

# The Prototyping and Evaluation of Mobile Apps which Enhance Intrinsic Motivation

Jue ZHANG\*, Tairiku NAGAYAMA\*\*, Shouta MEGUMI\*\*\*

\* Kogakuin University, zhangjue@cc.kogakuin.ac.jp

\*\* Kogakuin University, j209092@ns.kogakuin.ac.jp

\*\*\*Kogakuin University, j208102@ns.kogakuin.ac.jp

**Abstract:** In this study, we targeted the real people who are losing their willingness to participate in social activities, tried to develop content that makes people's behavior more enjoyable and which both directly and indirectly promotes the urge to go out, all with the goal of improving their motivation to participate in society through intrinsic motivation. We had two case studies, one made an alarm application and another made a navigation application for smartphone. We made an attempt to encourage the user's behavioral motivation by increasing the levels of fun, self-determination, and sense of accomplishment which are areas of intrinsic motivation. With both applications having been positively evaluated, this result shows the apps which add a concept of entertainment to everyday activities such as getting up and going out, for which there is no original game, induce and maintain behavior which enhances intrinsic motivation and promotes activity.

**Key words:** *Intrinsic Motivation, Contents Design, Mobile Apps, Evaluation*

## 1. Introduction

Motivation causes behavior towards achieving a goal and is the factor that maintains and adjusts that behavior. Among such motivation is intrinsic motivation, which rises up from within. It is caused by curiosity and interest. It becomes the source of one's feeling of fun, and can enhance areas such as one's sense of competence and accomplishment. The field of content design has made various developments focusing on entertainment content with the goal of enhancing motivation by adding fun to content that wasn't so originally.

However, to give the example of the social problem of withdrawal issues, those who are losing their desire to participate in social activities mostly are without work and do not leave their home. They become immersed in television, the Internet, and computer games because the contents of these are said to have a tendency to encourage withdrawal. This study is for real people who are losing their willingness to participate in social activities. We tried to develop content that makes people's behavior more enjoyable and which both directly and indirectly promotes the urge to go out, all with the goal of improving their motivation to participate in society through intrinsic motivation.

## 2. Case Study I

In regards to participation in social activities, it is important in daily life to regularly take part in actions such as going to work or school. Case study I is intended for users who usually take part in social activities, and focuses on user behavior where sense of resistance is easily awakened.

In recent years, thanks to the rapid spread of smartphones a wide variety of applications has appeared, and such smartphones which have many functions such as lights and notepads have become able to replace many things. Smartphones also include an alarm function which can be used as an alarm clock. Recently users have become able to paste images such as of their favorite characters as background images to the alarm interface and by thus increasing a sense of affection for the alarm, an attempt can be seen to be trying to alleviate the sense of resistance towards getting out of bed. Customizable alarms such as these encourage a sense of self-determination in the user and can be said to be a way of trying to increase intrinsic motivation.

## **2.1 Prototype of Contents**

In virtual reality games, it is easy for them to connect to the user themselves, and easy to empathize. It is for these reasons that I chose the genre of caring games. To encourage a sense of self-determination, in addition to a "change character function", the application was implemented with a "prevent falling back asleep function", and a "skill learning function". In addition, within the caring games genre, those which use extrinsic rewards within the game are the titles which enjoy high sales. By selecting 32 titles and performing a cluster analysis on them, one or two types of typical reward were found to be used from among those categorized.

In this case study a dedicated Android application was created which used the Eclipse development environment and was coded in Java.

### **2.1.1 The Selection of Rewards**

An investigation was held into extrinsic rewards used in games by researching high selling titles within the caring games genre. After performing a cluster analysis on 32 items, these rewards were split into three categories - "Add Ability", "Item", and "Game Special Features". A total of seven types of reward were used - "Gold", "Experience Points", and "Change" from the "Add Ability" group, "Rare Item" and "Material Item" from the "Item" group, and "Exhilaration" and "Occupation" from the "Game Special Features" group.

