

MENHIR: Mental health monitoring through interactive conversations

MENHIR: Monitorización de la salud mental mediante conversaciones interactivas

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Abstract: Mental health is an essential component of health; however depression and anxiety are common disorders across the European Union. Many people may be described as “living with” a mental illness, and managing their own symptoms. However, they are often unsure of the thresholds for treatment, how to control their mental health, what are the best coping strategies or which resources are available to them. Conversational systems may facilitate watchful waiting and symptom monitoring, by initiating contact and symptom checking at various times of the day and night. The MENHIR project aims to research and develop conversational technologies to promote mental health and assist people with mental ill health (depression and anxiety) to manage their conditions. The participants will exchange and share their expertise toward this common objective, building a network for exchanging ideas and knowledge between Spain, Germany, Italy and United Kingdom, including academic, non-profit organisations and companies.

Keywords: Mental Health, dialogue system, chatbot, anxiety, depression, wellbeing

Resumen: La salud mental es un componente esencial de la salud, sin embargo la depresión y la ansiedad son desórdenes muy comunes en la Unión Europea. Muchas personas conviven con un problema de salud mental y gestionan sus propios síntomas. Sin embargo, suelen estar inseguras acerca de cuál es el umbral para iniciar la búsqueda de tratamiento, cómo controlar su salud mental, cuáles son las mejores estrategias de afrontamiento o qué recursos están a su disposición. Los sistemas conversacionales pueden facilitar la monitorización de síntomas o la “espera vigilante”, iniciando el contacto y comprobando los síntomas en diversos momentos del día. El proyecto MENHIR propone investigar y desarrollar tecnologías conversacionales para promover la salud mental y asistir a personas con problemas de depresión o ansiedad para la gestión de sus síntomas. Los participantes intercambiarán su experiencia para alcanzar este objetivo común, construyendo una red para el intercambio de ideas y conocimiento entre España, Alemania, Italia y Reino Unido, incluyendo universidades, organizaciones sin ánimo de lucro y empresas.

Palabras clave: Salud mental, sistema de diálogo, chatbot, ansiedad, depresión, bienestar

1 Project funding and duration

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MENHIR started on 1st February 2019 and will have a duration of 4 years, finishing on 31st January 2023.

2 Consortium

The consortium brings together 8 partners including universities, a non-profit organisation and companies:

- Universidad de Granada, Spain (coordinator).
- Universidad del País Vasco, Spain.
- Action Mental Health, United Kingdom.
- University of Ulster, United Kingdom.
- Intelligent Voice Limited, United Kingdom.
- Ulm University, Germany.
- Università degli Studi della Campania Luigi Vanvitelli, Italy.
- GLOBIT - Globale Informationstechnik GmbH, Germany.

3 Description

The World Health Organisation (World Health Organization, 2018) defines mental health as an essential component of health that should not be considered only as the absence of mental disorders or disabilities, but as an state of mental well-being. This implies that mental health care should not be understood only from the point of view of the treatment of symptoms, but it should have an important focus on its understanding, promotion and protection.

MENHIR is aligned with this idea and can be contextualised in the EU policies designed for the promotion of mental health and well-being. The Joint Action (on) Mental health and Well-being launched in 2013 resulted in the European Framework for Action on Mental Health and Well-being (European Commission, 2018), which supports EU countries to review their policies and share experiences in improving policy efficiency and effectiveness. MENHIR aligns with this framework and its recommendations, as the conversational system developed is designed considering the relevance of sustained mental health care and prevention by means of continuous user-system interaction, reduces mental health inequalities as it provides easy and universal access to mental health monitoring, and facilitates gaining very valuable feedback on the benefits of mood and anxiety monitoring that can help policymakers promote mental health.

Treatments such as cognitive therapy and medication are effective in reducing the symptoms of anxiety and depression and

many people do experience a complete recovery following an episode of mental illness. However, for others, depression and anxiety disorders follow a different trajectory and there may be recurrences of the symptoms or episodes with varying levels of severity. Many people may be described as “living with” a mental illness, and managing their own symptoms using coping strategies and using their own support networks together with the formal support services and therapies such as counselling and medication.

