

Mental Health Promotion with Animated Characters: Exploring Issues and Potential

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Abstract

In this article, we explore the possibility of using animated characters as personal social companions for supporting interventions for promoting health behaviors. We explore how supportive feedback could be provided to users of such artificial companion systems, by coupling both personalized intervention content from a mental health perspective with personalized affective social agents such as graphical facial avatars or Embodied Conversational Agents (ECAs). We discuss the issues and potential of such an approach.

Introduction

Recent years have seen an explosion of work on artificial affective characters in a variety of contexts (Trappl 1997; Paiva 2000; Dautenhan 2000; Dautenhahn et al., 2002; Trappl 2002; Pelachaud and Bilvi, 2003; De Rosis et al., 2003; Predinger 2004). In particular, Embodied Conversational Agents (ECAs) have been proposed as a natural human-computer interface because of their anthropomorphic features and capabilities (Walker, 1994; Cassel, 2000). Such avatars are now being used in a variety of contexts such as internet commercial agents, information agents in city kiosks, or at airport as check-in agents.

In the context of mental health promotion, it has been suggested that introducing avatars and ECAs to *complement* human interventions might have a strong positive impact on users (Coyle et al., 2007). Indeed although mental illness has been identified as the second leading cause of disability and premature mortality in the

developed world, the majority of people suffering from treatable mental health disorders do not have access to the required treatment and computer assisted mental health interventions and computerized interventions might be able to address this imbalance (Coyle et al., 2007).

In a search for using some of latest progress in ECAs and affective computing for enhancement of health and healthy habits, some issues need to be addressed:

- What kind of computer system could help? What precisely should it be able to do?
- What kind of psychotherapeutic interventions could benefit from computer-based assistance.
- What kind of interfaces would be engaging enough visually, emotionally, socially to perform the task at end?
- What kind of computer system linked to the interface would be relevant (e.g. behavior eliciting questionnaire, dialog system, a game-type of interaction?)
- Could we inspire ourselves from games they are already familiar with (i.e. HCI metaphors) to design helping systems for improving their health?
- Would girls need a different system than boys?
- Does the personality of the individual matter?
- How should the system behave depending upon the identified personality of the individual (once identified, it can easily be memorized and accessible)?

In this article we focus on one particular behavioral problem – underage drinking – and one particular psychotherapeutic intervention – brief motivational interviewing. Underage drinking has been identified as one of the USA’s most serious public health concerns (NIAAA

2004-2005). One out of three 10th graders report drinking in the past month, and one out of five report binge drinking (≥ 5 drinks per drinking occasion); older teenagers drink even more (Johnston, O'Malley, Bachman, & Schulenberg, 2007). Age of drinking onset and drinking intensity are positively associated with teens experiencing harm from their drinking; delaying the onset of drinking and reducing harmful drinking are the essential aims of prevention efforts. From a public health perspective, current prevention programs inadequately address these aims. A primary limitation is that prevention messages, in order to be most impactful, must be individualized. This requires considerable human effort, and typically involves face-to-face assessment and feedback sessions led by trained health educators. Moreover, variations across different health educators can contribute to variations in prevention effectiveness, so expert supervision and systematic program fidelity evaluation are standard practice. The human time and effort required make it difficult to feasibly reach large audiences, and have blocked prevention programs' ability to make a large-scale impact on underage drinking.

Artificial social companion software systems coupled with human intervention may offer an avenue by which to avoid these roadblocks. In this article, we introduce the notion of brief motivational interventions (BMI's). BMI's are proving a successful alternative to more traditional psychotherapeutic approaches. We give a brief description of an NIH-sponsored project entitled "Adolescent Behavior and Lifestyle Evaluation (ABLE)" which is the specific context we are currently looking into. We explain how the nature of BMI's makes them well suited for being coupled with computer social orthotic systems. We identify issues and potentials of such an approach and we propose an initial system involving personalized computer feedback to help behavior change. In particular, we investigate how social orthotic companion systems could be designed to help teenagers with alcohol abuse issues. This article proposes personalized computer feedback, avatars or ECAs reminders and interventions. If successful, such system could also be applicable for anger management interventions as well as a variety of other behaviors.

