

TOWARDS AI-BASED INTERCULTURAL TRAININGS USING SOCIAL ROBOTS: DERIVATION OF DESIGN CRITERIA FOR EFFECTIVE INTERCULTURAL HUMAN- ROBOT INTERACTIONS

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ABSTRACT: The development of “ABCD” technology (Artificial intelligence, Blockchain, Cloud computing, and Big data) has promoted the design and development of new and innovative technologies, which fundamentally revolutionized the ways organizations manage themselves. However, digital transformations have also brought in new challenges. Against the backdrop of growing internationalization, cross-border collaborations, and increasing global trade, it is of utmost importance to explore how technology renovates the intercultural dialogues, negotiations, trainings, and the subsequent knowledge transfer processes. Researchers have suggested that technology will play a vital role in facilitating the need to work with people from all around the world. And from the perspective of intercultural exchanges, and cross-border/cross-cultural collaborations, it is necessary to know how to navigate the intercultural challenges effectively. The emergence of social robots like the Furhat allows to design rich human-robot interactions including verbal- and non-verbal communication elements, which is promising to deliver artificial intelligence (AI) -based intercultural training capabilities. This research project has two objectives: first, this research will bring in the AI factor in human landscape to explore the actions and interactions of AI and intercultural environment in transition; second, this study aims to provide orientations and recommendations for implementing interactions with social robots to enable AI-based intercultural trainings. Therefore, design criteria for implementing effective verbal and nonverbal interactions are outlined for achieving high standards of intercultural interactions to provide better understanding and interpretations of the contexts in which certain intercultural actions are practiced.

KEY WORDS: *Intercultural communication; Artificial intelligence; Social contexts; Furhat; Intercultural trainings, Social Robots, Human-Robot-Interaction.*

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1. INTRODUCTION

World economy has been witnessing tremendous cross border trade as a result of globalization and the subsequent internationalization by the firms, resulting in exponential growth among the multinational companies. Entering a new foreign market and diversifying the market portfolio bring employees from different cultural backgrounds into close contact through not only working relationships but also individual interactions (Ang et al., 2006, Bücken et al., 2014). The pressure on these companies to compete internationally and to properly deal with the consequences of globalization is increasing. Hence, it is becoming increasingly important to work together with people from different backgrounds successfully and effectively, especially in a multinational environment. Successful collaboration with people from other cultural backgrounds requires new cross-cultural competencies and new challenges for employees and managers alike (Bücken et al., 2014, Morley & Cerdin, 2010, Williams & Johnson, 2011). Thus, the ability to work with people from different cultural backgrounds and to understand different cultural contexts can be a great competitive advantage, as the multicultural composition of teams in such multinational companies is already a standard practice. The influence of culture on companies cannot be underestimated. In a Global Human Capital Trends survey conducted by Deloitte (2016), 82% of respondents believe that culture is a potential competitive advantage (Kaplan et al., 2016). Understanding the perspectives of other cultures can bring countless benefits to not only the organizations but also to the individuals. However, increased cross-cultural collaboration also increases the probability of cultural misunderstandings, tensions, and conflicts within the teams (Ang et al., 2007). According to Ikegami et al. (2017) cultural differences are often perceived as a burden. Each culture is defined by norms, beliefs and values which influence and complicate individual's thoughts and actions. In this case not knowing the fundamental rules of other cultures can cause misunderstandings among business partners with different cultural backgrounds (Triandis, 2006).

Therefore, employees in such multinational teams must acquire certain cross-cultural skills to be able to deal appropriately with colleagues from other countries. Appropriate communication regarding cultural standards can make the difference between success and failure, and the need for cross-cultural skills will be extremely important. In this context, the concept of culture, and subsequent understanding of cultural contexts can be extremely useful.

Furthermore, design and development of new and innovative technologies, which fundamentally revolutionized the ways organizations manage themselves, have exponentially increased the challenges international organizations face. Hence, as a result of growing internationalization, cross-border collaborations, and increasing global trade, it is of utmost importance to explore how technology renovates the intercultural dialogues, negotiations, trainings, and the subsequent knowledge transfer processes. In the same vein, emergence of social robots like the Furhat allows to design rich human-robot interactions including verbal- and non-verbal communication elements, which is promising to deliver artificial intelligence (AI) -based intercultural training capabilities.

By empowering Furhat to not only understand the culturally sensitive scenarios, and contextual exchanges, the potential to revolutionize the intercultural trainings is enormous. Furthermore, being able to offer an advanced and versatile technological tool can facilitate intercultural communication and develop deeper levels of understanding among the people from different cultural backgrounds.

