Mug-Tree: A Playful Mug to Encourage Healthy Habit of Drinking Fluid Regularly

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Abstract. We have explored the design of a playful mug, called Mug-Tree, to motivate people to drink water regularly and to develop a good water-drinking habit. Our system includes (1) a smart mug that can recognize user drinking from it, and (2) a digital photo frame that displays a playful game connecting water drinking to watering a virtual tree. The Mug-Tree reminds users to drink water regularly, and also help users to develop a good water drinking habit by attracting continuous participation to this game.

Keywords: smart object, persuasive media, digital healthcare

1 Introduction

Water is essential for survival of all life on earth, including human. Since water consists of about 60%~70% of our body weight, we need plenty of fresh water replenishment everyday to keep water flowing in the body and stay healthy. Among the many important functions of water in our body are [1] regulating body temperature and blood circulation, carrying nutrients and oxygen to cells, removing toxin and other wastes, etc. Studies have shown that an adult should drink at least 10 eight-ounce glasses of water a day, and more under overweight, high workload and heat stress [2]. However, recent studies have found that most people don't drink enough water [3]. Such chronic water deficiency may lead to both short and long term health illnesses, including hypertension, asthma, allergies, and migraine headaches.

Although most people know the importance of drinking water or fluid (water can also mean fluid in this paper), but it is easy to forget to drink water regularly during our everyday business. Often, we delay water drinking until our dried tongues and dehydrated bodies notify us the urgency to get some water. A better way of keeping our body healthy of water is to develop a *habit* of drinking water regularly. That is, to keep regular supply of water handy and drink on a regular schedule rather than wait until we feel thirsty [3].

In this work, we would like to adapt Ubicomp and persuasive technology to help people develop this healthy water drinking habit. We take the *smart object approach*. By embedding behavior modification into an everyday drinking mug called Mug-Tree, it can remind and motivate users to drink water from the mug regularly while provid-

ing a playful interaction to motivate people into enjoying drinking water. Its long term goal is to help users develop a good water-drinking habit.

Recently, there are several work on embedding digital persuasion into everyday objects for a variety of human behavior modifications, such as the ToothTunes tooth brush [4], the playful eating tray [5], the VITO TV remote [6], the Waterbot bathroom sink [7], the nutritional-aware kitchen [8], etc. Our Mug-Tree shares a similar goal. However, since it targets a different behavior, it has different design considerations and persuasion strategies.

2 Design Consideration

Our target users can be workers in general. While busy working on their jobs, they often forget to drink water regularly. To help them, we utilize a play-based behavior modification model developed previously [5] for designing our Mug-Tree as shown in Figure 1. At the foundation is *playfulness*, which is an activity design that can induce a user's active participation in the water drinking activity. It is realized as a game that brings enjoyment and motivates users to drink water at a regular time interval. The 2nd layer is *active engagement*, which links digital game playing to the physical water drinking. The 3rd layer is *reinforcement*, which provides timely game reward to strengthen water drinking behavior. Through repetition, this behavior of active engagement can be internalized and become a water drinking habit.
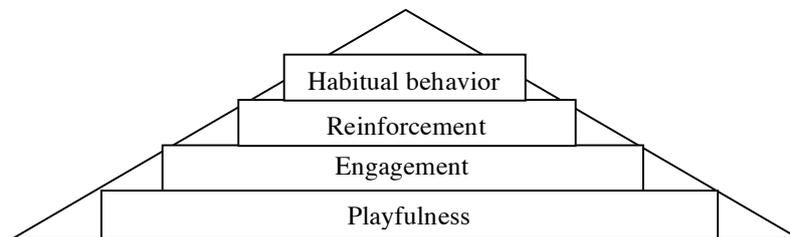

