

Break the Habit! Designing an e-Therapy Intervention Using a Virtual Coach in Aid of Smoking Cessation

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Abstract. E-therapy offers new means to support smokers during their attempt to quit. An embodied conversational agent can support people as a virtual coach on the internet. In this paper requirements are formulated for such a virtual coach and a global design is proposed. The requirements and the design are based on an extensive analysis of the practice of individual coaching of the Dutch organization STIVORO. In addition, the outcomes of a survey research measuring the acceptance of such a virtual coach by a potential user group are described.

1 Introduction

Smoking poses a major threat to public health. The toxic chemicals from cigarettes cause respiratory and cardiovascular diseases and cancer having a negative effect on the quality of life, often with fatal consequences. In The Netherlands around 20,000 people die every year because of first-hand smoking, being one of the leading causes of death¹. To quit smoking is a big challenge for most people because of the highly addictive nature of the habit. Most people quit without using any aid, but this is proven to be highly ineffective. The most promising aid during an attempt is individual coaching combined with some form of nicotine replacement [10].

Besides the effects on public health, smoking puts a financial burden on public health services. To reduce these effects the organization STIVORO for a smoke-free future develops and implements health promotion programs on smoking cessation directed at interpersonal, organizational, community and public policy levels. STIVORO is planning to implement individual coaching consisting of six face-to-face sessions of 45 minutes.

Because of the rise of internet technology the use of e-therapy provides new possibilities to intervene in a cost-effective way. The advantages of e-therapy are the small barriers for smokers to adopt a program, continuous availability and the opportunity for smokers to interact and provide social support. At this time several informational websites, newsgroups, forums, e-mail services and quit programs are available through the internet.

¹ <http://www.nationaalkompas.nl> Gezondheidsdeterminanten\ Leefstijl\ Roken, 16 mei 2005

Standard e-therapy initiatives suffer from high dropout rates [14]. Using an embodied conversational agent (ECA) could be a way to increase adherence through social interaction in an intuitive and entertaining way. Research shows that using an ECA instead of a normal text interface creates more arousal, trust and commitment [8]. As mentioned the individual coaching proves to be effective. Deployment of an ECA in the role of a personal coach could be a new effective way to support people in the process of quitting smoking. This paper describes a design proposal of a virtual coach using the individual coaching practice of STIVORO as a blueprint.

2 The Design Process

Figure 1 shows the structure of the design process of the virtual coach. The virtual coach is planned to be used as a health promotion program to reduce the number of smokers. When designing such a program the use of a scientific design method increases the chance the program will work out effectively. In the design process of the virtual coach aspects of the Intervention Mapping (IM) protocol are applied [2]. This protocol emphasizes the importance of identifying a target population, the use of empirical data to support design choices, and thinking of the consequences of delivering a message through a certain medium. The IM protocol also focuses on the use of a theory-base to justify the design choices.

When designing an ECA four main areas need close attention to ensure the ECA will have its unique and anthropomorphic character. Personification of an ECA is

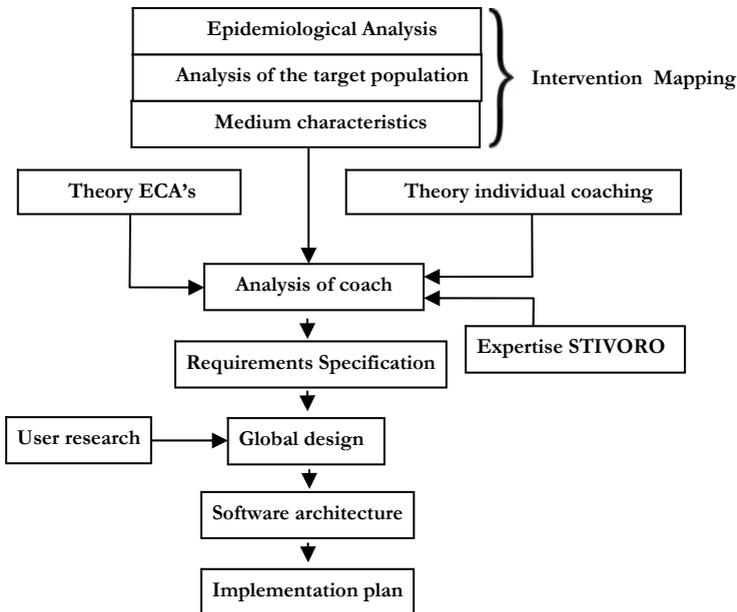


Fig. 1. The design process

possible with a physical, expressional, conversational and emotional point of view [9]. The design process was structured to first analyze the behavior of the coach in practice through analysis of an instruction DVD, the use of literature and relying on the expertise of STIVORO for unspecified matters. The analysis focuses on the four mentioned themes and forms the basis for a requirements specification. The analysis is based on a wide range of literature regarding conversational aspects, emotion and personality classifications and especially literature on the functions and execution of nonverbal behavior.

