Expressive Textures:
Synthetic and Video Avatars

by

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Submitted in partial fulfilment of the requirements for the degree Magister Scientiae

in the Faculty of Natural and Agricultural Science

University of Pretoria

Pretoria

May 2002

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Abstract

Avatars or virtual characters represent the users in various virtual environments and in variety of applications, giving the user an identity and a visual representation in the virtual environment. Avatars enabled the participant to interact with other avatars and manipulate other objects in the virtual world. When the avatar representing the participant interacts with other avatars, the avatar is required to show facial expressions and body expressions in order to make interaction more meaningful and realistic.

Extensive research has been done on facial animation for avatars. The aim of most of the approaches is to achieve a high degree of realism and this leads to the development of complex models of kinematics, muscle movement, movement of clothing as well as cognition and behavioural models. Image-based techniques and video avatars are also used for creating virtual humans. However, the complexity of the geometric and physically simulated avatar models used by the above methods make them unsuitable for use in distributed collaborative virtual environments that run on low bandwidth networks or over the Internet.

This thesis presents the overview of related research in synthetic and video avatars with the core focus in facial animation. It then presents the Expressive textures theoretical approach that uses texture manipulation to create facial animation of real and synthetic avatars. Furthermore, it presents the design and implementation of an interactive avatar creation tool that generates avatars using the expressive texture approach. The interactive avatar creation tool can create simple avatars, creating simplified models of virtual humans, animating the avatar's facial expression and supplementing it with simple body movements. Using the expressive texture method, the face of each avatar can be fine tuned and animated by manipulating the textures.

The interactive avatar creation tool aims at providing a fair amount of realism enabled avatar creation and animation suitable for low cost Tele-presence, Tele-conferencing, distributed virtual environment applications and computer games.

The interaction between avatars is demonstrated in a simple virtual environment for a social interaction application. In particular, a virtual pub environment is used where full body avatars, created via the interactive avatar creation tool, are inserted This allows the user to observe the interactions between the avatars, and interactions between the avatar and the virtual objects in the virtual environment.

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Opsomming

Inkarnate* verskaf aan die verbruiker verskeie visuele omgewings en toepassings. Bg. Karakters veroorsaak dat die gebruiker kan identifiseer met die karakters en visuele verteenwoordiging in 'n virtuele omgewing kan plaasvind.

Uitgebreide navorsing is gedoen oor die gesigs-animasie van inkarnate. Die hoofdoel van hierdie navorsing en benaderinge is om 'n hoë graad van realisme te bewerkstellig. Dit het weer gelei tot die ontwikkeling van komplekse kinematiese modelle, spierbewegings, beweging van klere sowel as bewustheids en gedrags modelle. Verbeelding-gebaseerde tegnieke en video inkarnate word ook gebruik om menslike voorbeelde te ontwikkel. Die kompleksiteit van die geometrese en fisies gesimuleerde inkarnaat modelle maak dit egter ongeskik vir die algemene verspreiding van virtuele uitbeeldings wat op lae-bandwydte netwerke op die Internet plaasvind.

Hierdie tesis verteenwoordig 'n oorsig van die verwante navorsing wat gedoen is in sintetiese en video inkarnasie met die klem op gesigs animasie. Dit verskaf dan die teoretiese benadering wat tekstuur manupilasie gebruik om gesigs animasie van regte en kunsmatige inkarnate te bewerkstellig. Hierdie interaktiewe inkarnaat ontwikkelings instrument kan dan eenvoudige inkarnate tot stand bring en vereenvoudigde modelle van menslike inkarnate met gesigs uitdrukkings en eenvoudige liggaamsbewegings skep. Hierdie ekspresiewe tekstuur-metode het tot gevolg dat die gesig van elke inkarnaat baie fyn ingestel en uitgebeeld kan word.

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* Inkarnate (avatars) of virtuele karakters (virtual characters) is 'n visuele manifestasie van 'n abstrakte konsep

Die bogenoemde interaktiewe inkarnaat ontwikkelings model het ten doel om 'n redelike mate van realisme daar te stel wat dit geskik sal maak vir lae-koste Tele-teenwoordighied, Tele-konferensies, verspreiding van verskeie omgewings toepassings asook vir rekenaarspeletjies. Die interaksie tussen inkarnate word gedemonstreer deur 'n eenvoudige virtuele, omgewing wat 'n sosiale interaksie toepassing het. Sodoende kan die gebruiker die interaksie tussen die inkarnate en die interaksie tussen die inkarnate en virtuele onderwerpe in 'n virtuele omgewing waarneem.

Tesis studieleier: Prof. V. Lalioti
Department Rekenaarwetenskap

Ingedien ter gedeeltelike vervulling van die vereistes van die graad Magister Scientia

Acknowledgements

I would like to thank the following people for their assistance and contributions, without which this research would not have been possible:

- Prof. V. Lalioti for her guidance, assistance and support as my supervisor

- UP for the use of their facilities

- NRF for financial support

I would also like to thank everyone that supported me during this time and had endless patience listening to my thoughts and ideas and encouraging me when I needed it the most.

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