Related Work on Artificial Empathetic Characters

Recently, researchers have started to explore the potential of using animated characters and human-computer interaction.

One study worked on establishing working-alliance in the context of health behavior change for physical activity using an avatar with 'relational skills' such as empathy and social dialog abilities to maintain *motivation* in the patient. The user's emotional and physical states were recorded by

self-report and pedometer readings respectively, and dialogs were created in advance for each day of the interaction. Users preferred the interaction with the empathic agent than without, but found the repetitiveness of the dialogs a limitation (Bickmore et al., 2005). Another study related how an ECA can converse with a user to change their dietary behavior within the context of a diet counseling dialogue with unconstrained typed text utterances with an ECA in a Wizard of Oz experiment, and combined the results from simple parsing rules with contextual features using a Bayesian network to determine the user's stage of change, emotional state (*confident*, *demoralized*) and his attitude toward the agent automatically (de Rosis et al., 2006). A different approach was taken which studied how believable characters based on the OCC model (Ortony, et al., 1988) can elicit empathic reactions in children and help anti-bullying, found positive preliminary results (Dias and Paiva, 2005). Yet another approach started to investigate whether it is possible to build artificial affective empathy from user's affect sensed from physiological expressions of emotions (Predinger and Ishizuka, 2005). Such an alternative coupled with emotion expression abilities would enable the possibility to build animated characters capable to react similarly and resonate with the user's experienced emotions.

All these systems and applications have in common their emphasis on social intelligence found in encouragement, display of empathy, and developing rapport as key factors in engaging, maintaining engagement and motivating users in their application domains.

In this article we will investigate how the current abilities of animated characters can be coupled with current therapeutic interventions for mental health behavioral change assistance, and will focus on one specific domain, teenagers with alcohol abuse issues.

Brief Motivational Interventions

A rapidly growing theoretical and empirical literature has demonstrated the effectiveness of brief motivational interventions with substance abusing populations (DiClemente, Bellino, & Neavins, 1999; Miller, Andrews, Wilbourne, & Bennett, 1998; Burke, Arkowitz, & Mechola, 2003). In a recently published meta-analysis of controlled clinical trials of the briefest form of motivational interventions, *motivational interviewing (MI)*, Burke et al. (2003) concluded that motivational interviewing was a clinically effective approach to treating problems involving alcohol or drugs—MI participants reported reducing their drinking by an average of 56% across studies.

MI typically involves a brief assessment followed by feedback about the assessment results. Assessment data compiled from an individual are used to provide individualized, age- and gender-graded feedback about drinking and related behaviors. Throughout the MI interaction, a client-centered counseling style is used. The acronym FRAMES describes the clinical components of MI:

1. giving personal **F**eedback regarding a client's individual status
2. placing **R**esponsibility for change with the individual;
3. giving **A**dvice on the need to change in a supportive (i.e., not authoritarian) manner;
4. providing a **M**enu of different change options;
5. using an **E**mpathic counseling; and,
6. reinforcing the client's **S**elf-efficacy regarding their ability to succeed in making changes.

The clinical effectiveness of MI with substance abusing populations is well documented, and there is strong support for considering motivational interviewing interventions "empirically supported therapies" (ESTs). ESTs are defined by Hall (2001) as "treatments that have been demonstrated to be superior in efficacy to a placebo [an inert treatment designed to emulate the non-clinical components of the treatment] or another treatment [a previously established or currently practiced treatment for a given condition]" (p. 503). As a result, motivational interviewing and other brief motivational interventions are quickly gaining popularity as alternative or adjunctive approaches to more traditional, more cost-intensive, less effective, and less accessible approaches to behavior change (Ryder, 1999; Walitzer, Dermen, & Connors, 1999; Yahne & Miller, 1999).