Based on the analysis requirements were specified. The information gathered in the above-mentioned design steps is used to specify the global design. The design of the software architecture is based on a modular implementation. A prototype that can be developed within reasonable time and a future prototype, describing the planning of the expansions with additional modules, are proposed. Finally, the level of acceptance by potential users is investigated by a user survey.

3 An ECA as a Tutor, Friend or Social Worker

A coach to help smokers in their struggle to break their smoking habit can be described as a mountain guide with whom you climb to the top. In the process of climbing the coach has the role of tutor to give advice and of a social worker to provide emotional support. During the journey to the ultimate smoking abstinence a coach strives for a working alliance with the client, in some aspects comparable to friendship.

When looking at the available literature on ECA's that represent the latter roles, several examples come up. An animated pedagogical agent [7] representing a teacher should have a lifelike human appearance, avoid repetition in movements [20], take the emotional state of the student into account [15] and make use of non-verbal feedback [20]. An emotionally intelligent embodied tutor agent tries to be sensitive to the mental state of the student that interacts with it and uses these affective parameters to determine the course of the dialogue [6]. A relational agent makes use of techniques to evoke a long-term socio-emotional relationship, providing continuity through remembrance of history and management of future expectations [3]. To facilitate human-ECA friendship the ECA should adopt characteristics (personality, attitude) that are similar to those of the user [17]. However, for a virtual coach a friendship relationship is not necessary. A caring agent shows empathy in favor of therapeutic goals and creates a social bond to improve the working alliance.

3.1 Caring ECA's

Examples of interventions in favor of promoting public health and well-being using an embodied agent are Carmen's Bright IDEAS [12], the FearNot! Demonstrator [20], and FitTrack [3]. Carmen's Bright IDEAS is a didactic intervention that helps mothers of pediatric cancer patients to cope with the emotional, physical and financial problems that are caused by their situation. The EU project VICTEC has created the FearNot! Demonstrator, an application using virtual characters in a virtual drama to

educate children against bullying. The FitTrack software was developed to encourage students to exercise. The program consists of a daily session of 10 minutes with the agent Laura about the progress, barriers and targets of increasing physical activity. Laura makes use of speech synthesis and shows non-verbal expressions such as gestures, eye- and head movements, facial expressions and posture changes. The rationale of the ECA of Bickmore is to establish a relationship based on trust, care and social support. To evoke these matters the ECA speaks of a joint future and past, refers to their shared knowledge, uses appropriate greeting and parting actions. Research of Bickmore [3] shows that an ECA is capable of maintaining a long-lasting relationship with a user based on trust.

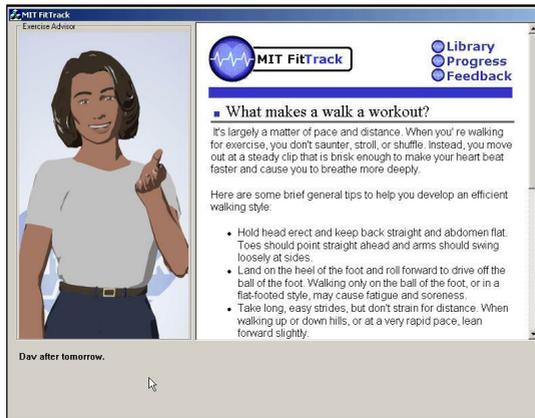


Fig. 2. FitTrack of Bickmore [3]

4 Analyzing a Coach in Practice

The behavior of a human coach in practice was analyzed using an instruction DVD of STIVORO². In addition several manuals and training materials of STIVORO have been consulted, telephone coaches were observed and unspecified matters were resolved by personal communication with STIVORO.

An observation of the exterior of the coach does not reveal any peculiarities. The coach is usually a woman of average age, casually dressed and has a Caucasian ethnicity. The personality of the coach is rather neutral, non-moralizing and friendly. The use of emotions does not serve any therapeutic goal when applying motivational interviewing (to be explained later). The coach shows only modest facial expressions adjusted to the utterances of the client. These expressions are generally empathic and serious. The most frequently occurring facial expressions are shown in Fig. 3.

² Motivational interviewing, training for trainers/coaches. Smoking cessation. (In Dutch: Motivational interviewing, training voor trainers/coaches. Stoppen met roken.) The Hague, STIVORO, 2005.

