*

The mission in the application is to save the island by reducing the amount of greenhouse gas each that household emits, not a user emits. Even if one family member neglects reporting ecological actions for a few days due to a variety of reasons (e.g. catching a cold, travelling, and so on), remaining family members can maintain the island by reporting harder. Besides, the application prepares a remedy when none of the family members afford to report enough actions. The application

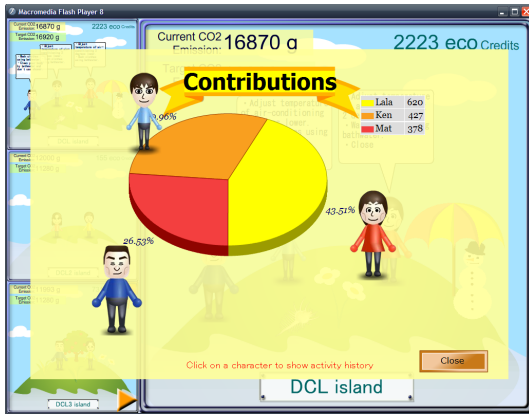


Figure 2. Each family member contribution.

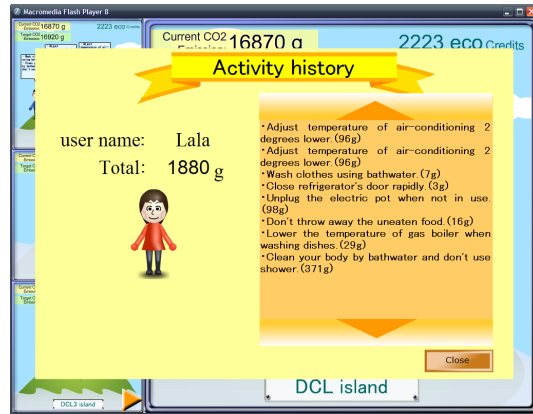


Figure 3. Each member's activity history.

offers the trading system, which is based on the same principle as the industry level emissions trading systems. A household that finds it easy to make significant reductions can sell emissions rights to households that find it difficult to make reductions (Figure 4).

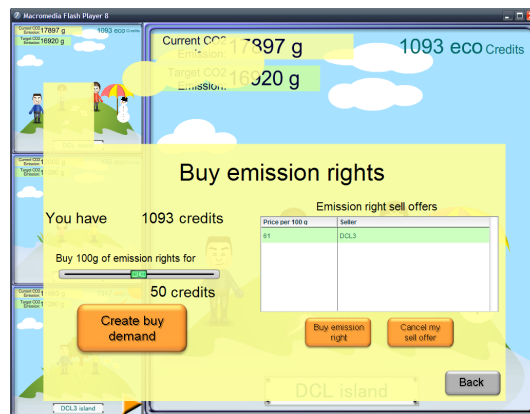


Figure 4. Emission trading system.

### Combine Use of Positive and Negative Feedback

The water around island is the most symbolic feedback in the application. When the sea level is low, users feel it as positive feedback. On the contrary, users feel negative when the sea level gets higher. Moreover, the feedback is intended to evoke the importance of ecological behavior by using the metaphor of sea surface elevation (Figure 5). Furthermore, the island decoration is another positive feedback because the virtual items for decorating island are used as rewards (Figure 6.) However, this may also effect as negative feedback when a household realizes that other islands are

more decorated than the island. Again, we cannot avoid negative feedback from the application in collectivist societies until excluding *mutual surveillance*.



Figure 5. Sinking island.



Figure 6. Buying virtual items.

### 4.3 Implementation

Figure 7 presents the overall architecture and technologies that used in our Ecoland system. The client computer that is installed in each household uses Adobe Flash to render visualization.