2. RELEVANCE AND OBJECTIVE OF INTERCULTURAL TRAININGS

A genuinely good start in this intercultural world would be to understand another culture. More and more people engage in international trade but fail in their endeavors due to perceived insignificant cultural differences, which in reality can mean the difference between success and failure. Hence, mastering the art of interculturality is definitely an important skill to help achieve this. However, the ability to understand and comprehend the differences is far from a guarantee that a cultural exchange conducted by members with diverse cultural backgrounds will go smoothly. Therefore, it is imperative to be aware of culture-specific communication patterns, that can help facilitate this exchange. Similarly, it is much more about understanding the differences in how people from diverse cultures think, feel, and act. Ignoring this results in numerous misunderstandings due to language and cultural differences. Misunderstandings that are not clarified over the years can quickly become stereotypes. Intercultural trainings, with the focus on communication patterns, styles, social contexts must therefore be given special attention, as it is precisely this that is one of the most important key factors for creating and maintaining successful business outcomes in different countries.

In order to be able to master intercultural encounters successfully and reflectively on a private or professional level, one should, first of all, know what is actually meant by the term culture. At this point, however, it should be noted that the concept of culture is too elusive to do justice to it using a single universal definition. More than 60 years ago, Kroeber and Kluckhohn compiled 164 definitions of the concept of culture in their work (Kroeber & Kluckhohn, 1952). What is generally understood by culture and what constitutes culture is presented very differently in the literature.

Hall and Hall (1987) mentioned that culture is primarily a system for creating, sending, storing, and processing information. They equated culture as a shared program for behavior, with the definition of an extraordinary, huge, and complex computer that programs the actions and reactions of every human being. In order to make the so-called system work, these programs must be followed by everyone (Hall et al., 1987). Furthermore, Hofstede and colleagues (2010) defines culture as the "...collective programming of the mind that distinguishes members of one category of people from another" (Hofstede, et al., 2010, p. 6).

3. DESIGN CRITERIA FOR EFFECTIVE SOCIAL ROBOT INTERACTIONS

Autonomous robots are increasingly entering our daily life and it's expected that they support our daily life in sites like museums, schools, and hospitals (Pandey et al., 2018). social robots are autonomous robots which can demonstrate social behaviours. The social behavior includes for instance the verbal communication by understanding and producing speech in natural language using text-to-speech and speech-to-text technologies. Furthermore, non-verbal communication elements like demonstrating facial gestures on the robot's face allow for instance the communication of emotions. Social robots can be seen as a specific form of conversational agents with a physical embodiment and by using voice as communication mode to allow human-like communication with the robot (Diederich et al., 2022).

Based on a literature review, Jung et al. (2021) concluded that the main objective of social robots is to provide meaningful social interactions with the users by being able to handle complex dialogues, to express and understand emotions and overall to possess personality and social competencies. This contrasts with traditional industry or service robots who are rather implemented to accomplish a single fixed task (Jung et al., 2021).

These social capabilities of social robots are promising to implement automated and interactive intercultural trainings for employees and students. This is especially because of their ability to handle complex interactions and specifically their ability to understand and express a broad variety of verbal and non-verbal communication.

From a user perspective several design criteria need to be considered so the interactions with the social robot in the context of intercultural trainings are accepted and therefore effectively used. In the case of social robots, the determinants of the acceptance are based on the one hand on classical acceptance criteria like perceived usefulness and on the other hand on the perceived humanness like the anthropomorphic design (Premathilake et al., 2022). In the following relevant constructs and theories are introduced which should be considered during the design of interactions with social robots to create effective intercultural trainings.

Anthropomorphisms and the Uncanny-Valley-Theory

The degree of anthropomorphism defines how human-like a social robot appears to be for the users. According to Pfeuffer et al. (2019), the features constituting a human-like design can be categorized into the following three categories:

- Visual features: e.g., Gestures, Mimics, Movements, or Appearance.
- Auditory features: e.g., Gender, Speech Synthesizer.
- Mental or Cognitive features: e.g., Personality, Emotionality, Cognitive Intelligence (for instance, to understand speech or images).

In general, prior research found indications that a high degree of anthropomorphism is related to a positive response towards the social robots. Nevertheless, the literature suggests that this relation is not simply positive linear but at a certain threshold a too human appearance can result in users having a perception of robots (Nissen and Jahn, 2021). This effect is described by the Uncanny-Valley-Theory, introduced by Mori (1970).

Acceptance Models

According to Davis' (1989) Technology Acceptance Model (TAM) the main determinants of users' acceptance of a new technology are perceived usefulness and perceived ease of use. The Perceived usefulness is defined by Davis (1989, p. 320) as "the degree to which a person believes that using a particular system would enhance his or her job performance." Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 320). This model was extended by Davis et al. (1992) by the construct perceived enjoyment, which in subsequent studies could be verified to be one relevant determinant for the acceptance of a system and is frequently used in social robot research (Jung 2019). Based on this model the Almere Model of Acceptance was developed in the context of social robots and their interaction with elder users (Heerink et al., 2010).

