MODELLING THERAPEUTIC EMPATHY IN A VIRTUAL AGENT TO SUPPORT THE REMOTE TREATMENT OF MAJOR DEPRESSION

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Abstract: The use of computer based psychotherapy has been one of the fields that have attracted the interest of practitioners and computer scientists in the last years given the initial and promising results. In particular the use of computerised cognitive behavioural therapy for the treatment of major depression has been supported the evidence that psychological therapies can be delivered effectively without face to face contact. However, the value of these tools for patients is limited by the difficulty of staying engaged during the long-time periods of the treatment. The use of Virtual Agents as enhanced human-computer interaction brings the opportunity to overcome this limitation by establishing effective long-term social relationships with patients. We introduce the main ideas behind the design of a cognitive-emotional model aimed to generate *therapeutic empathic* responses and support the remote treatment of major depression.

1 INTRODUCTION

The recent advances in the development of non-invasive, wearable sensors and wireless communications, have contributed to create environments where hardware devices are transparent, seamlessly integrated and connected in everyday life people's situations. One of the main fields that has benefited from these novel environments is healthcare through the development of systems that provide telemedicine/pervasive care capabilities for a higher patient's *empowerment*. Several applications have been developed in the last decade where different physiological, physical and environmental data are obtained through sensors that continuously and remotely monitor the patients' condition (Baga et al., 2009), (Farré et al., 2009).

The main advantage of these systems is that the real-time generated data through monitoring can be used to provide immediate feedback to patients, enabling a more active involvement of the person in his/her treatment. The treatment of mood disorders is one of the cases where important part of the success is due to the active participation of the patient. In particular, during the treatment of major depression each person should develop their own personalised strategies for staying well and avoiding relapses, strategies that are tailored to their individual needs and characteristics (Kelly, 2000).

The use of telemedicine applied to mental health (and particularly in the treatment of major depression) is a relatively new area under research. One of its main aims is to promote a participative attitude of patients over the course of the treatment and minimise the risk of a premature discontinuation of it which appear one of the main reasons behind relapsing. Some initiatives already exist in this context such as computerised cognitive behavioural therapy (CCBT) which uses stand-alone computer software or a web application to encourage patients to complete self-help tasks that involve altering behaviour and reflecting on and reframing cognitions. Examples of these applications include Beating the Blues (http://www.beatingtheblues.co.uk/), MoodGYM (http://moodgym.anu.edu.au/) and FearFighter (http://www.fearfighter.com/) among others. CCBT appears only weakly effective when the motivation to continue is left to the patient, but has greater benefit when use is augmented by support (Kaltenthaler, 2006); to date this has been provided either face to face or by telephone.

A complementary approach is a system that supports the remote patient's treatment through the

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provision of a continuous and personalised monitoring over specific behaviour patterns to collect relevant data allowing the identification of current patients' condition. The collected information can then be used to provide specific information and recommendations to the patient complementing the treatment and more important, prevent the recurrence of symptoms in the future.

Equally important to the suitable collection and interpretation of patient's data, is the manner to provide the information and recommendations to the patient in order to increase his/her engagement and help him/her to form an alliance with the system. The work presented in this paper describes the first steps towards the design of a virtual agent (VA) as the main user interface within a system to support the remote treatment of patients diagnosed with major depression. In particular, we present our main ideas for the development of the internal mechanism in the virtual agent that will lead an *effective therapeutic empathic behaviour* to engage patients and motivate them to keep interacting with the system and in consequence, promote treatment adherence.

The following section briefly presents some current works where synthetic characters have been developed for mental health interventions. Section 3 makes a general description of the system to support the remote treatment of major depresssion in which our VA is embedded. Section 4 describes the main ideas behind the design of the VA mainly discussing the differences between *natural empathy* and *therapeutic empathy* and how the conceptualisation of the second will be integrated in the VA's cognitive-emotional model to generate empathic responses. Finally section 5 presents the conclusions by describing the current and further work.

2 SYNTHETIC CHARACTERS IN MENTAL HEALTH

Semi-automated computer-driven interactions have long been used in healthcare for reminder messages, disseminating health information, administering questionnaires, and even conducting interventions (Glasgow et al., 2004). As the technology to create and control believable synthetic characters has become more widely available, the user interface design has changed to include embodied conversational agents. The key to successful interfaces that are structured around an agent is the relationship between user and agent (Bickmore and Mauer, 2006). If patients build a rapport with their agents, they are more likely to use the system, and more motivated to complete longer sessions. Well-designed VA's have been shown to motivate users (Baylor, 2009) and lead to higher user engagement than traditional static visual user interfaces (Dehn and van Mulken, 2000).