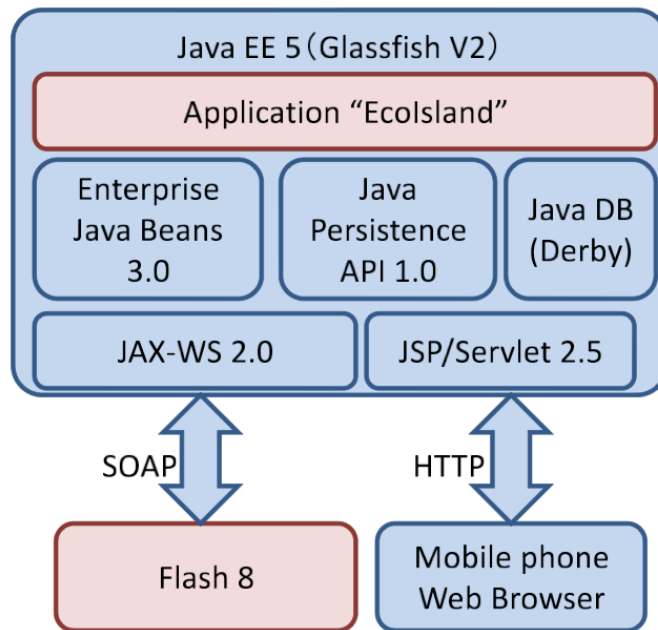


Figure 7. Ecoland Architecture.

The client offers feedback to users using data that is obtained from the Ecoland web application running on J2EE server, which is implemented in Java. The mobile

phone client uses a normal web browser to interact with the server to report ecological behavior. The system is the thin-client type: data are managed in a database on the server side, so that the client machine stores no data. Every interaction between users and the system in our experiment is recorded to be analyzed.

## 5. Experiment

In our first user study, we recruited six families known by our laboratory members, e.g. their acquaintance's families or relatives (20 persons, age 15 – 58, Male 12 and Female 8) who were interested in environmental issues and lived in a family. As the application was designed to be used in a group, all families had one or two children (age 15 – 24), five families had both parents, and one family had a single parent (age 47 – 58). They used their own mobile phones for reporting eco-friendly activities. The experiment lasted for four weeks. In the first week, we equipped the participant's air heater with a simple electricity usage meter, *Ecowatt*<sup>2</sup>. In the first week, participants did not use Ecoland. We measured ordinary energy consumption before installing Ecoland. In the second week, Ecoland was installed and only one family member from each household was asked to use it. In the third week, all family members used Ecoland. In the last week, all family members used Ecoland that contains emission-trading system between families. After the experiment, we conducted a survey in the form of a questionnaire asking about the changes in the participants' attitudes. All participants took part in our experiment gratis.

### 5.1 Results

In the survey, 17 out of 20 participants said that they were more conscious of environmental ecology after the experiment than before.

From the air heater electricity usage data, there was no significant correlation with the reported activities (Figure 8). While this is an alarming result, it reflects that the experiment period was short to measure the day-to-day variance in an electricity usage. We ran the experiment at the end of December 2007 and the beginning of January 2008, and the period might also be non-optimal because it is a holiday season in Japan. Some families were away from home for long period (pink region in Figure 8).

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<sup>2</sup> <http://www.enegate.co.jp/>