MENHIR will pursue objective symptom monitoring and relapse prevention for people with mental illness. Symptom monitoring, whereby the patient assesses and records their moods, behaviour, and symptoms over time, can provide clinicians with additional, real time, more ecologically valid information to inform treatment strategies and empower the client to manage their own mental health symptoms.

The capture of real time information facilitates rapid intervention and appropriate feedback such as prompts, supportive messages and symptom summaries. The system will therefore promote user empowerment and collaborative care. The limitations of previous technology-based monitoring approaches are the high dropout rates and poor adherence in particular user groups. This is due in part to a lack of interactive features and appropriate prompts, difficulties for people with low levels of technological literacy and failure to provide human support (Walsh, Golden, and Priebe, 2016). The MENHIR chatbot aims to address these difficulties by using more realistic, natural and smart interactions. The project will also generate data on how people with anxiety and depression interact with and respond to symptom monitoring chatbots.

4 Aims and specific objectives

The aim of the project is to develop and test the efficacy and user experience of the MENHIR chatbot for the self-management of mental illness.

The objectives are as follows:

1. Co-create the MENHIR integrated chatbot/programme.
2. Monitor the use of the chatbot to develop an understanding of how users engage with it and how that impacts on

their behaviour and well-being.

3. Test the effect of the chatbot on the user's mental health over time.

The first goal of the project is to develop a smart mental health monitoring and communication chatbot for people who are living with a mental illness. The system will go some way to imitate a “virtual therapist” or “concerned friend” and provide a natural conversational experience that also tracks the user's moods, behaviours, social interactions and mental health symptoms. It can provide personalised responses based on the user's profile, recent mood trends and provide the appropriate coping strategies whilst also signposting to online digital resources, social communities and local geolocated services that are relevant at the point of care and need. The chatbot knowledge base will be curated from therapies and coping strategies identified in the scientific literature and techniques recommended by the psychology experts in this project.

The chatbot empowers the user to manage their own mental health by facilitating mood tracking over time and by linking symptom level data. This is akin to the quantified-self movement except the application is mental health as opposed to physical health. It is important to visualise mood trends to instil user reflection allowing for knowledge-driven motivational efforts. Trends will be depicted visually to promote reflection and understanding of the user's unique patterns of mood behaviour and symptom patterns, diurnal trends and links with daily activities. The chatbot will have a therapist personality with humor, empathy and rapport and conversational variability to promote engagement. Variability in the conversations will be a key design feature to imitate human-to-human conversations and to avoid tedious predictable dialogues.

Following, the data collected will be subjected to analysis to generate an understanding of the extent to which user engagement impacts on subsequent moods, behaviours and activity. Information on mental health symptoms will be collected regularly to establish the effect of engagement with the programme over time on the person's mental health generally. These processes will be performed with the users consent and controlled by the Ethical Board.

5 *Scientific relevance*

As shown in Figure 1, the chatbot incorporates a wide range of scientific and technical challenges including natural language and speech processing, knowledge management, emotion/sentiment analysis, dialogue management, user modeling, user experience design, conversation modeling and management, communicative style definition, system personality, and establishing trust to maximise user adoption. To a lesser extent, the project will explore the potential for the augmentation of the chatbot with data from wearable devices.

Voice Assistive Computer Interfaces can provide automated on-demand health assistance reducing costs. However, speech is intrinsically complex, and emotional speech is even more requiring the need for an holistic approach that accounts for several factors including personality traits, social and contextual information. Such interfaces can be exploited as automatic diagnostic tools for the diagnosis of different degrees of depressive states and in general for detecting from interactional exchanges reliable behavioural and contextual information. Our goal is to considerably extend the results of earlier research expanding the set of identified depressive speech acoustic features and automate their detection so that depressed and anxiety speech can be accurately distinguished from healthy speech.

