PEDdo: Steps to a Healthy Lifestyle

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Abstract

Studies show that 14-to-40 year olds are spending more time at the computer and less time exercising. Using Contextual Design, our group tackled the challenge of motivating people in that demographic group to exercise more. The result is the "PEDdo" (*Latin* ped: foot, *Persian* do: two) – a device which encourages physical activity of its users in an entertaining way and reinforces positive exercise habits.

Keywords

Exercise, Obesity, Physical Activity, Contextual Design, User Motivation

ACM Classification Keywords

H.5.2 [User Interfaces]: Graphical user interfaces (GUI), Prototyping, User-centered design

Introduction

In the last decade, we have witnessed a decrease in physical activity especially among young people as they spend increasingly more time playing video games. [8]

Diseases such as diabetes, high cholesterol, and cancer are major public health problems all over the world. Sedentary lifestyles double the risk of cardiovascular diseases, diabetes, and obesity and substantially

increase the risk of colon cancer, high blood pressure, osteoporosis, depression and anxiety. [8] In Austria, the percentage of obese adults rose from 8.5% to 11% between 1995 and 2000. [1] Similar statistics exist for other European countries. [10]

Overweight children as well as adults are more sedentary than their non-overweight counterparts and may find themselves with more free time on their hands. [11] Were they to walk for 30-60 minutes, even at a moderate pace, they would burn fat and build muscle towards a faster metabolism. Walking an hour a day can also lower or eliminate the risk of cardiovascular diseases, breast cancer, colon cancer, diabetes and stroke according to the Pan American Health Organization. [7]

To combat the problem of obesity, our group set out to motivate people who spend most of their time in front of a computer towards more physical activity in an entertaining way. This paper consists of two main sections:

- identification of the problem in context
- designing a solution

Design Process

We started with reviewing existing literature about diets and sports. Afterwards, we observed the exercise and dietary habits of ten volunteers for our contextual research. Then, using notes from our observations, we created an affinity diagram.

In the diagram, we uncovered broad headings relating to the volunteers' habits:

- Sources of information: volunteers get information about diets and weight loss programs from varied sources (e.g. TV, the Internet, etc.)
- Groceries: different volunteers have different grocery shopping habits.
- Cooking and eating habits: Religion, time, and other factors play into volunteers' ability to cook for themselves.
- Motivation for weight loss: some volunteers want to lose weight for personal reasons, others because they had been advised to do so by their physicians.
- Transportation: volunteers walk, cycle, use public transportation, or drive to work.
- Interest in sports
- Previous diet success: almost all volunteers had tried a diet already. Results were mixed.

Using the affinity diagram and our findings, we started with a brainstorming session to identify basic requirements for possible solutions to the design problem and identified the following functional requirements for a device:

- The device should add a level of functionality to some device the user already has and/or knows how to use.
- The device should be compact and mobile.
- The device should have a feedback mechanism in the interface.

▪ The device should be personalized for the dietary and exercise needs of each user.

▪ The device should be entertaining.

▪ The device should be affordable and multifunctional. On average, volunteers were ready to pay up to 20 Euros (~24 US Dollars) per month for weight loss or activity programs.

▪ The device should function like a digital personal trainer.

Design Ideas

With those requirements in mind, we designed several potential solutions.

1. The Diet Spoon: We came up with a spoon which vibrates according to the number of times it is moved up and down in the span of 10 seconds. It warns the user whenever she eats too fast, which is a setting defined by the person herself when she configures the device.

Such a spoon could only be useful when the user has the spoon with her at every meal. Another potential problem is that no correlation exists between the amount of fat and the total calories in a portion of food. Realizing these usability issues, we abandoned the idea.

2. MP3 player with a Pedometer: The Diabetes Prevention Program showed that in 3,234 people with Impaired Glucose Tolerance (a condition that comes before Diabetes) those who walked or exercised at least five times a week for 30 minutes a session lost 5% to 7% of their body weight and reduced their risk of diabetes by 58%. [3]

To support a habit of walking more often, we devised a conceptual device to integrate an MP3 player with a heart-rate monitor and a pedometer. We envisioned an intelligent system that connects activity parameters to music. For example, by running fast the tempo of the music would get faster and unbearable, forcing the user to reduce tempo. Upon further evaluation of the concept, we thought that such a device could be useful for athletes but irritating to a user who uses it everyday while walking so we decided to omit this idea as well.

3. DiMoSys - Diet Monitoring System: This system would have three parts: the DiMoSys "Central Unit," several sport devices with embedded DiMoSys agents, and a software system installed on a central unit.

We envisioned a scenario where the user could enter what he has eaten on a special watch and the watch would replicate the information on the Central Unit as well as on any other device where DiMoSys was installed. Additionally, the agent would emulate the user during a workout by morphing according to the amount and level of activity generated during the workout; the agent would become stronger and better looking if the activity level was high, weaker if the level was low. One challenge with this idea is that the user has to manually enter whatever he has eaten, which would probably not resonate well with users.

Concept Development

We decided to concentrate on a smaller group of users and merge two of our ideas for our final concept.

In a second round of brainstorming, we focused on the needs of volunteers between the ages of 14 and 40 who have very little physical activity and spend 8 to 10

hours a day sitting. They expressed a desire to be supported during a diet or more physical activity but do not have time for professional weight loss programs.

In a literature review, we noticed that there are not many video games like "Dance Dance Revolution" [5], which support physical activities for young people in their spare time. We did find interactive pedometers like Pikachu 2, Sakura, and Yaw Kaiser but these are targeted towards children. We decided to use games our volunteers had showed an interest in during contextual research as inspiration and incorporate a game into the solution interface.

