Designing a Mobile Persuasive Application to Encourage Reduction of Users' Exposure to Cell Phone RF Emissions

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Abstract. The International Agency for Research on Cancer classifies radiofrequency (RF) electromagnetic emissions of cell phones as possibly carcinogenic to humans [1] and suggests the use of hands-free devices such as earphones to reduce direct exposure of the brain to such emissions. In this paper, we present the design of a mobile application that exploits persuasive principles to encourage the use of earphones during cell phone calls. We propose different notifications and visualizations aimed at informing the user about her behavior with respect to earphone use and discuss the results of a user study that was aimed at investigating aspects such as understandability, emotional impact, and perceived usefulness of the proposed solutions. Results of the study are used to inform the design of the application. To the best of our knowledge, this is the first investigation of persuasive technologies applied to the reduction of user's exposure to cell phone RF emissions.

Keywords: mobile persuasion, mobile phones, behavior change, health, RF emissions, earphones.

1 Introduction

Today, the positive effects of the availability of cell phones on our quality of life are undeniable. However, there is also concern about the potential negative impact of cell phone use on health even if the subject is controversial. In particular, currently available research has not provided complete evidence of a relationship between cell phone use and adverse health effects. However, pending more definitive answers, in 2012 the International Agency for Research on Cancer (IARC) changed the classification of radiofrequency (RF) electromagnetic emissions of mobile phones from level 4 (probably non-carcinogenic) to level 2B (possibly carcinogenic) [1]. To reduce user's exposure to radiofrequency energy, organizations such as the IARC, the Federal Communication Commission, and the Food and Drug Administration recommend pragmatic measures such as using cell phones only for shorter conversations and using hands-free devices which place more distance between the phone and users' head.

A. Spagnolli et al. (Eds.): PERSUASIVE 2014, LNCS 8462, pp. 13–24, 2014.

In this work, we explore persuasive technology as a way to foster awareness on the possible risk of RF emissions and recommend the use of earphones. In recent years, persuasion principles have been applied to the design of mobile applications aimed at such diverse goals as increasing user's physical activity [2] or encouraging the use of green transportation [3]. In our case, the cell phone is the ideal medium through which to convey the considered persuasive message. First, the cell phone is directly related to the target behavior, hence making it possible to convey messages at the most appropriate time. Second, users can be often reminded that they are trying to change their behavior since they take cell phones with them anytime, anywhere. Third, the cell phone is typically a personal object, not shared with others, which makes it ideal as a way to convey health-related messages.

In the paper, we illustrate the design of BrainSaver, a mobile application for Android smartphones that monitors call behavior and gives feedback about how the user is behaving with respect to the use of earphones. To determine the most appropriate stimuli to help the user improve her behavior while avoiding to annoy her with invasive and unsuitable messages, we created different notifications and visualizations based on persuasive principles and evaluated their effect with a user study. The study focused on aspects such as understandability of the messages, emotional impact of the visualizations, and perceived usefulness of the notifications.

2 Related Work

Some persuasive mobile applications have recently used the phone screen wallpaper to provide mobile users with feedback about specific behaviors, mapping them into metaphoric visualizations. In UbiFit Garden [2], the user is persuaded to maintain a certain level of physical activity through a wallpaper that displays weekly progress in the form of flowers (representing different performed activities) and butterflies (representing achieved goals). UbiGreen [3] was instead designed to make the user more conscious about her consumption of CO2 through a wallpaper that displays a tree or a polar scenario with bears and icebergs whose state depends on the level of CO2 consumption. In EcoIsland [4], users are mapped into virtual characters on an island, and positive behaviors are rewarded by allowing users to decorate their environment, while negative behaviors lead to flooding of the island. While some studies suggest to use only positive reinforcement to prevent users to feel frustrated when they do not achieve their goals [5], the evaluation of EcoIsland and UbiGreen pointed out that people were encouraged also by the negative feedback received by seeing the negative consequences of their actions on the visualization.

Changes in the wallpaper have the dual function of giving the user feedback on her actions and to remind her that she is trying to change her behavior since often this is not her main thought [6]. The reminder function is crucial to convey the message at the most appropriate time, i.e., immediately preceding or following the triggering of the unwanted behavior [7]. The message must also be presented in the most aesthetically pleasing and less intrusive way [8]. Moreover, since the message pertains to the private life of an individual, it must be presented in an abstract way so that other