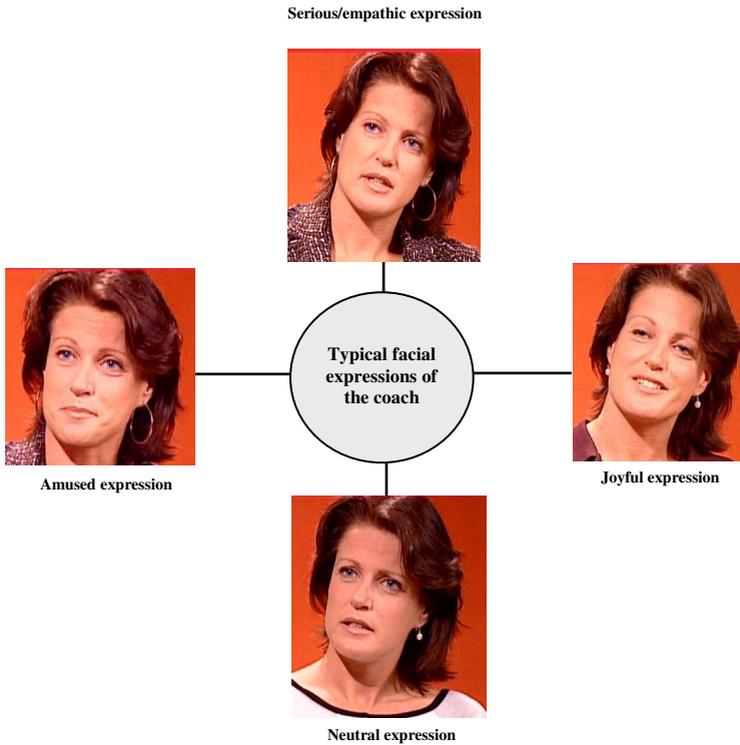


Fig. 3. The most prominent facial expressions of the coach (Source: Instruction DVD of STIVORO)

The conversation is completely determined by the theoretical framework of motivational interviewing [13]. This client-centred yet directive style of counselling has the central goal of eliciting behavior change by helping clients to explore and resolve ambivalence. The coach elicits change talk from the client by removing resistance and makes use of different strategies to improve collaboration and structure the client's thoughts. The coach uses several techniques namely reflection of emotion, content and conflict, active listening, summarizing, asking open-ended questions and provoking. The coach mostly speaks with a low volume and a low tempo to encourage the client to take the floor. Empathic utterances are often accompanied by a specific prosody.

Looking at the non-verbal communication the coach shows specific gaze behavior, encouraging head movements, only sporadically uses gestures and has a rather static but open posture. A more than regular degree of eye-contact can be observed between coach and client [1]. The analysis of the gaze behavior is based on the 'Alphabet and Lexicon of eyes' [16] a framework explaining the relationship between non-verbal signals using eyes, eyebrows and eyelids and their communicative function. The most prominent gaze behavior is depicted in Fig. 4.

5 The Global Design of the Coach

In this paragraph a feasible prototype of the virtual coach that has still to be developed will be described based on the requirements specification. The analysis of the coach in practice has brought up information about the priority of the use of the different nonverbal channels.

A first prototype of the virtual coach contains an instant messenger window visualizing a lifelike female coach from shoulders upwards. A clear interface metaphor is chosen thereby making the application also accessible for less experienced, mostly older and less well educated people. Through a chat interface conversation will be possible through unrestrained text input. The turns are sequential, there is no overlap. The coach shows gaze behavior, head movements and facial expressions. As seen in the analysis the coach utilizes only these nonverbal channels to a large extent. Implementation of only these expressions reduces the complexity of the implementation thereby saving time and money with only a minimal loss of functionality.

