Using Tailoring to Increase the Effectiveness of a Persuasive Game-Based Training for Novel Technologies

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Abstract. A vast majority of people with motor disabilities cannot be part of the today's digital society, due to the difficulties they face in using conventional interfaces (i.e., mouse and keyboard) for computer operation. The MAMEM project aims at facilitating the social inclusion of these people by developing a technology that allows computer operation, solely by using the eyes and mind. However, training is one of the key factors affecting the users' technology acceptance. Game-based computer training including persuasive strategies could be an effective way to influence user beliefs and behaviors regarding a novel system. Tailoring these strategies to an individual level is a promising way to increase the effectiveness of a persuasive game. In the current paper, we briefly discuss the theoretical development of a persuasive game-based training for the MAMEM technology, as well as how we used tailored communication strategies to further enhance user technology acceptance. The development of such a tailored persuasive game will be essential for increasing acceptance and usage of assistive technology but also for the scientific insights in personalization of persuasion.

Keywords: Persuasion, Tailoring, Technology Acceptance, Assistive Technology,

1 Introduction

Computer technologies have transformed the way we work, stay in touch with family and friends and in general how we spend our free time. However, individuals with motor disabilities (such as people with Parkinson's disease and tetraplegia) have several problems adapting to the today's digital society. The common symptom of these disorders is the loss of the voluntary muscular control while preserving cognitive functions. This leads to a variety of functional deficits, including the ability to operate computer applications that require the use of a conventional interfaces (i.e., mouse, keyboard and touchscreens). As a result, the affected individuals face the danger of being socially excluded [1].

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Motivated by this, the European project called Multimedia Authoring and Management using your Eyes and Mind (MAMEM)[1] aims at facilitating the social integration of these people, by increasing their opportunities for employment, social inclusion and independence. Thus, MAMEM delivers a novel technology that allows physically disabled people to operate software applications and execute multimedia-related tasks, through eye-movements (using an eye-tracker) and mental commands (using EEG-recorders).

Besides potential benefits of computer Assistive Technologies (ATs) like MAMEM, earlier literature warned about high rates of AT non-use, which leads to detrimental effects on both an individual and collective level [2]. Similar to the general population, beliefs and attitudes of individuals with disabilities towards a technology may prevent its acceptance and use [3, 4]. During the initial stage of technology adoption, training has been found as one of the key factors to influence user beliefs and attitudes about the specific technology [5, 6]. This signals the potential of persuasive technologies, embedded in computer and software training interventions, to create or increase favorable user reactions to new technologies.

Studies have shown that persuasive games can be an effective approach to change attitudes and behaviors and has been applied to various domains, such as education, health and sustainability. Persuasive games have been defined as games that are designed with the primary purpose of changing a user's behavior or attitude using various behavior change theories and strategies [7]. Inspired by such empirical evidence, we developed and implemented a game-based training intervention for the MAMEM technology, consisted of various persuasive strategies.

Though persuasive technologies can be effective in motivating the desired behavior and attitude change, there are individual differences in the way people are motivated [8]. One of the limitations reported in the area of persuasive game design is that, oftentimes, persuasive games adopt a one-size-fits-all approach to their intervention [7]. Numerous studies, both in the field of persuasive technology and in the gameplay specifically, highlighted the importance of tailoring strategies to an individual level, in order to increase people's motivation to change their attitudes and/or behaviors [7, 9, and 10].

The focus of the current paper is to provide a description of the tailored, persuasive game-based training for the MAMEM technology, intended to influence users' technology acceptance beliefs and usage behaviors. Firstly, we briefly introduce the MAMEM technology and then, we briefly describe the persuasive strategies that constitute the persuasive game-based training. Afterwards, we go on discussing how we designed our game-based computer training to be tailored to individual users, using both theory and data-driven approach.

[1] http://www.mamem.eu/

2 MAMEM technology

MAMEM technology provides novel and natural ways in which people can operate their computers, like using their eyes. As a result, a new web browser has been developed, called GazeTheWeb (GTW). GTW can be controlled solely with the eyes movements, which are captured by an eye-tracking device, mounted at the bottom of the computer screen. Training is deemed necessary, in order for the users to become familiar with using their eyes to control a computer as well as with learning the functionalities of the new web browser (GTW). Hence, the first step was to design the necessary training activities (i.e., using the GTW icons and typing on the virtual keyboard), in order for the user to learn the system. Next, the identified training activities were translated into a gameplay, consisted of a plethora of persuasive strategies and game mechanics.