Fig. 1. Schematic representation of the play-based model

We have identified the following three design considerations for our Mug-Tree: *attention*, *enjoyment*, and *engagement*. First, the Mug-Tree must be able to draw a user's attention when it is time to drink water. According to [9], people often concentrate too much on working such that they are unaware of thirsty signals from their body. To remind users, the Mug-Tree periodically produces visible events to grab user attention. The second design consideration is *enjoyment*. The game design must bring sufficient enjoyment and pleasure to attract users' participation. When people drink water from time to time, their physical body may not bring any substantial feeling of reward and satisfaction, because the reward is mostly felt internally within a body. To bring greater enjoyment of reward to drinking water, our Mug-Tree is linked to a game that provides playful interaction to users. The third design consideration is *engagement*, which connects the *natural drinking* from a mug to a *digital game interaction*. There is no need for users to operate any digital devices, because our Mug-Tree recognizes drinking events automatically.

3 Preliminary Mug-Tree Prototype

We have created a preliminary Mug-Tree prototype shown in Fig. 2. The system contains the following components: (1) a sensor-enhanced mug shown in Fig. 2(b) recognizes water drinking events and transmits these events wirelessly to a digital photo frame; and (2) a water drinking game, displayed on a digital photo frame shown in Fig. 2(c), takes these drinking events as inputs to play a game. We will first describe the activity recognition of the smart mug, followed by the water drinking game on the digital photo frame.

Fig. 2. The Mug-Tree prototype

Activity recognition of a smart mug. To recognize a user's drinking event, a low cost mercoid switch sensor is installed at the base of a mug to detect tilt motion of the mug. This tilt motion is a necessary step in drinking from a mug, that is, a user needs to tilt the mug to get the water flowing out the mug to his/her mouth. In addition, a radio is used to wirelessly transmit drinking events to a digital photo frame.

Water drinking game on a digital photo frame. A visual game runs on a digital photo frame. This game is based on a metaphor in which an act of caring and watering a virtual tree symbolizes a similar act of caring for one's own body through regular water drinking. When a mug detects that a user does not drink enough water regularly, the virtual tree will turn from beautiful green full of leaves, shown in Fig. 2(d), to withered bare branches, shown in Fig. 2(e). The game feedback is designed to be subtle and not interruptive/disruptive to users' current work. Therefore, we use this game metaphor that reminds users that their body is just like a slowly dehydrating tree. In addition, this game hopes to cultivate growing empathy from users to the well-beings of virtual trees. In the other way, the game theme is not limited to a tree, but can be changed to other suitable, user-preferred metaphor. An example can be cute ducks wanting plentiful rainwater (generated by user water drinking) to fill up a pond where they can swim happily.

4 Discussion and Future Work

Preliminary experience using the Mug-Tree gives new future directions for improvement. First, since most users are unlikely to bring a mug with them anywhere they

drink, e.g., in restaurants, there is a portability concern. In addition, users may drink directly from pre-packaged containers, such as a can of juice, or a bottle of milk, etc. To address this portability issue, we are thinking to create an attachable and detachable base that can fit the bottom of most cups or bottles. In addition, this base can recognize and wirelessly transmit drinking events to any game display at home, a mobile display carried by users (e.g., a cell phone display), or a flexible display attached to the base. Second, we are interested in detailed information on beverages in the mug in order to provide additional health guidance, e.g., preventing diabetes patients from overdrinking sugary fluids. Third, we are thinking to provide different levels of game feedbacks in which users can choose based on their needs. This is similar to different settings on an alarm clock. For example, the first level would gently remind users through a visual feedback such as the virtual tree described previously; the second level could softly remind users by a dry sound such as wood burning; the third level might be soft interruption such as a pop-up post-it on their desktop computer; and the last level is a forceful interruption, such as turning on a screensaver, to force users to drink water immediately. It is also possible to have different forms of feedbacks such as connecting a user's drinking event to watering a real plant in an office or at home. Finally, we are thinking to bring social collaboration into the game by extending it to the Internet. Consider creating a virtual forest in which the health of a tree maps to a participant's water drinking habit. People can send messages to each other to remind and encourage regular water drinking, as well as to express *caring* for each other. We believe that adding social collaboration to the game can make an effective persuasion strategy.

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