There are currently some promising examples of VA-based interfaces in mental health applications. The work presented in (Lisetti and Wagner, 2008) discusses the issues and potential of animated characters to promote healthy behaviours for helping teenagers with alcohol abuse through *motivational interventions*. Tartaro and Cassell (2008) describe the development and evaluation of a virtual character to engage children suffering from autism spectrum disorders (ASD) in collaborative narrative to produce contingent discourse. Bickmore et al. (2010a) developed an agent which encouraged people with schizophrenia to adhere to their medication regime, as well as an agent who provided discharge information to people with depression who were about to leave the hospital where they had been admitted for treatment (Bickmore et al., 2010b). In (Pontier and Siddiqui, 2008) a VA that guides the user through the Beck Depression Inventory (BDI), –a questionnaire used to measure the severity of depression– is presented. Through a basic emotional model, the VA shows an empathic behaviour (through its facial expression representing *sadness* and/or *happiness*) to the user depending on his/her assessed depression level.

All these previous efforts have contributed to identify a set of key characteristics that these interfaces should adopt. Such features include the *appearance*, *verbal* and *non-verbal communication*, coherent *personality*, *referencing knowledge of prior interactions*, *variability in agent behaviour* and the adoption of an *empathic behaviour* during interaction. In this paper we focus on our current activities towards the design of a VA able to produce effective *therapeutic empathy* interactions.

3 HELP4MOOD: SUPPORTING THE TREATMENT OF MAJOR DEPRESSION

Our proposed VA is a key component of a FP7-EU research project aimed to support the remote treatment of people with major depression (www.help4mood.info). The main aim of the project is to support people with major depression in its

mild to moderate form (those people who do not require hospitalisation but need to follow the treatment as part of their daily activities). The proposed system will collect a relevant set of parameters that allow the detection of specific behaviour patterns in the patient, prompting adherence to computerised cognitive behavioural therapy, and promoting healthy behaviours in response to monitored inputs.

The three main components of the Help4Mood system include a *Personal Monitoring System* (PMS), a *Virtual Agent*-based user interface, and a *Decision Support System* that will support clinicians in interpreting self-reported and monitoring data. The PMS will collect two types of data: *i) behavioural data* including patterns of sleeping, motor activity and speech; and *ii) subjective data* including brief validated scales to measure mood, cognition and behaviours. The identified behaviour patterns will then be used by the VA to prompt the patient (when appropriate) to carry out potentially helpful activities, such as relaxation or exercise, offer the opportunity to add entries to a spoken diary or, if the collected data suggest a potential treatment failure and/or a suicide risk, urgently alert the clinical site leading to a direct communication.

The specific feedback provided by the VA will be mainly through a combination of dialogue interaction and a basic set of body movements and facial expressions designed to maintain the attention of the patient and help him/her to effectively manage important stages of his/her treatment. The VA is composed of three main modules: the graphical appearance, a dialogue manager system which will implement and manage the interaction dialogues between the VA and the patient, and the module which generates the VA's cognitive-emotional behaviour which is introduced in this paper.

A patient-side Decision Support System will facilitate intelligent, adaptive interpretation of self-reported data. A clinician-side Decision Support System will distil both self-reported and objective data into a succinct textual and graphical overview that will help clinicians in the assessment of the patient's current state and guide further treatment decisions.

4 DESIGNING THE VIRTUAL AGENT

An important aspect in the development of the Help4Mood's VA is to motivate a long-term use and interaction between the user and the agent. This is an especially important issue when the main objective of a VA is to promote the use of the system and complete longer sessions (Bickmore and Mauer, 2006). The key characteristics that highly contribute to maintain the motivation of users while interacting with virtual characters include the believability of the VA's behaviour and a good verbal and non-verbal communication. To successfully obtain these two characteristics in a VA, there should be an internal mechanism that produces a coherent *emotional behaviour* and communication that complements the *cognitive actions* and decisions taken during interaction.

