

Chapter 1

“The human face is capable of an astonishing array of expressions: some of them declare unmistakable emotions, others are very subtle.”

John Raynes [100]

Introduction

People seek meaning through conversation, learning through interaction, and feel the emotions that others experience and feel through facial expression. During a conversation, facial expression can tell the respondent the emotion of the speaker and eye movement can indicate the abstract social value of a person. (In the western cultures, People who use frequent eye contact are perceived as more attentive, friendly, co-operative, confident, mature, and sincere than those who avoid using eye contacts. However, for the eastern cultures e.g. Japanese culture, direct eye contact is perceived as impolite and aggressive.).

When people interact with objects and other people, interaction is only possible if the objects and other people can be seen or touched by the respondent (the respondent sees the reaction of the other person through his/her facial expression). Therefore, facial expression forms a crucial part in the communication and interaction process.

Expressive texture avatars allows people to interact and communicate with other users, computer generated characters and objects in the virtual environment with lesser computations and using fewer system resources. The expressive texture avatar represents the user in the virtual environment, so that other users can identify the user from his/hers avatar representation. The expressive texture avatar can animate basic

facial expressions and use body motions together with facial animation to show emotional states and action.

By using the avatar creation tool, the face texture of the avatar can be adapted for different face images. The social interaction application shows the social interaction between different expressive avatars, which allow the user to observe the changes in the emotional state of each avatar under interaction in a synthetic environment.

Thesis focus

The work presented in this thesis is a theoretical approach and the software tool that enables users to create and animate facial expressions of avatars. The approach is to use a generic mesh onto which any face image, either synthetic or from a real person can be texture mapped, and by manipulation of the texture co-ordinates a variety of facial expressions is achieved. A software tool has been implemented to support the theoretical approach. The thesis presents expressive texture approach and highlights how this approach is different from the traditional facial animation approaches that were followed. It then discusses the process of avatar creation with a main focus in facial animation and discusses briefly body animation of the expressive avatar. It then highlights how virtual social interactions are achieved in the virtual environment.

Thesis layout

Chapter 2 discusses the classification of different approaches to and the distinct differences between them. It gives an overview of applications that make use of avatars, of the avatar generation process from a broad perspective, and of how facial expressions are created in avatars and the various facial animation approaches over the years.

In chapter 3, the Expressive Textures approach for animating facial expressions is presented. It discusses how the approach uses textures of images of both the synthetic faces and the real faces captured from video, and map these images onto a face mesh of the avatar. It presents an interactive way of fine-tuning and adjusting the underlined model, which allows a more realistic mapping of a special facial image. Furthermore, it presents how facial expressions are created and animated by texture manipulation.

Chapter 4 looks into the process of creating a simple full-body avatar suitable for a synthetic social environment and in how to animate the upper body movements of the avatar associated with facial emotions and other simple actions. It further discusses the interaction process between different avatars and their virtual environment, and discusses briefly the effects of combining sounds in the virtual environment. It then highlights how the interaction process between all the avatars in the synthetic social environment is co-ordinated using a simple state machine.

Chapter 5 discusses implementation of the Expressive Texture theoretical approach into the avatar creation tool and discusses the modelling that was required for the interactive virtual pub environment. It then discusses briefly how the model structure of the avatar is represented in OpenGL. It looks into the interactive virtual environment and how it simulates a real-world social environment, which allows the user to observe the social interaction between avatars, and the emotional changes of avatars caused by the social interaction.

Chapter 6 provides conclusions of the dissertation and discusses future work with regard to the avatar creation tool and the social interaction application.

In the appendix of this thesis the initialisation and complete function of all the controls in the GUI of the avatar creation tool and the social interaction application, is explained