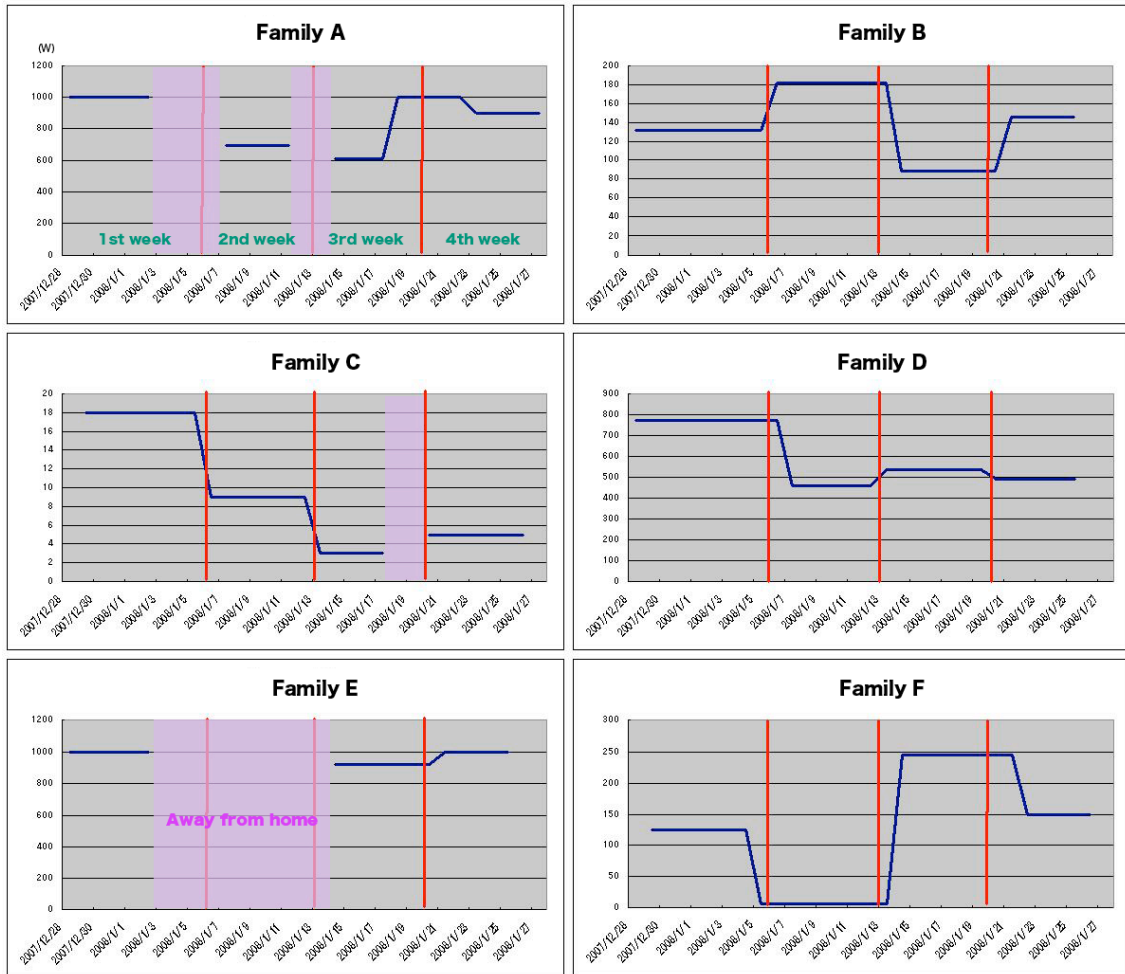


Figure 8. Air heater electricity usage data.

Besides, we had to consider about changes of weather conditions in the experiment period. Needless to say, air heater electricity usage varies according to weather conditions and others. During the experiment period, the biggest daily mean air temperature difference was 7.3 degrees Celsius (Figure 9: 10.2 degrees Celsius on Jan. 9<sup>th</sup>, 2.9 degrees Celsius on Jan. 23<sup>rd</sup>.) Given these factors, we could not derive the correlation from statistical analysis.

### Mutual Surveillance

The eco-friendly activity log (Table 1) shows that participants reported eco-friendly activities more in the third week than in the second week ( $p < .05$ ). According to the questionnaire, many participants answered that doing green activities with their family members contributed to change their environmental awareness. 14 out of 20 participants reported that they were asked to do eco-friendly behavior from their family members.

