A First Step Towards Understanding the Effect of an Interactive Robot on User Experience in Motivational Interview

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***Abstract*— This paper proposes a system where the robot gets facial valence and vocal arousal of the user during the interaction. The system maps the social cues onto two dimensional emotional scale. In experimental study, the robot will conduct motivational interview and become interactive in case of lower emotional states. The planned experimental results will show the effect of the socially interactive robot during the motivational interviewing.**

***Index Terms*— socially interactive robots, motivational interview, dimensional model of emotion.**

I. INTRODUCTION

To facilitate successful interaction between humans and robots, interaction needs to be natural and share similarities with human-human interaction. It is important for social robots to understand verbal and nonverbal social cues, which is a prerequisite for natural, safe and comfortable interaction and also helps in anticipating the needs and expectations of the user [8]. For socially interactive robots whose primary function is to interact with people, social interaction plays a crucial role [9]. It is important for these robots to encourage users pro-actively in social interaction.

The term "user experience" is a multifaceted concept and hard to define. Hartson et. al. [12] provided a definition as "the totality of the effect or effects felt by a user as a result of interaction with, and the usage context of, a system, device, or product, including the influence of usability, usefulness, and emotional impact during interaction and savoring memory after interaction". User experience comprises the users emotions, beliefs, preferences and perceptions that arise before, during, and after technology use [10]. The way a robot behaves during interaction with a human may affect their feeling of security, which is one of the dimensions of user experience [11]. Positive user experience with robots is necessary for achieving intended benefits [10]. Human-oriented perception, that is the capability of the robot to track human features (face, voice etc.) is also considered one of the aspects of user experience in human-robot interaction (HRI) [11].

Motivational interviewing (MI) is an emphatic and collaborative conversation style, which is goal oriented and designed for strengthening an individual's motivation toward a particular goal with a commitment to change [1]. Regular physical activity (PA) has been shown to reduce the risk of several chronic diseases [5]. MI could increase individuals physical activity (PA) [4].

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MI is usually delivered by a counselor in a face-to-face conversation. Social robots have the ability to engage participants for a motivational interview [2]. In the context of robot-based delivery mode, the counselor could be substituted by an embodied humanoid robot. There are very few studies employing a humanoid robot in MI [2], [3]. In [3], the authors employed a humanoid robot as a motivational agent in order to increase individuals' motivation towards physical activity. Their findings showed no benefit of MI on participant perceptions compared with traditional advice. They argue that the lack of positive effect of MI might be due to errors in speech recognition and incongruous nonverbal behaviors. In the more recent work [2], they also employed a humanoid robot that delivered a scripted motivational interview in physical activity. The results showed that many of the participants enjoyed the interaction and positively appraised the nonjudgmental aspect of the motivational interview with the robot.

The planned experimental procedure is inspired by [2] and followed the similar experimental design with the difference of an interactive robot. In our work, the robot takes into account the social cues (facial and vocal) and becomes interactive when the social cues are in the second and third quadrant of the dimensional emotional scale.

In the remainder of this paper, an overview of the proposed system is given in Section II. The method, experimental design and procedure are described in Section III, and the paper is concluded in Section IV.

II. PROPOSED SYSTEM

Emotions are modeled in two ways; discrete approach [13] and dimensional approach [14]. In the discrete approach, emotions are categorized into six basic emotions i.e. anger, disgust, fear, happiness, sadness and surprise [13]. In the dimensional approach, affective space described in dimensions. In Russell's valence-arousal scale, each emotional state can be placed on a 2D plane with horizontal axis (valence) and vertical axis (arousal) where valence ranges from unpleasant to pleasant and arousal ranges from calm to excited [14]. The four quadrants of valence-arousal space are as follows: high valence-high arousal (HVHA), low valence-high arousal (LVHA), low valence-low arousal (LVLA) and high valence-low arousal (HVLA). The emotions mapped to the second quadrant (LVHA) and third quadrant (LVLA) are negative emotions (angry, nervous, annoyed, sad, bored etc.) In dimensional emotion recognition, arousal is better predicted using audio cues whereas for valence, visual cues perform better [15].