Another "must" for the solution is that it would have to be portable. Since our volunteers are physically able to walk for up to 90 minutes per day, we knew that the product also had to be useful for walking and other physical activities of a pedestrian nature. Most of our volunteers said that they did not have enough spare-time to devote to exercise so we knew it was important to integrate more physical activities into their everyday lives in an unobtrusive way.

We finally decided on a portable device having the advantages of both the second and third concept. We integrated the motivational agent of the DiMoSys into an MP3 player (although the idea would work for any mobile device equipped with a pedometer and able to run the software.) In addition, it has a reward system in the form of a suite of games. The character of the game is chosen during initial use and can get stronger when the user is more active as described in number three of the previous section. The agent can either look and act like virtual pets in the "creatures" [2] or it can virtually represent the user him/herself like in the

virtual world of Gulliver's Welt [4] unlike in the interactive pedometers mentioned before which put a limit on the user's choice of character. In the literature, we found concepts of similar agents that actively motivate the user in his exercise program [9], but we found that such agents could be annoying for the user since we think our user would simply want to enjoy his walk without distraction, except for whenever he would like to check his progress or play a game.

We prototyped the concept with simple games like Super Mario, Pac Man, and Alien. The reasons we chose these games were:

1. these games are well-known amongst our volunteers and peers of their generations
2. there is an open source emulation for video games for a well-known MP3 player and some developers are porting games to other MP3 players. [6]

Integrating such games in a portable device would not cost a lot and would make the device affordable. When it comes to physical activity, more of it would translate into more points for the user as shown by clovers (see figure 1, next page.) The more you are active, the more you earn.

The application could be used on any mobile device (such as PDAs, cell phones, etc.) having an external pedometer. Most cell phones and PDAs have Bluetooth technology and we expect that MP3 players will have it in a couple of years too. An external pedometer with Bluetooth technology would make the entire system an affordable option.

To finance the system, we would expect to charge a subscription fee at a price point at or under the 20 Euros per month our volunteers said they would be willing to pay.

Final Prototype

We decided to name our design the "PEDdo" and then created a low-fidelity paper prototype of it and tested it on eight people. We envisioned the device to allow the user to perform the following functions in addition to those of an MP3 player:

- Enter weight, height, and age

- Choose a favorite game character

- Measure calories burned and steps taken daily, weekly, and monthly

- Award bonus points in games for physical activity

Evaluation of Our Design

After creating the prototype we explained our storyboards to our potential users to give them a general feeling about the device and its functionality. Then we asked them to go through a couple of test scenarios. Some of our test scenarios were "Entering Personal Data," "Choosing an Agent," and "Checking the weekly report."

Additionally, we asked our potential users if the menu items were clear enough, if they needed a lot of time to find the menu items, and if they could complete some other basic tasks. Finally, we asked about their opinions about the PEDdo and if they would find such a device useful.

Figure 1: This figure demonstrates menu items for PedoDiet – a menu item of the PEDdo - and an overview of the activities of the week. Two clovers in the lower left-hand corner of the screen show how many bonus points have been awarded during the week.

Our users liked the concept of PEDdo. Suggested improvements included a change to some of the naming and structure of the menu items. For example, some users found the word "agent" very negative because it is often associated with a certain annoying helper in a well-known proprietary application for office productivity.

Another suggestion was to display the number of current steps on the screen at all times giving the user a constant source of feedback. We decided that it would be good to incorporate but should have a setting to turn it on and off as the user wishes.

Conclusion

PEDdo is our solution to combat a sedentary lifestyle in a fun and entertaining fashion. If used on a regular basis, it would support habits leading to a healthier lifestyle. Because it provides a game feature, we expect it to be especially appealing to young people but would benefit anyone who spends a majority of time in a sedentary fashion.

In the future, we suggest iterations in development of the prototype with different kinds of games and accompanying tests which we expect to take 4 to 6 weeks to see if the novelty of PEDdo wears off. Additionally, we would like incorporate functionality for users to be able to compete using wireless technology.

Acknowledgements

References

[1] Austrian Society on Eating Disorders.
http://www.oeges.or.at/.

[2] Creatures: Artificial Life Autonomous Software Agents for Home Entertainment.
http://mrl.snu.ac.kr/courses/CourseSyntheticCharacter/grand96creatures.pdf.

[3] Diabetes In Control 10,000 Step Study 30 Million Steps and 15,000 Miles Later.
http://www.diabetesincontrol.com/studies/step.shtml.

[4] Gulliver's Welt.
http://www.aec.at/gulliverswelt/.

[5] History of Computer Game Design.
http://pdf.textfiles.com/academics/ddr-case-history-chan.pdf.

[6] IBoy.
http://ipodlinux.org/GB_Emulator#Progress.

[7] Obesity, Diet, and Physical Activity.
http://newweb.www.paho.org/English/GOV/CE/SPP/spp 37-08-e.pdf.

[8] Reducing Risks, Promoting Healthy Life.
http://www.who.int/whr/2002/en/.

[9] Relational Agents.
http://www.ccs.neu.edu/home/bickmore/agents/.

[10] The health status of the European Union.
http://europa.eu.int/comm/health/ph_information/documents/health_status_en.pdf.

[11] Video Games, Not TV, Linked to Obesity in Kids.
http://www.cfah.org/hbns/news/video03-17-04.cfm.