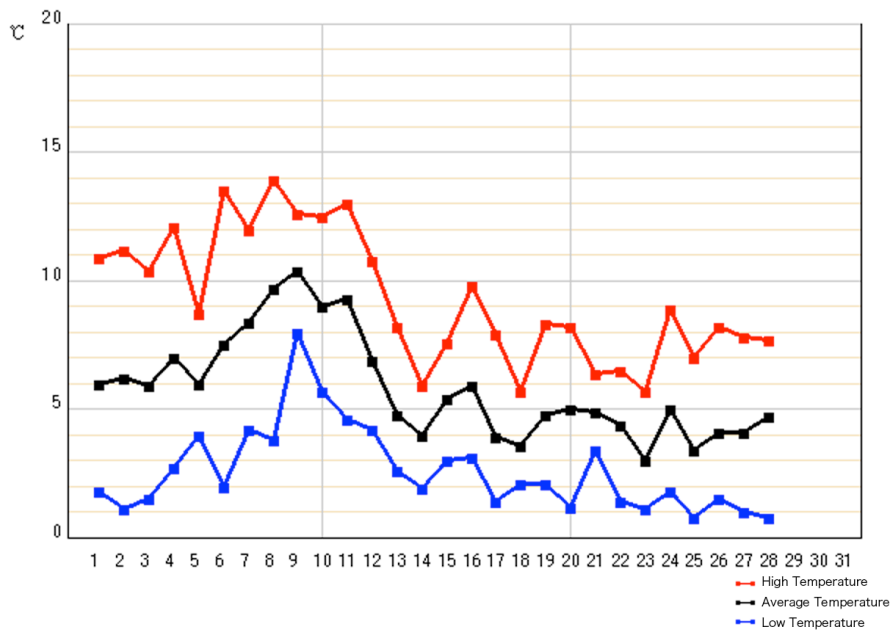


Figure 9. Temperature changes in Tokyo in January 2008.

13 out of 20 participants felt they had to do eco-friendly behavior from watching their family members did eco-friendly actions. Moreover, 14 out of 20 participants reported that the application promoted the communication within their family. The fact supports that one of our strategies: “mutual surveillance” especially between family members could be used effectively. On the contrary, however, displaying users’ activities in a speech bubble had a little impact in this experiment, because the font size of the bubble was too small to recognize in the current application, which was pointed out by four participants.

Household	A	B	C	D	E	F
2 <sup>nd</sup> week	99	46	21	11	26	97
3 <sup>rd</sup> week	132	53	20	16	52	141

Table 1. The number of eco-friendly activities one participant in each household reports.

People tend to compare themselves to the others especially when they are looking at the same goal. 12 participants reported that they cared about the sea level of other islands. Some participants said that a user had a feeling of superiority if another person’s achievement was less than the user’s achievement. This suggests, we think, mutual surveillance effects a promotion of competition with others even in collectivist societies.

### *Mutual Aid*

The target reduction of CO<sub>2</sub> emissions was fixed to 6 % of the average Japanese CO<sub>2</sub> emissions (Japanese government conducted a campaign against global warming aimed at cutting greenhouse gas emissions by 6 %). 10 participants expressed that the target was easy to be accomplished, but 5 said it was somewhat difficult.

In this experiment, however, only 2 out of 6 household (this means only 1 pair) used the emissions trading system. Participants mentioned that it was confusing and not necessary. This was simply because the participants who achieved the target reduction without difficulty earned enough EcoPoints already. So most participants had no reason to use the trading system. The cause of the failure was that participants could not work other economic activities to earn EcoPoints in the application unlike real emission trading systems.

### *Combine Use of Positive and Negative Feedback*

19 participants said that the feedback of sinking virtual island contributed to the change in their attitudes, which proved that even negative feedback made a satisfactory effect. However, the application could not encourage intrinsic motivation for eco-friendly activities, since some participants said that they felt motivated by explicit incentives, such as saving their sinking virtual islands (19 participants), purchasing virtual items (14 participants) and amassing EcoPoints (14 participants) rather than ecological reasons. Though this is an extrinsic reason, this must be an important motivation in getting started for continuous use of the application.

14 participants mentioned that earning EcoPoints by reporting eco-friendly activities contributed to behavior modification. They said that buying virtual items and decorating his/her island increases the motivation for acting eco-friendly activities. From interviewing, we found that some participants felt earning EcoPoints itself was an incentive while others felt collecting virtual items was an incentive.