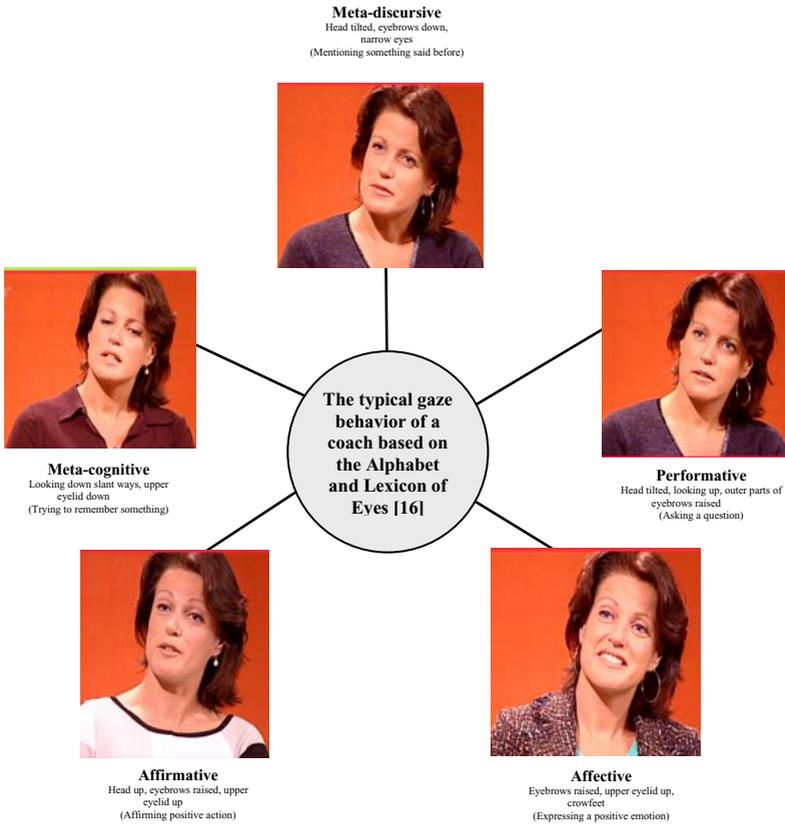


Fig. 4. Most frequent occurring gaze behavior (Source: Instruction DVD of STIVORO)

Regular interaction with chatbots does not provide the quality and conversational techniques needed for this design. The traditional ELIZA-chatbot [19] or a similar chatbot that has become available through the Loebner Prize competition³ will be enriched with scripts that incorporate the motivational interviewing framework. Like in the design of the ECA Laura of Bickmore [3], domain knowledge and knowledge of past conversations will be incorporated in the coach to establish a relationship based on trust, care and social support. To adapt the dialogue between smoker and virtual coach to the characteristics [17] and mental state [6] of the smoker a user profile of the smoker will be built. To improve the meaningfulness of the conversation, topic parsing will enable the coach to control the course of the conversation according to the coaching protocol. Emotion parsing using an emotion lexicon will make it possible to use empathic utterances in a meaningful way.

To select gaze behavior, facial expressions, head movements and hand movements and adjust the length and timing to the output speech of the text-to-speech engine, the BEAT toolkit [4] will be used. For sophistication of the expressions, to prevent repetition and increase the anthropomorphic character of the coach, the EMOTE toolkit [5] will be used. Choosing an incremental approach some modular extensions are possible. Speech recognition, gaze detection through analysis of video images from a webcam and emotion detection based on acoustic analysis and recognition of facial expressions are future add-ons that require additional research.

6 Technology Acceptance of the Virtual Coach

When designing an intervention the major questions should be posed as to whether the program will be adopted and whether the program will be fully delivered to the target population. To get insight into the factors that play a role in accomplishing a successful adoption and implementation of the program it will help to anticipate on these factors by formulation of an adoption and implementation plan [2]. A predictor for the extent to which adoption of the virtual coach will take place is the level of technology acceptance.

To evaluate whether the proposed innovative technology will be accepted by a potential user group a survey has been conducted with 35 smoking university students wanting to quit within the next six months. Highly educated students are a population that is more likely to use the virtual coach compared to less well educated and older people because of their affinity and experience with internet and computer applications (though the latter group is gaining experience quickly).

The Unified Theory of Acceptance and Use of Technology (UTAUT model) [18] has been operationalised to measure behavioral intention to use the virtual coach. Of the respondents 49% wants to try the coach when available, 37% is not willing to use the virtual coach and the rest is still in doubt. Most respondents expect to have enough time, skills and equipment to use the technology and most of them are relatively positive about the effort they expect it will take to use the virtual coach; they expect it to be user friendly and easy to learn. The respondents are still uncertain whether the virtual coach will indeed increase the effectiveness of the quit attempt (performance expectancies).

³ <http://www.loebner.net/Prize/loebner-prize.html>

A mediating factor for the performance expectancies turns out to be the level of computer experience. The expert user seems to have a more skeptical view than the novice. Another significant mediating relationship exists between behavioral intention and the willingness to use smoking cessation aid. The influence of age differences is not taken into account because of the limited spread. There is no significant relationship demonstrated between gender and the factors of the UTAUT-model.

7 Conclusions

This paper described the background and motivation for the future development of a virtual coach to aid smoking cessation. The proven to be effective personal coaching intervention of STIVORO has been a valuable blueprint to formulate requirements for the virtual coach. A global design has been proposed in which only the most prominent nonverbal channels are planned for implementation in the first prototype. To enrich the functionality and humanness of the virtual coach a lot of work has to be done on the improvement of natural language generation algorithms. When the coach is available a reasonable part of highly educated smokers will probably use the virtual coach during their quit attempt. The virtual coach is a promising new technology that needs a lot of additional research. In this stage the development of a first basic prototype is important to get an impression of its usability and effectiveness.

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