2.1 Development of MAMEM persuasive game

To date, several persuasive games are based on designers' intuition, despite substantial research evidence showing the relative superiority of interventions that are based on theories and models of behavior change motivation [7]. Taking into account such a limitation, we carefully selected the persuasive strategies of our game-based training, using Intervention Mapping (IM), a 6-step framework for developing and implementing health interventions [11]. The targeted behavioral variables of our intervention are relate to the technology acceptance and its determinants, as specified by the Technology Acceptance Model 3, TAM 3 [12] (for an overview see [13]). Furthermore, the derived theoretical interventions were translated into game design specifications, by making use of applied tools, like design patterns, defined in the software engineering domain as a description or template of a general repeatable solution to a commonly occurring problem (for an overview, see [14]). Since a further description of the intervention development is out of the scope of this paper we only present the core persuasive strategies that formed our game-based training method (more information can be found in [13, 14]. Table 1 contains these persuasive strategies accompanied by a brief description of their translation into game mechanics.

2.2 Tailored communication of the MAMEM persuasive game

One of the characteristics of the MAMEM persuasive game is that it provides influencing strategies, tailored to individual characteristics and learning process. Tailored communication is defined as any combination of information or change techniques, intended to reach one specific person, based on the characteristics that are unique to that person, related to the outcome of interest, and derided from individual assessment [15]

Three categories of tailored communication has been proposed: Personalization, feedback and content matching [15]. These three categories and their related techniques are often used in combination. Each of these categories has been implemented into the

MAMEM persuasive game. Table 2 describes each technique and how it has been tailored to relevant user characteristics, as well as how they were applied within the persuasive game to further enhance the technology acceptance of the MAMEM trainees.

Table 1. Overview of the core persuasive strategies for the MAMEM game-based training

Persuasive game-based training interventions	
Selected persuasive strategies	Application to the MAMEM game
Evaluative feedback	System provides frequent user performance evaluation at the end of each level.
Factual feedback (scoreboards)	System tracks and shows user performance in a number of quantifiable criteria (i.e., cumulative scores of time and errors).
Encouragement	System provides an encouraging message following low user performance at the end of a level
Suggestion	System provides suggestion for repeating a game level when performance is low
Self-monitoring	System keeps track of user performance (i.e., time, errors) which are visible to the user throughout the gameplay
Social comparison (leaderboards)	System shows a user's performance relative to the other users
External rewards and praises	System provides virtual trophies and praises users for their performance
Liking	Game graphics matching the gameplay
Levels	Game advances through different levels of increasing difficulty
Assignments	Game contains short-term goals to be achieved by the users
Tailoring	Personalize interventions based on user characteristics and performance data

3 Conclusion

All in all, this paper presents a tailored training program in the form of a persuasive game, with the overall goal to motivate MAMEM trainees to accept and use the system. The game-based training is well grounded in theories and models as well as recent scientific insights. A limitation of the intervention is that it has not been tested empirically yet. Currently, we are performing both lab studies and field studies with real patients to examine the effectiveness of the persuasive game-based training on user technology acceptance and performance. Based on the results of such studies we will refine our interventions and we will expand the tailoring of persuasive strategies to other relevant user characteristics (i.e., computer self-efficacy and computer skills). The output of this research project is relevant for increasing acceptance and usage of assistive technology by the MAMEM target groups, but also for the scientific insights in personalization of persuasion.

Table 2. Tailored communication for MAMEM game-based training (adapted from [15])

Tailoring category	Tailoring strategy	Strategy Description	User characteristics	Application to MAMEM game
Personalization	Identification	Identification of the recipient in the message	Mentioning of user's name	The game features user name on the top right of the screen; User name is mentioned in the feedback provision.
Personalization	Contextualization	Frames information in meaningful context	Use of cultural ethnicity	Game assignments are tailored to the culture of the MAMEM patient groups (i.e., Greek and Hebrew).
Feedback	Descriptive	Reports of what is known about the user based on his/her data	Use of User performance data	Individual performance data (i.e., time and errors) are visible to the user during the gameplay, as also individual cumulative scores are provided at the end of each game level.
Feedback	Comparative	Contrasts what is known about the recipient with what is known about others	Use of user group performance data	User's individual performance data is compared only to that of other user who belong to the same patient group (i.e., Parkinson's disease group)
Feedback	Evaluative	Make interpretations or judgements based on what is known about the user	Use of user performance data	System Interpretation of the user performance data (i.e., "it only took you 5 minutes to finish the level; this is very fast").
Content matching		Direct messages to individual status on key theoretical determinants	User gender and age	The content matching messages the MAMEM game provides are based on determinants derived from TAM and two core moderators of the model (gender and age)

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