### **2.1.2 Alarm Function**

In this case study, "Alarm Manager" was used for the alarm function as the application needs to perform a task at a specific time, even if it is not running. After starting the app, the screen transfers from the start-up screen in Figure.1.1 to the standby screen shown in Figure.1.2. Settings can be made through the set alarm button on the standby screen. The set alarm screen (Figure.2.1) uses "Time Picker Dialog", the message when waking (Figure.2.2) uses "Alert Dialog". For the "prevent falling back asleep" function, it was designed so that bonus points (taking gems, see Figure.3) would be generated 10 seconds after the alarm starts up and the music plays. If not all of the bonus points are taken, then they are lost after 10 minutes, but if all the bonus points are taken, the character levels up. Furthermore, a feature was implemented that degenerates the character being raised if it is determined that the user fell back asleep. This degeneration was coded so that if a level up is achieved the following day, then the character will return to the level they had been at before degenerating.

### **2.1.3 Bonus Point Generating Function**

By generating the bonus points and material items (taking a gift box, see Figure.3) necessary for the character to change and learn skills, as well as rewarding the user after waking, their motivation to wake up is improved. In addition, general alarm functions are set once before sleeping or set to wake every day. While in most cases the

operation can only be set once, in order to encourage interest and continuity, this application was created with bonus points which occur at regular time intervals so that users can experience changes constantly.



Figure.1.1 App Startup Screen



Figure.1.2 App Standby Screen



Figure.2.1 Set Alarm Screen



Figure.2.2 Message When Waking



Figure.3 Bonus Point

Red gem: Points generated immediately after waking;  
Green gem: Points generated at regular intervals;  
Gift box: Points for learning skills

### 2.1.3 Change Character Function

The character design was implemented using FrameAnimation class so that the characters could move frame by frame.



Figure.4 Character Design

The changing of the six characters shown in Figure.4 is possible through consuming bonus points (gems) in the shop. By providing a large number of characters, the user can select their favorite character (Figure.5.1 Shop Screen). This function was implemented so that the user could feel a sense of self-determination. The sense of self-determination is one of the elements which enhance intrinsic motivation. By giving a sense of expectation as to what the next character will be, it was aimed that the sense of accomplishment and growth upon changing to another character would increase intrinsic motivation. So that characters which have been changed can be switched back to at any time, skills were made common to all characters, and a character change skill was prepared. In addition, a status screen was provided for the skills function so that aside from the shop it could be seen at which level and how many points the character currently had. Three special skills were prepared for the characters which could be learned by consuming both material items and bonus points. Skills are only learned once and are passed over even if the user changes character. A system was implemented so that the many characters could learn many skills (Figure.5.2).



Figure.5.1 Shop Screen



Figure.5.2 Learn Skills screen

## 2.2 Evaluation Experiment

For the evaluation experiment, 10 college students in their 20s used the application prototype for a period of three days. Participants were asked to set the alarm time as 30 minutes before when they usually wake up, and to record a daily operation history. After the end of the experiment they evaluated the app via a questionnaire. The contents of the questionnaire were classified as follows:

(A) Did you play the game regularly?

(B) Were you usually late?

The subjects were given questions such as these to evaluate the effectiveness of the app, and gave YES/NO answers.

(a) Ease of setting the alarm

(b) Smoothness of operating

(c) Level of fun

(d) Character design

(e) Would you continue to use it in the future?

These evaluation items were used for the participants to show their impressions of the application. The evaluation value of the five point rating system was (+2) – (-2) and the results were examined using standard deviation (SD) (Table 1.).