## **6. Findings from the Experiment**

### **6.1 Cooperation, Competition, and Sense of Pride**

In our experiment, we observed that our strategies promoted double-barreled effects. One is cooperation with other participants, and the other is competition between participants. While the application showed other families' status as the sea level, pie

chart, and speech bubbles in order to promote aiding others, at the same time, the situation may provide the other family with a sense of inferiority. However, interesting point here is that no participant felt a feeling of strangeness in the coexistence. No participant abandoned our experiment. On the contrary, from the results of our questionnaire, participants reported that sea levels of other islands as well as cooperation with family members motivated them to behave in more sustainable way.

Consolvo and colleagues (2009) emphasized that offering negative reinforcement or punishing should be avoided in order to sustain the individual's interest without making her feel too bad or it runs the very real risk of being abandoned. From our experiences, however, offering only such serene and fine feedback tends to get participants bored. Naturally, it takes long time for people to achieve the goal that persuasive application set (if not, persuasive application is not needed). If using a persuasive application ends up a routine work, the user would get bored with the application soon. Thus we believe that persuasive application must try various expedients to keep users from getting bored. Though promoting cooperation or competition itself is not the purpose of persuasive application, it is necessary feature for users to continue using application for long periods.

On the other hand, we should avoid excessive use of sense of pride in collectivist cultures. Mankoff and colleagues (2007) suggested a SNS web page design to show how a user reduces CO<sub>2</sub> emission in his/her profile page. In fact, this may show the user stand out from the others, but this may not motivate others to do more. On the contrary, the user may be considered not to be in the same group.

## **6.2 Design for Feeling Closer to “Commons”**

As we mentioned earlier, environment concern is one of the typical examples of the tragedy of the commons. To date, many solutions to the tragedy of the commons have been argued. One solution is to convert a common good into a private property, giving an incentive to the new owner to enforce its sustainability. Our approach used in the Ecoland was similar to this solution. We introduced a virtual island shared by a household as an asset worth protecting. Participants were required to do ecological actions in exchange for decorating their islands.

What the notable point here is that participants were motivated even though the asset was *not* real thing. Though it is difficult to choose the solution in real world unlike common meadow because it is impossible to slice CO<sub>2</sub> emissions like a pizza, it seems useful to make the link between real action and virtual change.

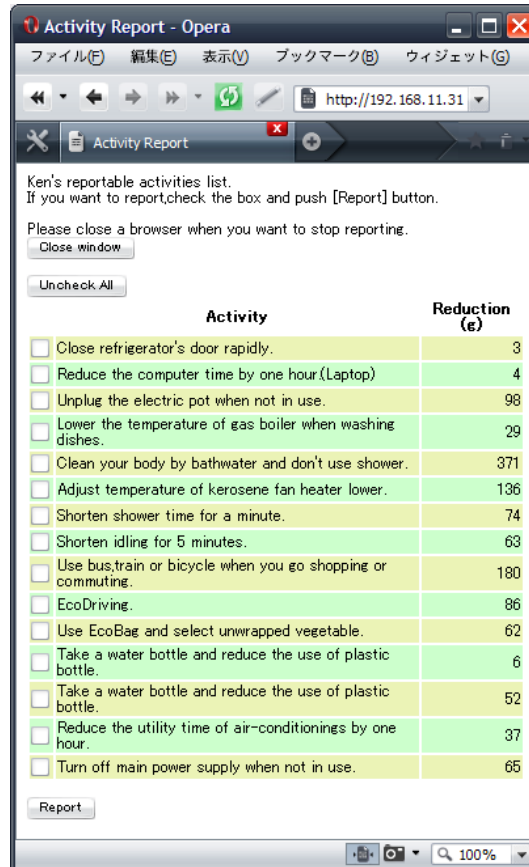


Figure 10. Activity report page.

### 6.3 Teaching Proper Behavior

As we mentioned earlier, we adopted self-reporting style in the application (Figure 10). 4 participants mentioned that the self-reporting was somewhat burdensome because of the need to input activities manually every time. In fact this is true, and it is one of the issues that we need to make it to be improved. However, it does not simply lead that the sensor-based detection is the best way. Results in the experiment shows that presenting activities in a list was useful for teaching what kinds of activities were eco-friendly. Although we recruited the participants who were interested in ecology, 16 out of 20 participants did not act any activities that were not specified in the activity list. This means that it was necessary to show users eco-friendly activities in order to motivate behavior change. In addition to getting interested in environmental sustainability by using this application, the increase of the knowledge about sustainability is considered to come from the list shown directly to the users. It enabled users to educate the importance of the activities that they did not know before. 15 out of 20 participants expressed that their knowledge about green activities has increased, which could not be possible if the system uses the sensor-based detection. This was

not explored well because most of the target behaviors that existing persuasive applications have been motivated are not so difficult to do without special knowledge.

