

A Persuasive System for Obesity Prevention in Teenagers: a Concept

Maurizio Caon¹, Stefano Carrino¹, Renata Guarnieri², Giuseppe Andreoni²,
Claudio L. Lafortuna³, Omar Abou Khaled¹, and Elena Mugellini¹

¹University of Applied Sciences and Arts Western Switzerland, Fribourg
{Maurizio.Caon,Stefano.Carrino,Omar.AbuKhaled,Elena.Mugellini}
@hes-so.ch

²Politecnico di Milano, Italy
Giuseppe.Androni@polimi.it,Renata.Guarnieri@fondazione.polimi.it

³Consiglio Nazionale delle Ricerche, Milan, Italy
Claudio.Lafortuna@cnr.it

Abstract. In the frame of the PEGASO European project, we aim at creating an ecosystem that enables teenagers to easily adopt a healthy lifestyle. In this ecosystem, the persuasive ICT system plays a key role in motivating users to build healthy habits. The persuasive system is based on mobile technologies and provides tailored motivational mechanisms based on the information provided by the virtual individual model.

Keywords: persuasive technology, obesity prevention, computer-tailored intervention.

1 Introduction

Lifestyle has been identified as the main preventive methods for several health risks. Among the main emerging problems overweight at all ages ranks probably at first place. But if for adults this could be a result of a joint pathology, in teenager counter fighting overweight with proper strategies could be a win-win model for a real prevention of future pathologies. Overweight could also easily become Obesity, which is now epidemic in many countries so that a general alarm has been issued worldwide. Obesity is due to several factors as genetic contributors, metabolic conditions (e.g. diabetes and hypertension), psychological and behavioral issues. Concerning the last two factors, an important role is played by an inadequate education [1], in particular about health literacy. We faced the promotion of healthier lifestyles in an ongoing European project (PEGASO) aiming at developing a complete services ecosystem that would be able to motivate teenagers to learn and to apply a healthy life-style effortlessly. This ecosystem comprehends many actors as the school system, the teenagers' family, the social community, the medical experts and other stakeholders. The creation of this ecosystem aims at enabling the teenagers, who are not fully independent in their life to facilitate the adoption of a healthy life-style.

2 Virtual Individual Model

The ICT system plays a key-role in the PEGASO ecosystem. The influence that technology can exercise on people is recognized by the scientific community and currently a new domain in the computer science, known as Persuasive Technology [2], focuses on formalizing the design and development of computing products that can change the way users act and think. In the persuasive technology field, the Behavior Change Support Systems became an important object of studies since this name describes the persuasive systems that integrate additional software features as continuous accessibility and social support, unobtrusiveness, ease of use, and improved dialogue between the users and the system [3]. The PEGASO project aims at pushing this concept further introducing the feature of dynamically selecting the opportune tailored interventions based on the user's individual characteristics and interaction context. Tailoring the intervention involves modeling the user's characteristics and for this purpose it has been developed the Virtual Individual Model, which comes from the concept of the Virtual Physiological Human. The latter is a methodological and technological framework for integrated modeling of a living human body that describes the interaction of all the physiological components of individuals from molecular to apparatus level [4]. The Virtual Individual Model aims to include individual's characterization composed of physiological, physical, and psychological determinants. This allows integrating biological aspects of human functioning with lifestyle behaviors and psychosocial externalities that are crucial for the determination of the adoption of a certain life-style. This model is integrated in the system through an ontology-based virtualization. This process allows turning the information contained in the Virtual Individual Model into a structured knowledge that can be dynamically updated and elaborated by the computer to select the best interventions for each individual. Tailored interventions make the information personally relevant and researches demonstrated that computer-tailored health education is more effective in motivating people to make dietary changes [5] and that it could be also a good practice to promote physical activity [6].

3 Tailored Intervention Forms

The Virtual Individual Model characterizes the user's nutritional habits, physical status, and psychological status to provide personalized intervention to foster the adoption of a healthy life-style. Obviously, the interaction between the system and the user plays a crucial role in the tailoring process and to facilitate the effectiveness of the intervention. Since the teenagers are the targets of the PEGASO project, the smartphone has been chosen as the mediator of the interaction. Indeed, the smartphones are already perceived as a companion and it is most likely that this relationship between user and smartphone will strengthen in the future [7]. The smartphone is the perfect companion because it is personal and it is ubiquitous. It will provide the possibility of interacting directly with the user asking to enter some information or in a discreet and implicit manner allowing monitoring the user activity. The sensed data referring to the parameters that con-