4. THE SOCIAL ROBOT FURHAT AS EXAMPLE FRAMEWORK FOR IMPLEMENTING SOCIAL ROBOT INTERACTIONS

The social robot Furhat from the company Furhat Robotics is promising to design rich verbal and non-verbal interactions based on the integrated AI capabilities. The Furhat is a head containing a projected facial animation and includes a voice-based multiparty conversational system (Moubayed, 2012; Moubayed, 2013). In the following section, possible design elements for designing interactions for training intercultural communications are outlined based on the categorization of Pfeuffer et al. (2019) introduced in the last section.

Visual features

The Furhat framework makes it possible to select one of several predefined face designs or to integrate own facial designs. As illustrated in Figure 1, multiple predefined facial designs representing various age groups, genders, ethnical backgrounds, as well as cartoon and robotic characters are available.

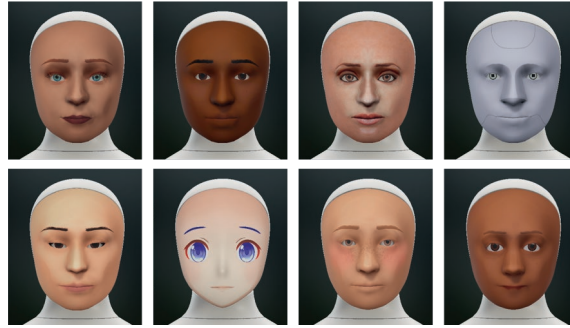


Figure 1. Example of predefined facial designs in the Furhat framework. Screenshots based on the virtual Furhat.

During the interaction with the users, the artificial faces can express multiple gestures to convey emotions as illustrated in Figure 2. To make the social robot appearance closer to a real human person, it is also able to automatically smile back if a user's smiles, and to continuously run micro-expressions like blinking, small facial movements in the area of mouth and eyes as well as permanent little movements of the eyes gaze.¹

Auditory features

The Furhat supports more than 40 languages with various voices in all genders. For the speech synthesis Furhat supports onboard voiced running directly on the social robot as well as cloud-based providers like Amazon Polly. Beside speech synthesis also pre-recorded audio files can be used. The lips of the artificial face automatically sync to the output audio. The speech can also include pre-recorded audio files.^{2,3}

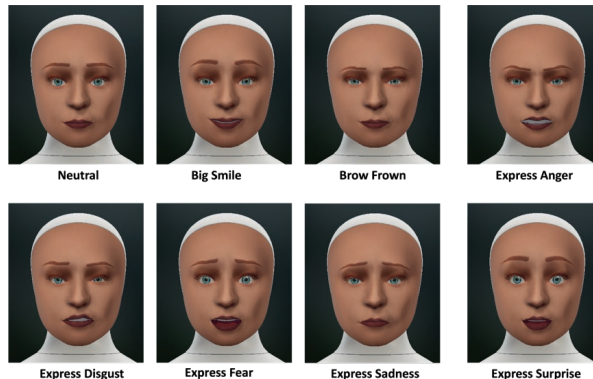


Figure 2. Example of predefined gestures in the Furhat framework. Screenshots based on the virtual Furhat.

¹ Source: <https://docs.furhat.io/gestures/> (accessed on June 3rd, 2023)

² Source: <https://docs.furhat.io/speech/> (accessed on June 3rd, 2023)

³ Source: <https://furhatrobotics.com/docs/Furhat-Robotics-Technical-Product-Overview.pdf> (accessed on June 3rd, 2023)

Mental or Cognitive features

To create rich interactions, the Furhat applies AI for the visual perception of users. This includes face and facial gesture recognition.⁴ For designing the conversation flows, a virtual Furhat is offered which makes it possible to develop and test the conversations on a personal computer without the need of having a physical Furhat available. Simple conversations can be implemented with a graphical programming interface called blockly.⁵ Advanced workflows can be created directly in the Furhat skill framework by using the Kotlin programming language.⁶ Alternatively, external conversational systems like the Rasa conversational framework can be connected via an API.⁷

5. SUMMARY AND FUTURE RESEARCH

The overarching objective of this article is to introduce and motivate research in the intersection of AI and especially social robots and the field of intercultural communication and particularly intercultural trainings. Furthermore, this research intends to provide orientations and recommendations for implementing interactions with social robots to enable AI-based intercultural trainings. This is done by compiling an overview of relevant concepts in the field of culture, social robots, and relevant design criteria regarding user acceptance. A detailed example of design aspects of social robot interactions is given based on the social robot Furhat. This overview can be a basis for future research on the design and effectiveness of intercultural trainings via social robot interactions.

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⁴ Source: <https://furhatrobotics.com/docs/Furhat-Robotics-Technical-Product-Overview.pdf> (accessed on June 3rd, 2023)

⁵ Source: <https://docs.furhat.io/blockly/> (accessed on June 3rd, 2023)

⁶ Source: https://docs.furhat.io/tutorials/your_first_skill/ (accessed on June 3rd, 2023)

⁷ Source: <https://furhatrobotics.com/docs/building-applications-with-the-furhat-robot.pdf> & <https://rasa.com/> (accessed on June 3rd, 2023)

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