## 7. Future Possibilities

### 7.1 Experiments in Individualist Societies

We have not conducted an experiment in individualist society. Naturally we recognize the need for re-designing the application and conducting the experiment. Though we designed the Ecoland especially for collectivist cultures, we think some ideas used in Ecoland can be applied to individualist society. For example, design for feeling closer to commons must be strongly desired in individualist society. We feel offering negative feedback in moderation may function as both promotion of target behavior and keeping interest in the application. In contrast, we cannot expect how effective the first and the second strategies, *organizing group* and *anonymity*.

There is a popular green application on Facebook, named “I Am Green<sup>3</sup>”. The application gives a user a leaf after the user do an ecological action, which feature is similar to our application. However, the application has another feature that promotes a user to call for others to be engaged in the green activities in order to leverage social influence (Figure 11). Also this application shows the number of leaves on the user’s profile page. This feature is definitely contrary to our design strategies. Though it is difficult to make collectivist people (such as Japanese) use this application due to the linguistic barrier, it is absolutely essential to conduct a comparative experiments.

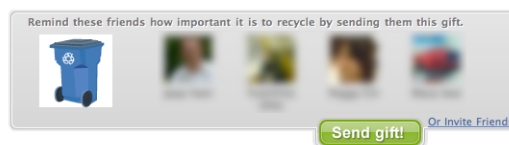


Figure 11. “I Am Green” screen.

### 7.2 Psychological Consideration of Group Feedback

There have been some psychological researches about group feedback. But most of them could not draw conclusions on the effects of group feedback alone. For example, Slavin, Wodarski and Blackburn (1981) showed that group contingency can reduce electricity consumption in master-metered apartment buildings. In this research, participants received a reward as well, so not all of the effects could be accounted for

<sup>3</sup> <http://apps.facebook.com/iamgreen/>

by group feedback. Though our experiment also gave EcoPoints as rewards (even virtual currency), it is easy to change the application setting not to give rewards. Even if a group performs better without rewards, the result must make an impact in psychological research.

### **7.3 Introducing New Technologies**

One of the basic persuasion techniques mentioned by Fogg (2003) is providing a way to bypass complex procedures. However 4 participants mentioned that the self-reporting was burdensome because of the need to input their activities manually. Though it is difficult currently to introduce automatic activity detection because target activities are complex and wide-ranged, we need to investigate lightweight methods to report activities combined both implicit sensor-based interaction and explicit interaction like current self-reporting (Mankoff et al., 2007).

## **8. Conclusion**

In order to develop an effective persuasive application that promote public interests, it is effective to take into account cultural differences. We extracted five design strategies for persuasive applications that promote public interests in collectivist societies. These strategies are: 1) organizing groups, 2) anonymity, 3) mutual surveillance, 4) development of mutual aid, and 5) combine use of positive and negative feedback. We developed a persuasive application for encouraging users to reduce CO<sub>2</sub> emissions in order to demonstrate how the five strategies were applied. From our experiment, we confirmed that *mutual surveillance* and *combine use of positive and negative feedback* worked effectively. Especially, significant feature in the experiment was that combine use of cooperation and competition worked for keeping interests in the application for long periods, and our design made users feel closer to CO<sub>2</sub> emissions with using virtual assets and EcoPoints especially in the early stage.

Our work needs to be further explored over a longer period of time and families in different profiles, and to conduct a comparative experiment in individualist societies. Some design strategies including mutual surveillance that effects a promotion of competition could be useful also for individualist societies. Therefore we will extend our design strategies that take into account individualist societies.

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