cern the selected characteristics modeled for the tailoring will be updated constantly in the Virtual Individual Model. Moreover, with the many connection possibilities, the smartphone can allow accessing the information stored in the cloud and can connect to other devices, such as wearable accessories that can improve the physical activity monitoring. Since it is ubiquitous, it can always provide the appropriate trigger, as tailored messages, to influence the user's behavior. This is very important, since Fogg observed that "without an appropriate trigger, behavior will not occur even if both motivation and ability are high" [8]. Moreover, the many sensors integrated in the smartphone allow capturing the contextual information, which can help to generate the trigger at the opportune moment maximizing its effectiveness. Moreover, the smartphone allows installing many applications as media services and games that will motivate the teenagers to interact with the system. The mobile game will be designed to promote physical exercise. The integration with social networks will add the social aspect of the users' life to the parameters for the tailoring of the interventions and, most importantly, the social factor represents a very effective motivator. Another mobile application will be a sort of personal food diary, where the user will be able to note his/her alimentary behavior. This diary will help to understand the alimentary behavior of the user in order to provide the right feedback. For example, some data suggest that breakfast consumption is associated with higher intakes of micronutrients, fruit and vegetables and less frequent use of soft drink [9]. This means that the breakfast consumption habit can help to adopt a healthy dietary behavior. The diary allows following this behavior and to intervene through an alarm in order to remind to the teenager to have breakfast. The eating behavior is not only related to homeostatic reasons. In fact, an important factor that influences people's need and choice of food is represented by the emotional state [10]. The diary will allow noting also the mood in order to include the emotional state in the recognition of behavioral patterns. In fact, this information can be used to find some specific behavioral pattern related to emotional eating in order to generate the best intervention.

4 Conclusion

Currently, the PEGASO project is in the design phase, where all the experts from the different domains are working to create the cross-disciplinary Virtual Individual Model with the related ontology for the digitalization. At the same time, some participants coming from the Psychology, the Industrial Design and the Computer Science domains are conducting focus groups and participatory design events in schools in three different countries (Italy, Spain and United Kingdom) for the design of the system. In a later stage when the system will be developed, three pilots in different countries will take place (Italy, Spain and United Kingdom). These pilots will allow validating the effectiveness of this approach and examining the cultural differences that may impact on teenagers' life-style. The discussion of the future development of this system with the experts that will attend the workshop will provide the possibility of generating an interesting debate and to receive important feedback from different points of view.

References

1. C. Weinert, S. Cudney, and E. Kinion, "Development of My Health Companion to enhance self-care management of chronic health conditions in rural dwellers.,," *Public Health Nurs.*, vol. 27, no. 3, pp. 263–9, 2001.
2. Fogg, B. J. (2002). Persuasive technology: using computers to change what we think and do. *Ubiquity*, 2002(December), 5.
3. Oinas-Kukkonen, H. (2013). A foundation for the study of behavior change support systems. *Personal and ubiquitous computing*, 17(6), 1223-1235.
4. Fenner, J. W., et al. (2008). "The EuroPhysiome, STEP and a roadmap for the virtual physiological human", *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 366(1878), 2979-2999.
5. J. Brug, A. Oenema, and M. Campbell, "Past, present, and future of computer-tailored nutrition education.,," *Am. J. Clin. Nutr.*, vol. 77, no. 4 Suppl, p. 1028S–1034S, Apr. 2003.
6. H. O. den Akker, L. S. Moualed, V. M. Jones, and H. J. Hermens, "A self-learning personalized feedback agent for motivating physical activity," *Proc. 4th Int. Symp. Appl. Sci. Biomed. Commun. Technol. - ISABEL '11*, pp. 1–5, 2011.
7. Carrino, S., Caon, M., Abou Khaled, O., Andreoni, G., Mugellini, E. (2014) "PEGASO: Towards a Life Companion", in the Proceedings of the 16th International Conference on Human-Computer Interaction, in press.
8. Fogg, B. J. (2009). "A behavior model for persuasive design", In Proceedings of the 4th international conference on persuasive technology (p. 40). ACM.
9. Merten MJ, Williams AL, Shriver LH. Breakfast consumption in adolescence and young adulthood: parental presence, community context, and obesity. *Journal of the American Dietetic Association*, 2009, 109(8):1384-1391
10. C. Science, A. Kapoor, P. Johns, K. Rowan, E. A. Carroll, M. Czerwinski, and A. Roseway, "Food and Mood : Just-in-Time Support for Emotional Eating," ACII2013, pp. 252–257, 2013.