A *coherent* and *consistent emotional* behaviour (usually referred as *emotional competence* with respect of two domains: emotion production and emotion perception (Scherer, 2010)) has been identified as particularly important in VAs used for psychotherapy (Bickmore and Gruber, 2010), (Lisetti, 2008) and it is still an open research line where several considerations (including theoretical, technical and ethical) need to be addressed. In the last years, several computational models of emotions have emerged trying to cover specific (and sometimes theoretically incompatible) emotional mechanisms (Marsella et al., 2010). The differences in many of the existent computational models of emotions are a logical consequence of the different emotion theories where these models have their roots (Scherer, 2010).

From the current existent theories of emotion, the one that predominates above the others in the efforts dedicated to implement computational models of emotions is the *cognitive appraisal theory of emotions* (Scherer et al., 2001). The core concept of appraisal theories refer that the events in a person's environment are constantly identified and evaluated by the individual. This *cognitive* evaluation (or appraisal) process leads to an emotional response (according to the event's relevance for the person) which in turn generates a specific behaviour to cope with the appraised events. The high success in choosing this theory as the theoretical background in several computational models seems in part due to the emphasis and explanation of the connection between cognition and emotion which help in the construction of artificial systems that simulate complex human-like behaviours. Moreover, appraisal theories of emotion appear the most comprehensive way to represent the complexity of the emotion process, covering the whole path from low-level appraisals of the eliciting event to high-level influence over behaviour (Scherer, 2010).

Several computational architectures based on the appraisal theory of emotions have been developed since the early 90's (Elliott, 1992) and as reflected in (Marsella et al., 2010), virtual characters based on this type of architectures has allowed the creation of real-time interactive characters that exhibit emotions in order to make them more compelling, more realistic, or more able to induce desirable social effects in the users.

4.1 Natural Empathy vs. Therapeutic Empathy

The promising research results reported in the literature such as the works mentioned above, encourage us to consider the adoption of a computational architecture based on appraisal theories of emotion for the implementation of the internal model in our Help4Mood's VA. We of course need to consider the particular characteristics of our target users to adopt the most suitable solution. As suggested by the clinicians of the Help4Mood consortium, two of the important characteristics in our VA should be an adaptable *empathic* behaviour and a *personality* style that motivates the use of the system.

A key difference in the empathic behaviour of our proposed VA regarding existent similar works such as e.g. the presented in Paiva et al., (2004) and Prendinger and Ishizuka (2005), is that the empathic responses needs to be *modulated* according to the special characteristics of the patients. Although the VA should be able to show empathy during interaction, it is highly important from a clinical perspective that the range of emotions displayed should be restricted to a neutral stance or positive emotions (such as *joy* and *happiness*) and not to produce an empathic behaviour by just adopting the same (frequently negative) emotions or affective state reported by the patient.

In this sense, it is important to distinguish the difference between natural empathy (experienced by every people in every-day situations) and therapeutic empathy in order to provide to the patients with a useful feedback for their particular treatment and promoting an effective therapeutic alliance. In (Hoffman, 2000) natural empathy is associated to psychological processes that make an individual to have feelings that are more congruent with another's situation that with his/her own situation.

From the psychotherapeutic and counselling perspective the term therapeutic empathy is defined as *when the therapist is sensing the feelings and personal meanings which the client is experiencing in each moment, when he can perceive these from 'inside', as they seem to the client, and when he can successfully communicate something of that understanding to his client* (Rogers, 1961 p. 62). This particular type of empathic behaviour is the one that it is clinically relevant and should include the mechanism to modulate those therapeutic useless or inadequate emotions.

There is currently some effort to identify and dissect the theoretical key components of therapeutic empathy. Thwaites and Bennett-Levy (2007) argue that a therapeutic empathy system should contain the following four components:

1. *Empathic attitude/stance:* infuses other aspects of empathic skill with a sense of benevolence, curiosity and interest.
2. *Empathic attunement:* a perceptual skill referred to as an active on-going effort to stay attuned on a moment-to-moment basis with the client's communication and unfolding process
3. *Empathic communication skills:* are the skills to explicitly communicate empathic understanding as well as emotions not only through the content of the speech itself, but also by non-verbal behaviour and tone of voice providing a sense of safety, warmth, understanding and acceptance.
4. *Empathy knowledge:* defined as what therapists learn from teachers and from reading during training and professional development and it is one of the key factors that differentiate therapeutic empathy from natural empathy.

Although our VA will not have the role of a therapist (but more related to a helper/guide during the treatment's short every-day sessions), it is interesting to analyse how the conceptualisation of therapeutic empathy can be modelled to implement a computational therapeutic empathy system. A central aspect is the integration of the four concepts at the different components of the computational appraisal architecture (Figure 1).

