Augmented Reality in the Character Animation Pipeline

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1 Introduction

Modelers and animators often rely on real-life references to build and animate 3D characters for games and film production. Videotaping a real subject and the manipulation of mock-ups support the creation of precise and expressive character animation in virtual content creation environments such as 3D modeling and animation packages. We propose to use Augmented Reality (AR) to bridge the gap between physical and virtual production environments by superimposing 3D graphics on real world objects. We have created tools (see Figure 1 for illustrations) based on the *Studierstube* AR framework [Schmalstieg et al. 2002] to improve the character animation pipeline by exploiting the physical world as a user interface.

2 Immersive keyframe and behavior design

Professional artists use motion capture techniques or other expensive means such as the Monkey kinematic tracker device [Esposito et al. 1995] to create an initial motion data set for the final, refined animation. Similarly, within an AR environment the animated virtual model and the real-world reference are merged to form a single interactive modeling instrument. We use a wooden mannequin as an input device to animate skeleton-based anthropomorphic 3D models. The head and limbs of the mannequin are pose-tracked. The system maps real-time pose data to rotation information for the joints of the character skeleton using inverse kinematics and motion mapping techniques.

AR enables not only close interaction with virtual models by using tangible objects but also the creation of complex motions such as a character balancing on top of a moving platform. Animators can use an actual physical model of the platform in concert with the character to create realistic motions. By employing sensors such as observing the real platform's pose using a fiducial marker and a webcam, an internal world model is created and maintained. This world model enables the character to react to changes in the physical environment, and thus appear to be balancing on top of the real platform. As the user manipulates the platform using 6 degrees of freedom, the resulting tangible user interface (TUI) [Ishii and Ullmer 1997] offers an intuitive way to observe and control character behavior from arbitrary viewpoints.

3 Interface for control and data transfer

Animated characters may appear on various stationary and mobile devices depending on their current production stage: a character is still being sketched on a designer PC, while another one is tested within a console game presented to customers. It would be desirable to eliminate repetitive traveling between design and presentation environments by enabling animators to tweak character attributes where and when they want. We decrease the seam between workspaces by using a mobile control interface generated on demand that builds upon the Personal Universal Controller (PUC) technology [Nichols et al. 2002]. Characters providing an XML-based markup of their relevant, configurable attributes as part of their scene graph-based description can be dynamically queried by PUC-enabled PCs, PDAs or smartphones. These devices are thus able to render a mobile graphical user interface to control attributes included in the description, allowing users to see changes immediately inside the target presentation environment.

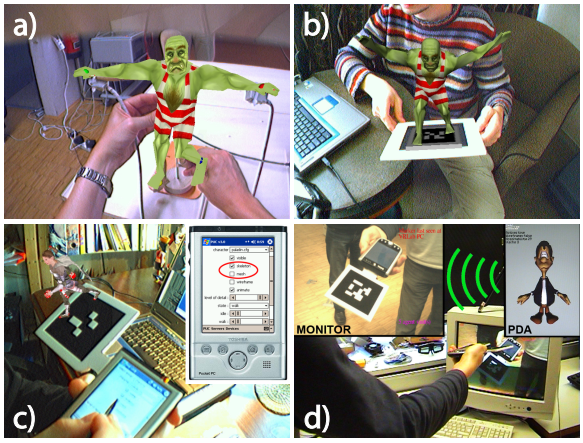

Figure 1: a) Immersive keyframe design, b) Behavior design, c) Mobile control interface, d) Tangible data transfer

TUIs also serve as a great metaphor for the seamless transfer of digital information between physical workspaces. We employ a pose-tracked PDA to act as a tangible data transfer medium to move characters between designer computers and the presentation environment. When the fiducial marker mounted on the PDA penetrates a virtual bounding volume defined around the character's current workspace such as a PC monitor or projection screen, our system initiates migration to/from the PDA. Visual character attributes remain persistent across all workspaces.

*The authors were sponsored by the Austrian Science Fund FWF (contract No. Y193).

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