A Social Interaction Interface Supporting Affective Augmentation Based on Neuronal Data

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ABSTRACT

In this demonstration we present a prototype for an avatar-mediated social interaction interface that supports the replication of head- and eye movement in distributed virtual environments. In addition to the retargeting of these natural behaviors, the system is capable of augmenting the interaction based on the visual presentation of affective states. We derive those states using neuronal data captured by electroencephalographic (EEG) sensing in combination with a machine learning driven classification of emotional states.

CCS CONCEPTS

• **Human-centered computing** → *Mixed / augmented reality.*

KEYWORDS

Communication interfaces; embodiment; affective computing; avatars; brain-computer interfaces

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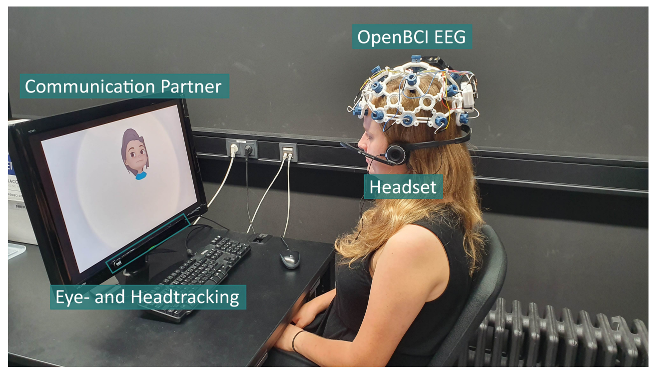

Figure 1: Hardware description. A Tobii eyetracker tracks the user's gaze and head movements. Movements of the communication partner are replicated to an avatar. Audio data is streamed and used for audio transmission and voice-to-mouth animation. An OpenBCI EEG headset senses neuronal activity and transmits EEG data. The data is preprocessed and classified using a recurrent neuronal network. Tracking data, audio data and classified affective states are streamed to a Unity 3D Network application to synchronize the environment.

1 INTRODUCTION

Todays platforms and research prototypes for communicative interfaces in Virtual-, Mixed, and Augmented Reality (VR, MR, AR) often allow to replicate spatial communicative behaviors such as body motion, gaze, and facial expression [4, 7]. Recent research has begun to augment these natural behaviors with additional social information, such as visual transformations [5], affective displays [3], or modifications of natural behaviors [1, 6]. To explore such augmentations on the basis of neuronal data, we presented a Brain2Communciate, a prototype to perform such augmentations on the basis of affective states that are derived from EEG data [8]. In this demonstration, we demonstrate the prototype with additional features and an iterated processing pipeline.

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2 APPROACH

2.1 Classification of Affective States

In previous work [8], we trained an SVM using the default implementation of the scikit-learn project, leveraging a polynomial kernel. While the accuracy was high during offline classification, we did notice that it was inaccurate during real-time classification. We therefore trained a Long short-term memory (LSTM) recurrent neural network using the PyTorch framework with one layer and a hidden layer size of 100 and the output beding directly fed the softmax output layer. We chose happy and sad as affective states to identify, as those states were found to be evoked more often in natural interactions in pretesting. Video stimuli were used for data acquisition to trigger those affective states. The data was annotated