

ALIVE: Avatar Learning Impact assessment for Virtual Environments

Sarune Savickaite¹, Elliot Millington¹, Chris Freeman², Robert McMillan² and
Mohammed Khamis¹

¹ University of Glasgow, Glasgow, UK

² Edify.ac, UK

sarune.savickaite@glasgow.ac.uk

Abstract. Currently, accurate representation of physical spaces and, especially, human interactions in Virtual Reality (VR) can often feel clunky, unrealistic and require specialist knowledge and development. Our project explores avatar use through the Unreal Meta Humans tool (an extraordinary new 3D character creation technology), specifically, testing the use of realistic avatars in soft skills training and social interactions. This is a proof-of-concept project to generate ideas that address this gap in knowledge, do fast, low-cost prototyping and user testing to further our understanding of the field. We built and tested the recognition of basic emotions in Meta Humans and cartoon avatars in VR. The aim was to understand whether the realism of the avatar impacts our perception of basic human emotion and the sense of immersion in VR. This work aims to advance the study of artificial social interactions, and guide industry practice.

Keywords: Human Computer Interaction, Avatars, Virtual Reality

1 Introduction

Virtual Reality (VR) offers boundless opportunities for social communication divorced from physical location. One of the benefits of VR as a social platform is the ability of avatars to convey non-verbal communication. The effectiveness of avatars for this purpose depends on their appearance (realism, resemblance to the user, and the degree of available personalisation) [4] and behaviour (subtlety, realism, and expressiveness) [5]. It should be noted that this does not necessarily mean that the avatar should replicate the player's physical form, but instead can represent their self-image [6]. If successful, two people using VR avatars can use this non-verbal communication to build intimacy that is not possible when using only a desktop computer [7] and roughly equivalent to in-person communication [8].

Despite the strengths of avatars for visualcomms, there are downsides to their current

implementation. Most notorious of these is the Uncanny Valley effect where observers have a negative reaction to increasingly human-like entities, manifesting as a cold, eerie, and repellent feeling [9]. There are several hypotheses for why this effect exists, but recent evidence suggests that it could arise from a general aversion to objects which deviate slightly from familiar patterns [10]. As human faces are a strongly recognised pattern, they then elicit a stronger response than other objects. One of the challenges of avoiding the uncanny valley is that it reduces with greater realism, however, so does the transmission of emotional information [11]. This means that lower quality avatars are less uncanny, but to convey the same emotional intensity they have to be more exaggerated, consequently leading to high uncanniness. MetaHumans created in Unreal Engine 4 have achieved very low uncanny feelings by combining high fidelity models with motion capture [16], therefore breaking a key barrier to virtual agents.

A significant application of facial emotion research has been the development of interventions to improve the social cognition and skills of participants. While this has been primarily applied to clinical groups such as schizophrenia [21], the results are also applicable to the wider population [22]. Early findings suggest that the effectiveness of these interventions increases when using VR avatars compared to 2D images [23]. As MetaHumans currently appear to have achieved a high level of realism without inducing uncanniness at baseline, it is possible that they will be capable of expressing intense human emotions without becoming exaggerated. When combined with motion capture technology, they may be able to facilitate high quality social interaction between two or more people.

This will open opportunities for both organic human connection and social skill training opportunities. This study will be the first to measure the emotion recognition accuracy and uncanniness of MetaHumans.

2 Methods & Preliminary Results

Meta Humans (unrealengine.com) currently have 18 avatars and we wanted to include the basic seven emotions often used in psychological experiences. To avoid large number of trials, we have selected six Meta Humans (younger avatars of three racial profiles (Caucasian, Asian and Black), male and female). Each of the six avatars was animated using iPhone face capture technology. Full experimental design is summarized in Figure 1. Alongside images of emotions selected (paulekman.com) and an image of the full set of Meta Humans avatars.

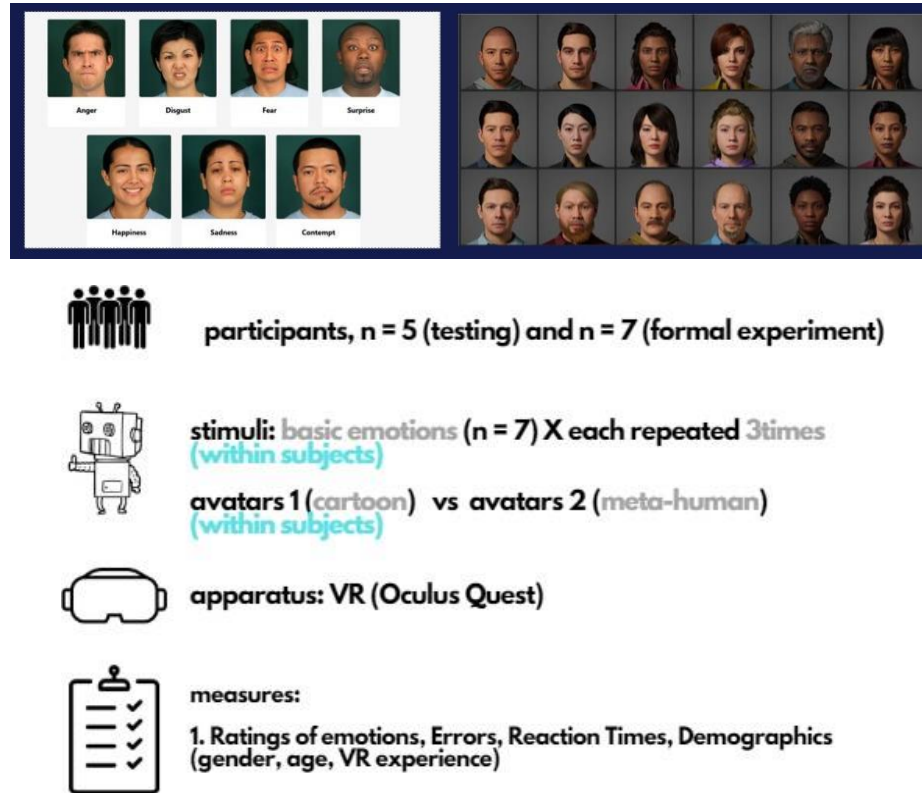


Fig. 1. Summary of Experimental Design.