While initially used with *addictive behavior* problems, such interventions have been implemented with success for a *variety of behaviors* ranging from diabetes self-management (Doherty, Hall, James, Roberts, & Simpson, 2000) to water disinfection practices (Thevos, Quick, & Yanduli, 2000) to treatment adherence among psychiatric patients (Swanson, Pantaloni, & Cohen, 1999) to fruit and vegetable intake among African Americans (Resnicow, Jackson, Wang, et al., 2001).

Motivational Interviewing

Miller and Rollnick (1991) describe the five principles of motivational interviewing as:

1. expressing empathy,
2. developing discrepancy,
3. avoiding argumentation,

4. rolling with resistance, and
5. supporting self-efficacy.

These five guidelines distinguish motivational interviewing from more traditional confrontation-of-denial counseling approaches for substance use problems (see Table 1). In contrast to traditional approaches, motivational interventions are intended, through *support* and *persuasion*, to increase the likelihood that people will make changes in their behavior by helping them to recognize that problems exist in their lives and to overcome ambivalence about change.

Table 1. Contrasting Therapeutic Styles

<u>Stereotypic Counseling</u>	<u>Motivational Interviewing</u>
• Goal-oriented	• Patient-centered
• Expert role	• Collaborative
• Focus on action	• Focus on motivation
• Direct persuasion	• Explore ambivalence
• Medical education	• Individualized feedback
• Give reasons to change	• Elicit reasons to change
• Clinician talks more	• Clinician listens more

This directive, client-centered counseling style has as an overarching goal to create and *magnify discrepancies between client goals and current behavior*. Rollnick and Miller (1995) describe MI as "helping clients to explore and resolve ambivalence [about reducing substance involvement]", and enumerate the "spirit" of MI as:

1. Motivation to change is elicited from the client, and not imposed from without.
2. It is the client's task, not the counselor's, to articulate and resolve his or her ambivalence.
3. Direct persuasion is not an effective method for resolving ambivalence.
4. The counseling style is generally quiet and eliciting.
5. The counselor is directive in helping the client to examine and resolve ambivalence.
6. Readiness to change is not a client trait, but a fluctuating product of interpersonal interaction.
7. The therapeutic relationship is more like a partnership or companionship than expert/recipient roles.

Motivational interventions appear to be particularly effective for clients at earlier stages of change or who demonstrate high levels of anger (Heather, Rollnick, Bell, & Richmond, 1996; Waldron, Miller, & Tonigan, 2001), and hold promise for use in "*window of opportunity*" situations (e.g., emergency room visits, substance-related arrests) during which motivation to change may be especially malleable (Heather et al., 1996; Monti, 1997).

Adolescent Behavior and Lifestyle Evaluation (ABLE)

Our motivational interviewing intervention for high school students follows most closely the motivational interviewing intervention for college students developed by Marlatt et al. (1998; see Dimeff et al., 1999 for details). In our motivational interviewing intervention for high school students, participants are provided with personalized feedback as is done in many brief interventions. However, due to the age and developmental characteristics of the sample (relatively inexperienced with alcohol and not seeking treatment), more preventive goals also are addressed. Beliefs about alcohol effects and normative practices are elicited and challenged.

Specifically, topics covered in the feedback session include *personalized feedback* in the areas of:

- (a) self-reported drinking,
- (b) perceived current and future risks of drinking,
- (c) negative consequences of current consumption patterns,
- (d) personal goals and their relation to alcohol use,
- (e) social supports and their beliefs about drinking, and
- (f) intentions and self-efficacy in regard to personal drinking goals.