A recent well conducted meta analysis reported that users valued the convenience of mood tracking, and the ecological validity of the data was of value in clinical sessions. However there was frustration that current methods did not always capture what patients wanted to report or missed the essential qualities of conversations. Automated feedback messages were sometimes well received or drew mixed reactions, with some users finding them patronising or inappropriate, repetitive and impersonal (Walsh, Golden, and Priebe, 2016).

MENHIR will provide novel approaches focused on making the interaction personalised to the users in several ways. The acoustic analysis of the user input and the corresponding system responses must be adapted to the specific user groups. A big challenge to be addressed in the system is that prospective users are very heterogeneous in terms of age, gender, mental health condition (in

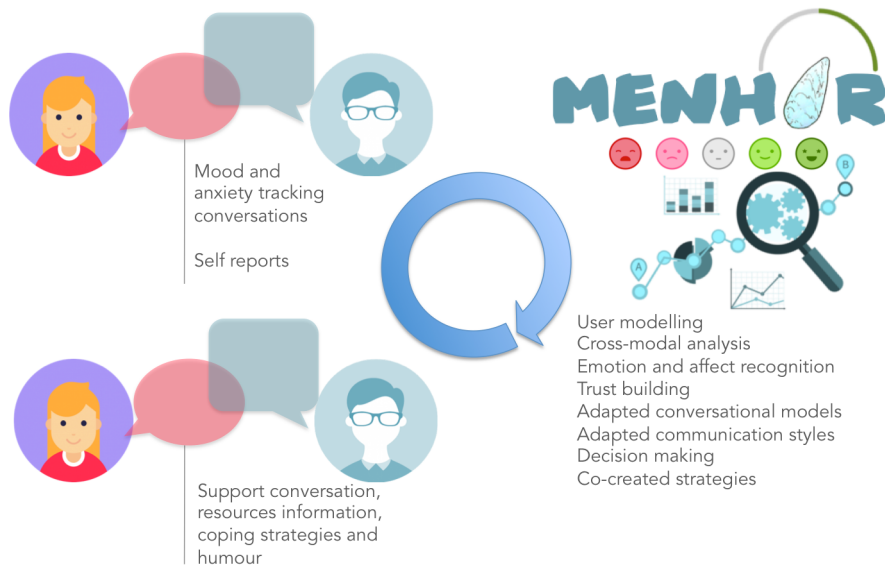


Figure 1: Summary of MENHIR's conversational loop

our case depression and/or anxiety), progression (some users may have more problems than others in reaching a healthy status) and responses to the system's strategies (different users may react differently to the same system advice). The user model generated within MENHIR will advance current state-of-the-art models which focus on specific user groups and represent the user by means of a series of pieces of information and preferences that do not vary over time.

From the perspective of conversation management, the system interactions must be tailored to knowledge that it has about the user at that specific moment of the interaction, during the previous turns of that session, and for the whole history of user-system interactions. During each interaction, the system must have a calculation on how far the user is from the objective, what his/her mood is, emotional state and anxiety level and how they have progressed over time. It will have to consider also the history of previous interactions to consider information about which strategies have been more effective in a similar context for that particular user or users in a similar condition.

In addition, as shown in Figure 1, MENHIR involves several types of conversations: tracking and self report and support. On the one hand, the system will try to track the mood and anxiety level of the user for which it would have to foster trust and rapport. These conversations can be more system-

directed, e.g. answering a questionnaire that measures the level of anxiety, and sometimes will be more user-directed, for example, when the user explains how they felt during the previous days. On the other hand, the system must also give support to the user, in this case the conversation must be more persuasive as it will help the user cope with their current mental health situation. Developing conversation models and management strategies suited to these disparate conversation structures and being able to figure out when the system must lead the conversation or let the user talk to favour self-disclosure will be a very important scientific result of the project.

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References

- European Commission. 2018. EU-Compass for Action on Mental Health and Well-being.
- Walsh, S., E. Golden, and S. Priebe. 2016. Systematic review of patients' participation in and experiences of technology-based monitoring of mental health symptoms in the community. *BJM Open*, 6(6).
- World Health Organization. 2018. Mental health: Strengthening our response.