In our proposed system, we adopted the aforementioned two-dimensional arousal and valence model [14]. The output emotion values in our system are provided by Affdex SDK [16] and openSMILE [17]. Affdex SDK [16] is a real-time facial expression recognition toolkit, trained on more than 5 million human faces to classify facial expressions and used in human-computer applications. openSMILE is an open-source audio analysis tool that is written in C++ and provides audio feature extraction in real-time [17]. The implemented system integrated these toolkits as ROS packages that can be used on any ROS-compatible robotic platform. Since arousal prediction is better from audio and valence prediction is better from vision, in the proposed system, we use facial valence and vocal arousal values. They are mapped onto two dimensional space. If the mapped emotions are in the second and third quadrant, the robot becomes interactive and expresses empathy which is one of the components of motivational interviewing. The proposed system is depicted in Figure 1.

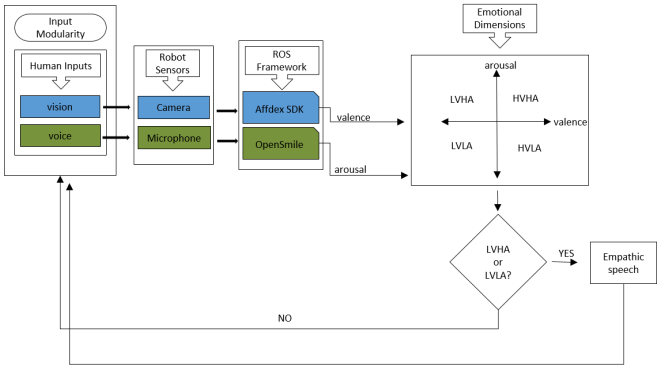

Fig. 1. The proposed system.

III. METHOD

A. Research Questions

The main focus of interest in this work is to test the impact of a socially interactive robot in motivational interviewing. We examine how a socially interactive robot that regards social cues can encourage participants to change their behavior and to provide a better user experience. We aim to evaluate the perceived effect of motivational interviewing in physical activity and the user experience. The research questions are as follows:

- Is the participants' perceived experience better when the robot is socially interactive?
- Can a socially interactive robot contribute to the effect of motivational interviewing?
- Can a socially interactive robot motivate participants to engage in physical activity?

B. The Experimental Procedure

The planned experiment takes place at Örebro University in PeisHome2 which is a living-room-like laboratory used for human-robot interaction experiments. Each session starts with informing the participant about the experiment. Thereafter, the participant is left alone with the robot (Pepper, humanoid robot) in the room and the motivational interview begins.

At the end of the interview, the participants fills out the Godspeed questionnaire [7] and the following Likert scale questionnaire in which each question has options ranging from "Strongly disagree" to "Strongly agree":

- This interview affected my motivation in a positive way.
- The robot helped me to recognize the need to change my behavior.
- I found the interview with the robot engaging.
- The content of each question was clear.
- The robot helped me to talk about changing my behavior.
- The robot helped me discuss the pros and cons of my behavior.
- I got frustrated during the interview.
- It was important listening to myself discussing my behavior.
- The robot acted as a partner in my behavior change.
- The robot helped me feel confident in my ability to change my behavior.
- I would use a robot like this in the future to keep me motivated.

This questionnaire is a modified version of Client Evaluation of Counseling [6] and the questionnaire developed in [2]. The questions in [2] were open-ended, we modified some of the questions as closed-ended. We are also planning to present the questions in [2] in the form of open-ended as optional questions.

IV. CONCLUSIONS AND FUTURE WORK

This position paper presents the general outline of the planned work. Thus far, we have implemented the system. There are a few studies using a robot in motivational interviewing, however no other study considers an interactive robot. The main challenges for our approach is timing of the robot speech since we do not have any reliable speech recognition in the current system. As future work, the proposed system and methodology remains to be evaluated with user studies. We will focus on exploring the effect of socially interactive robots that take into account facial and vocal cues and becomes interactive. The experimental results will show the effect of the socially interactive robot during the motivational interviewing.

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