Heterogeneous Character Animation: How to make an interactive character jump between stationary and mobile graphical computing platforms

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This sketch presents a method for enabling a real-time animated character to appear to jump between a stationary computer screen and a mobile graphical device. This heterogeneous character animation - character animation that takes place across two or more networked and collocated graphical devices - is a key element in the Virtual Raft Project, which is being shown in the Emerging Technologies program at SIGGRAPH 2005. The cross-platform jump occurs when a participant brings a Tablet PC (a "virtual raft") up to a stationary computer (a "virtual island"). The character's jump appears very simple to the participant, but technically it involves precise coordination of numerous technical and design elements - autonomous behavior, interactive animation, real-world sensing, inter-device communication, interface design, physical set construction and graphical and sound effects. Approximately 250 participants have interacted with the Virtual Raft Project in groups of ten to twenty at a time; a video of these interactions accompanies this sketch and demonstrates how the characters jump from virtual island to virtual raft. Effective heterogeneous character animation could make possible novel forms of entertainment, education and new media art.

1 IMPLEMENTATION

The hardware for the Virtual Raft Project consists of three standard desktop computers (islands) and three Toshiba Portege M200 Tablet PCs (rafts). The system allows the characters to jump from an island to an empty raft, from a raft to an island, and from a raft to an empty raft.

The installation has a web cam mounted on each virtual island to detect motion via a simple computer vision system. When the web cam detects motion, the autonomous characters on the islands walk up to the screen. The vision system adds a level of interactivity to the installation as it provides a feeling that the autonomous characters are attending to participants as soon as they enter the space. This movement toward the screen also puts the character in position to begin the jump animation if the person presents a virtual raft.

The system uses IrDA for detecting the proximity of the mobile device. When a computer detects the IrDA signal of a nearby device, it attempts to connect to the other computer using TCP through Wi-Fi (802.11) and wired Ethernet. The use of TCP allows there to be as many islands and rafts as there are unique IP addresses. Once a connection is made, the system packages up the attributes of the character (e.g. color, gender, unique ID, emotion states) into a single data object and sends it through TCP to the other device. The animations and behavior code of the character are duplicated on each of the islands and rafts.

The virtual characters in the installation have simple behavior systems that consist of several components: a sensory system, an attention system, an action system, a navigation system, and a motor system. These elements work together to cause a character to move to the correct position and orientation to begin the cross-platform jump.

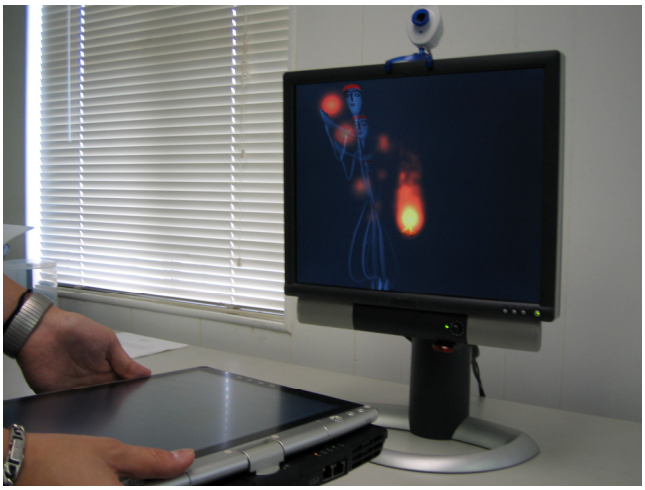

Figure 1: A character jumps from a monitor to a Tablet PC.

The animation of the characters contributes to the effectiveness of the overall experience. Moving to a heterogeneous format does not remove the necessity to have expressive character animation. In the heterogeneous jump described here, the animation adheres to the principles of traditional animation such as anticipation, follow through and secondary motion.

The interface of the virtual raft includes a 3D model of a "raft" composed of several wood logs in the middle of the screen. The virtual raft is surrounded by a body of animated water with computational ripple effects on its surface. The virtual raft has a visible "prow" that serves as a subtle arrow pointing forward, which encourages people to orient the device in the correct direction. When a character is on the virtual raft it looks up toward the participant, as if it is attending to him or her. This helps to increase the engagement that participants feel toward the characters.

Specific graphical and sound effects are used to increase the believability of the transfer process. When an autonomous character jumps from a desktop island and lands on a virtual raft, a splashing sound is heard as the real time graphical ripples spread out from the point of contact. This and other sound effects help increase the believability of the jump.

2 SUMMARY

An effective heterogeneous animation should appear simple to a participant, but it invariably involves careful coordination of numerous factors. The jump described here involves coordination of networking, infrared communication, computer vision, autonomous behavior, interactive animation, interface design, physical set construction and graphical and sound effects. The key to the appeal of this heterogeneous animation is the integration and timing of all of these factors.