We provide adolescents with *written, graphic, and verbal feedback* about their own substance use vis-à-vis age- and gender-specific national norms. The belief that "everyone does it" is challenged via this feedback (Dimeff et al., 1999). As noted in Larimer and Cronce's (2002) recent review of individual-focused strategies to reduce problematic alcohol consumption by college students, this type of brief motivational feedback has consistently been found efficacious in reducing late adolescents' hazardous drinking in four separate studies conducted at three different universities by three different research teams.

Digital Social Orthotic Companions

Given the nature of brief motivational intervention with its well-identified six components, we believe that it would be relevant and beneficial to couple the intervention with computerized social companions, possibly on a mobile device such as a mobile phone. Indeed, one potential medium for intervention has been introduced with the massive use of portable phones, which have been found useful for such contexts as persuasive games or managing a chronic disease because they can be 'worn' all the time and are always available to provide feedback.

Consistent with the approach used in ABLE, recruitment and baseline data collection would take place on site at the school. Initially, a school-wide confidential survey is conducted to identify those students qualifying as drinkers (e.g., 6 or more drinking occasions in the past year).

Once identified, drinkers would then be invited to participate in computerized health evaluation and feedback. The Artificial Social Companion MI software will feature a three-dimensional, mobile, and emotionally expressive animated narrator who reads all material (such that no reading literacy is required). The intervention will be conducted in a single-session with the following three primary MI components:

- 1) feedback regarding the negative consequences of alcohol use that the participant reported, as well as self-reported readiness to change and alcohol use as compared to that of same age and gender peers; these could be computerized and available as reminders;
- 2) pros and cons of alcohol use and related change, in which the participant chooses from lists of positive and negative aspects of alcohol use from their perspective. The benefits are identified during the interview as shown in Figure 1, and could be computerized and maintained available as reminders in the software.

The image shows a screenshot of a survey question on a light blue background. At the top right is a small icon of a globe. The question reads: "What are some benefits that you might expect if you reduced your alcohol use...?". Below the question is a sub-header: "Some benefits I might expect if I reduced...". There is a list of ten options, each with a radio button (checkbox) to its left. The options are: a. I would expect to be healthier; b. I would expect to worry less about being caught; c. I would expect to have more money; d. I would expect my memory to improve; e. I would expect to be able to think more clearly; f. I would expect to have more energy to do things; g. I would expect to be more productive; h. I would expect to do better at my job or school; i. I would expect to have more self-respect; j. I would expect to _____.

Figure 1: Benefits from Reduced Alcohol Consumption

(3) a summary and query regarding the participant's interest in change, followed by optional goal-setting regarding alcohol use reduction. Once identified, the responses to the query regarding the participant's willingness to change and goals can be computerized, stored and re-presented to the individual any time as a reminder when he or she feels in need of reminder or reassurance, possibly on a mobile device like a PDA or portable phone. Figure 2 shows how goal discrepancies are elicited and could be computerized as a reminder when needed.

Please think about your 5 most important goals...

Use the scale below to rate your goals:

Very Negatively 1	Negatively 2	Not Positively or Negatively 3	Positively 4	Very Positively 5
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My Goals	My alcohol use affects this goal:	Reducing my alcohol use would affect this goal:
1)		
2)		
3)		
4)		
5)		

9

Figure 2: Important Goals Discrepancies

Furthermore, the network of people the individual can count (currently elicited from teenager and listed as text in the current feedback pamphlet), could be linked in the feedback software with photos of the support people concerned with their phone number attached, ready to be dialed when needed.

(4) Throughout the intervention section, the social companion uses an empathic counseling style – anticipated can be well-rendered with an empathic anthropomorphic avatars (see next section), and “reflects” back the participant’s answers, emphasizes that choosing to change or not is up to the participant, and expresses optimism regarding the possibility of success.

Avatars as Social Companions

In choosing the most appropriate ECA for interaction with a specific teenager, special considerations can be given to the appearance of the avatar, something that cannot be done with a human psychotherapist, and therefore presents an added flexibility for our computer-based social companion approach.