Ethical approval was received from the University of Glasgow and participants were tested April 2022. A total of 7 participants took part in the study. Oculus Quest (oculus.com) was used for the display. Meta Humans set resulted in 126 trials and Wolf3D (wolf3d.io) avatars set was also 126 (avatars were matched to the age, gender and race of Meta Humans as much as possible). As the resulting number of trials was 254, testing session was split into two with a break in between. Demographics form was filled in at the start of the experiment. Experiment took approximately an hour to complete.

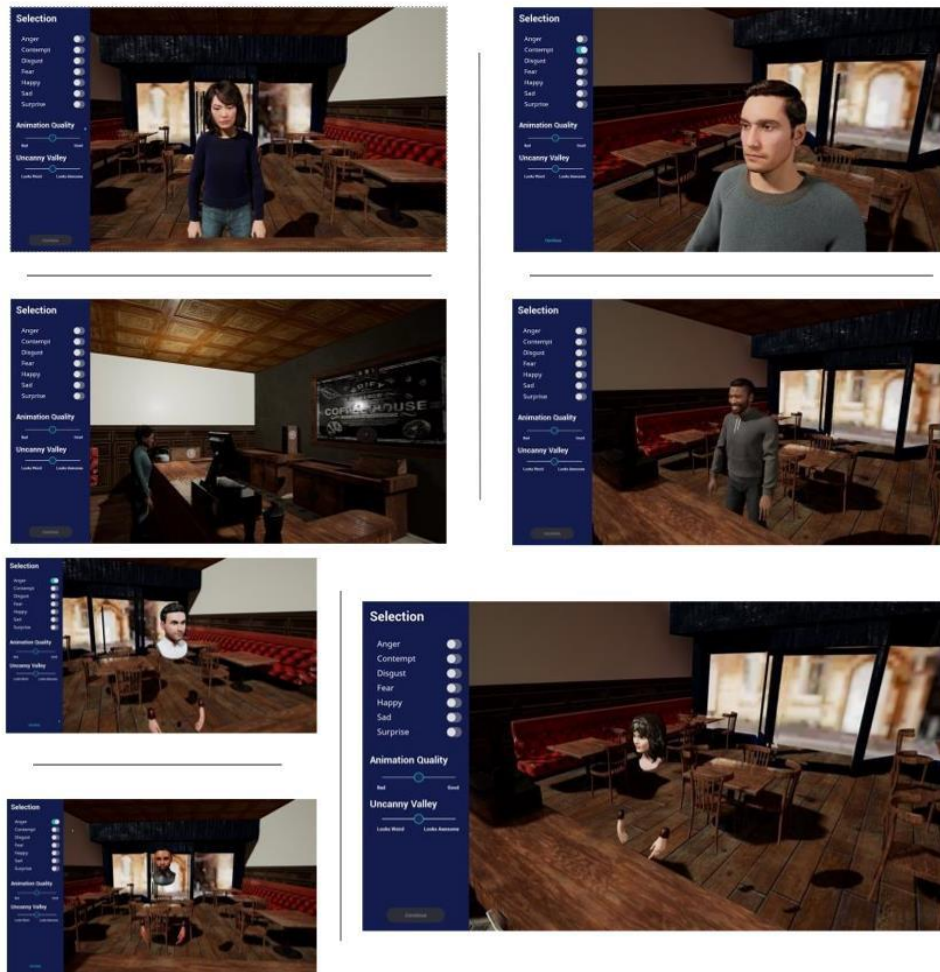


Fig. 2. Testing environment (café) with the avatars and rating panel (desktop version of this app for demonstration): top set shows meta humans in the environment, where the bottom set shows Wolf3D avatars in the same environment.

We have just completed data collection and the results are being prepared for analysis. At the time of the presentation we will be able to discuss our findings.

3 Discussion & Future Directions

Virtual Reality (VR) offers boundless opportunities for social communication divorced from physical location. This promise is especially relevant as the globalisation of information eclipses the globalisation of goods and people. We wish to understand how improving the realism of the avatars (teachers and students) can contribute to more effective teaching strategies. Cutting edge real-time rendering technology of Unreal Metahumans can simulate real-life social situations more accurately, including teaching scenarios. Moreover, understanding human facial expression is one of the key cues for social interactions alongside the body language. Body language capture and perception in VR is one of the next research steps for us.

Understanding how nuanced facial expressions are and how they might depend on body language perception is an overarching question for social interactions in the virtual space. Exploring how these social cues are used in the virtual teaching space is essential for furthering our comprehension of student-teacher interactions. Social aspect of teaching has been challenged over the pandemic and a lot of current teaching still takes place online. Equipped with improved avatars, immersive teaching tools such as Edify can make any teaching activity more personable and engaging. Understanding the role of embodiment and perception of social actions in virtual environments has potential for social skills training and interventions outside of teaching. Therefore, findings of this project can extend to further research and industrial applications.

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