Table 1. Questionnaire Evaluation Results

User Characteristic (Did you play the game regularly?)	Number	Question(SD)				
		(a)	(b)	(c)	(d)	(e)
Yes	8	0.50(1.22)	0.63(1.32)	0.88(1.17)	1.50(0.71)	0.75(0.43)
No	2	1.50(0.50)	1.00(0.00)	1.00(0.00)	1.50(0.50)	0.50(0.50)
Average(SD)		0.70(1.19)	0.70(1.19)	0.90(1.04)	1.50(0.67)	0.70(0.46)
User Characteristic (Were you usually late?)	Number	Question(SD)				
		(a)	(b)	(c)	(d)	(e)
Yes	4	0.50(1.38)	0.50(1.38)	0.83(1.34)	1.33(0.75)	0.67(0.47)
No	6	1.00(0.71)	1.00(0.71)	1.00(0.00)	1.75(0.43)	0.75(0.43)
Average(SD)		0.70(1.19)	0.70(1.19)	0.90(1.04)	1.50(0.67)	0.70(0.46)

## 2.3 Results Summary for Case Study I

The evaluation results indicated a positive rating overall. In addition, the evaluation for level of fun (c) was rated "good" or higher by most participants, which makes it possible to say that fun had been added to the alarm function. Also, the evaluation of participants who usually play games was comparatively low. I believe this is due to those users who usually play games having already experienced a great number of titles and thus requiring more substantial content for their interest and concern to be peaked in a new game. Therefore, there is a need to further increase the abundance and fun of the features in the prototype application. Also, participants who are usually late gave higher evaluations than those who aren't. I believe that this is because they gained some extra time in the morning to do something and thus was able to concentrate on the game part of the application, resulting in a higher evaluation. It is expected that there will be more effects on intrinsic motivation in line with the growth of the participant.

### 3. Case Study II

Based on the purpose and results of the prototype app in case study I, in case study II an app was made which assumes the user has a further resistance to going out, and that is aimed at motivating the user to leave their home.

In recent years it has been found that approximately 2% of the Japanese population suffer from social withdrawal or have a mild fear of going out. Most of these people spend their time using the television, Internet, and playing computer games, which all encourage a tendency to not want to go out. In case study II I thought of introducing a system which would increase a person's motivation to go outside. This was achieved by creating a game which in contrary to how games are usually played indoors, is played outside, and incorporates elements of navigation systems commonly used when on the move. The game involves searching for spots while on the move, and thus gaining a sense of accomplishment when completing a task.

#### 3.1 Prototype of Contents

In this case study, a prototype "dedicated iPhone application" was made using Object-C and the Mac OS Xcode development environment. From the concept of improving motivation to go out, I invented the concept of "walking outside". I implemented the app with a "Map Application" as an axis, and added the "Area Conquest Feature" and "My Route Feature".

##### 3.1.1 Area Conquest Feature

This feature was devised based on the behavioral assessment feature implemented on consoles such as Playstation3 and Xbox 360 which has a concept of visualizing the evaluation for a user's own behavior. For this app I implemented the "Conquer Tokyo's 23 Wards" (Figure.6.1) and "Site Hopping" features. These features require the use of GPS to obtain location information and to determine the current location of the user. It was designed so that if the user is at a place they are yet to have visited a popup appears, and places which are conquered are then stamped (Figure.6.2).



Figure.6.1 Screen for the "Conquer Area" behavioral evaluation feature (Before moving)



Figure.6.2 Conquered area event (When updating)

### 3.1.2 My Route Feature

This feature is triggered when GPS is started and draws a line showing the road that the user has passed. Also by using the iPhone screenshot feature (press the power button while holding the home button), a memo can be left on the screen which shows where you have passed on the map. This has a wide variety of uses such as for remembering favorite walking routes, site hopping tours such as of city temples, and many others of the user's choice. In addition to this, by recommending their routes, users communicate with others, and this sharing leads to an improved sense of accomplishment.