Avatars or ECAs representing diversity will be available in the software agent systems. Options to change various features of the avatar, such as its face, skin type (indicating age), skin color, voice, hair, make-up, accessories, and background will be provided to the user (Nasoz and Lisetti, 2006). Given that people have varying preferences for the “look and feel” of their interlocutor (be it a physician, nurse, tutor, etc.) this flexible technology will provide the user with the choice to pick from a built-in library of different avatars displaying various ethnic backgrounds, ages, and gender, shown in Figure 3 (Nasoz and Lisetti, 2006).

Ethnicity was previously assessed as having meaning beyond arbitrary representation (Nass, Ibister, Lee, 2000), in a study that established that the same words meant different things when coming from an ECA that had similar *ethnicity* as opposed to different. The results provided strong evidence for surprising similarities in the way people respond to ethnicity in ECAs and in humans.

The possibility for the teenager to chose an avatar that matches his or her ethnicity might enable the social companion to have the maximum positive impact on behavioral change.



Figure 3: Multi-Ethnic Designed Avatars

Interestingly, gender stereotypes that people unconsciously apply to computers were found not to be as strong as those they have about people (Nass, Ibister, Lee, 2000), and therefore the choice of the avatar gender might not be a crucial issue. Age was not studied previously and will need to be tested to insure maximum potential impact of our companion system.

It could be that for some individual, the most effective avatar is a anthropomorphic character with fantastical features (which can also be arranged with our software).

It could also be the case that the best character figure for one given individual is a morphed representation of the therapist who initially interviewed the individual and delivered the personalized feedback to him or her.

The software-based social companion is able to express custom-made facial expressions which will be coupled with the appropriate oral feedback read back to the user (as explained above). The facial expressions are (Paleari and Lisetti, 2007) based on Scherer's cognitive appraisal emotion theory, which temporally stages each facial action movement on the face according to cognitive event sequences associated with the emotion for increased expressive believability shown (as still images) in Figure 4 (a-c).

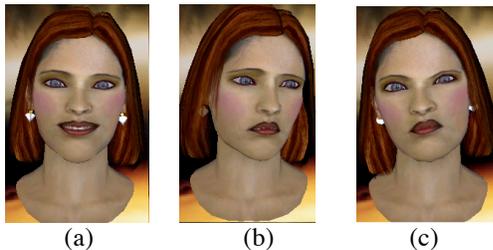


Figure 4: Dynamic Facial Expression Generation based on Scherer's CPT (a) Happy, (c) Sad, (e) Angry

Our approach is complementary to approaches developing mark-up languages to control behavior of life-like characters during interaction dialogues or during web-based interactions, as with APLM (De Rosis et al., 2003; Pasquariello et al., 2001; Pelachaud, 2003) – an XML-based language allowing to specify the meaning of a communicative act then instantiated to an expressive communicative signal, or as with MPML (Predinger, 2004) – an XML-style language enabling authors to script rich web-based interaction scenarios featuring life-like characters.

Personality was also found to be of importance in establishing believability and attempts to model emotions

and traits have been proposed (Hudlicka 2002; Velasquez 1996). Studies to advise which companion personality might best fit the individual will need to be conducted in order to guide the design of the digital personality.

One strength of our approach is that the feedback and intervention can be tailored to the specifics of the individual's preferences for anticipated maximum impact.

Conclusion

In this article we have proposed that social orthotic companion systems might have a powerful positive impact on a variety of behavior changes. In particular, we described how brief motivational interventions (BMIs) have proven successful helping adolescents with alcohol abuse issues. We identified how BMIs can be coupled with computerized personalized feedback. We discussed how embodied conversational agents (ECAs) or avatar can be designed to act as social companions in this contexts and identified key issues relevant to make this promising interdisciplinary approach viable and successful. Much more research on the topic is needed.

Acknowledgements

This research is supported in part by a grant from the National Institute on Alcohol Abuse and Alcoholism (No. 5R01AA013825).

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