An *empathic attunement* can be modelled in the VA when specific events are detected in the environment. These events are inferred using the data collected from the personal monitoring system and the patient's self-reports. Following the VA's goals (which are activated according to the particular objectives of each treatment's session), the event could be appraised as desirable or not in terms of the patient's perspective. Every event needs to be *understood* in these terms for the VA remains *empathically attuned* on a moment-to-moment basis.

The result of this appraisal process is used to select the specific emotion in the VA, which is also influenced by the modelled *personality* in the VA and the *empathy knowledge* layer. For the modelling of personality we are considering those trends related to an *agreeableness* personality to facilitate an *empathic attitude* in the VA. One of the main functions in the *empathy knowledge* component will be the *modulation* of the emotion triggered by the emotion selection mechanism. The *empathy knowledge* modulates the *negative* emotions to suit the clinical perspective for depression treatment, i.e. adopting a *neutral* stance when patient indicates negative moods, thoughts and feelings, and display *positive* emotions in the rest of situations.

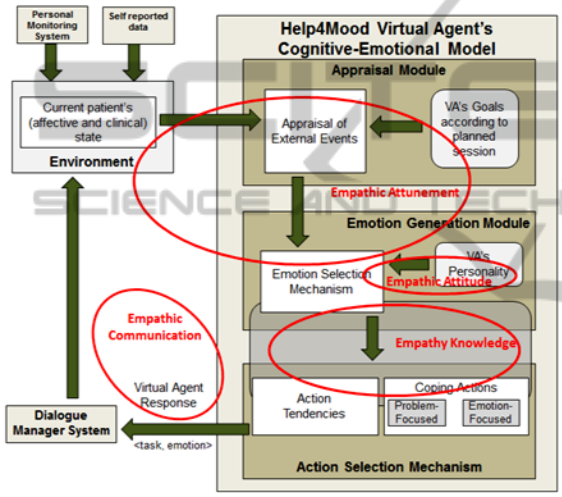

Figure 1: The Help4Mood VA's internal model.

The specific triggered emotion will be used to select the action for coping with the detected event. The *empathy knowledge* will also be used by the action-selection mechanism to choose the most adequate action during the interaction with the patient. As already introduced, the *empathy knowledge* is one of the key factors to distinguish *therapeutic empathy* from *natural empathy* and its inclusion in both, the emotion and action selection mechanisms, intends that the VA emulates the emotional involvement during specific interactions with the patient and an *emotional detachment* that allows for a more objective appraisal of the situation (Clark, 2007).

The actions take the form of high level commands (such as SUGGEST_ACTIVITY(*x*) or APPLY_QUESTIONNAIRE(*y*)) which are passed jointly with the emotion as a <task, emotion> pair to be implemented through the concrete utterances by the dialogue manager system and the corresponding facial expression in the graphical component of the VA. The <task, emotion> pair will affect the verbal and non-verbal communication of the VA by affecting the voice, the actual wording of the prompt and the facial expressions of the VA leading to an *empathic communication*.

5 CONCLUSIONS

The model presented in the past section is currently under development and we are analysing existent computational architectures of emotion that can be extended with our proposal. A good candidate is the known as the FAtiMA (FearNot Affective Mind Architecture) architecture (Paiva et al., 2004). FAtiMA is an open source software and it has been an evolving (appraisal theory based) architecture developed in the context of three EU projects: the FP-5 VICTEC (http://www.macs.hw.ac.uk/victec/index_geral.html), the FP-6 ECIRCUS (http://www.macs.hw.ac.uk/EcircusWeb/) and the FP-7 LIREC (http://lirec.eu/) projects. The original objective of FAtiMA was the creation of empathic agents within a computer application to tackle and eventually help to reduce bullying problems in schools. The core of the architecture has been subsequently extended to include additional components of the emotion phenomenon such as the implementation of a double-appraisal mechanism in order to evaluate the emotional impact of possible actions (Aylett and Louchart, 2008); the memory retrieval (and re-appraisal) of emotionally past episodes (Gomes et al., 2011); or the generation of emergent empathic reactions in social agents (Paiva, 2011).

Once implemented and integrated with the rest of the system, the outcome behaviour produced in the VA can be clinically evaluated in the further stages of Help4Mood and assess its suitability in the building of VA – patient interactions.

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