A button was also implemented which enables users to switch between plane maps and aerial photos. Maps were made to be able to be switched immediately by pressing the "Standard" button for a plane map and the "Hybrid" button for an aerial photo (Figures.7.1 and 7.2)



Figure.7.1 My Route feature

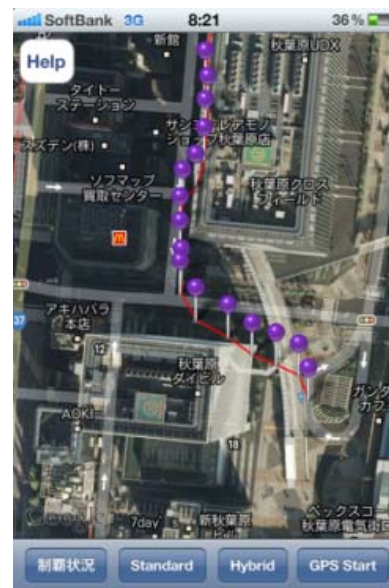


Figure.7.2 Aerial photo of Figure.7.1

### 3.2 Evaluation Experiment

This feature is triggered when GPS is started and draws a line showing the road that the user has passed. Also by using the iPhone screenshot feature (press the power button while holding the home button), a memo can be left on the screen which shows where you have passed on the map. This has a wide variety of uses such as for remembering favorite walking routes, site hopping tours such as of city temples, and many others of the user's choice. In addition to this, by recommending their routes, users communicate with others, and this sharing leads to an improved sense of accomplishment.

For the evaluation experiment, 10 college students in their 20s used the application prototype and evaluated it via a questionnaire. The questionnaire was divided broadly into two parts, the first of which asked questions such as

- (A) Do you go out on days off?
- (B) Do you usually take part in activities such as computer games?
- (C) Are you happy to evaluate what you accomplished?

on the participants' preferences on days off, and to evaluate the effectiveness of their actions. Such items were replied to with YES / NO answers.

The second half were questions regarding their evaluation of the app, and contained the following five items:

- (a) The convenience of switching between plane and aerial mode in one touch
- (b) The usability of the My Route feature
- (c) The sense of accomplishment and joy when the conquer function popup appears
- (d) Whether more stamps makes the user want to visit other places
- (e) Operation of the app

For (a), (b), and (d) participants were given adjectives and asked to answer on a five point scale. The evaluation value was (+2) – (-2), and the results were examined using standard deviation. (c) and (d) were answered YES / NO. YES is expressed as 1, and NO as 0 (Table 2).

Table 2. Average values of the evaluation questionnaire

User Characteristic	Number	Question				
		(a)	(b)	(c)	(d)	(e)
A: Yes	4	1.50	1.75	1.00	1.25	1.00
A: No	6	1.67	1.17	1.00	1.00	1.00
B: Yes	9	1.56	1.44	1.00	1.00	1.00
B: No	1	2.00	1.00	1.00	2.00	1.00
C: Yes	9	1.56	1.33	1.00	1.11	1.00
C: No	1	2.00	2.00	1.00	1.00	1.00
Average		1.71	1.45	1.00	1.23	1.00

### 3.3 Results Summary for Case Study II

By the results it can be seen that all participants, especially those who usually go out often (answered YES in A), evaluated the app highly. Items (c) and (d) which were implemented with the aim of improving motivation to go out were also evaluated positively. However, it was reported by the participants that getting just a stamp for achieving a task was not enough. I think that as an improvement, a link or jump to the next page whenever a stamp is given could be implemented which would give details on the specific location and increase the exchange of information. This would improve the user's sense of accomplishment.

## 4. Conclusion

In two case studies of this research an attempt was made to encourage the user's behavioral motivation by increasing the levels of fun, self-determination, and sense of accomplishment which are areas of intrinsic motivation. With both applications having been positively evaluated, this shows those apps which add a concept of entertainment to everyday activities such as getting up and going out, for which there is no original game, induce and maintain behavior which enhances intrinsic motivation and promotes activity.

In both case studies I and II, after filling out the questionnaire, participants said in open interviews that "I want to use this application for real". However, despite the positive evaluations, users who were usually late or didn't go out often evaluated the apps higher than those who didn't have such problems. Other opinions such as "how about having more animated effects?" and "wouldn't it be more interesting if you could set detailed information and view it when the respective icon was clicked on?" were also raised in the open interviews. These opinions suggest that users who are often late or don't go out, (who are the intended users of these apps), require more interesting

content than those who don't have such issues. In the future, I believe that it will be important to consider the feelings of different types of users, to improve content, and to introduce new concepts.

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