Exploiting Proprioception in Virtual-Environment Interaction

by

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Computer Science.

Chapel Hill

1997

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ABSTRACT

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Exploiting Proprioception in Virtual-Environment Interaction
(Under the direction of Frederick P. Brooks, Jr.)

Manipulation in immersive virtual environments is difficult partly because users must do without the haptic contact with real objects they rely on in the real world to orient themselves and the objects they are manipulating. To compensate for this lack, I propose exploiting the one real object every user has in a virtual environment, his body. I present a unified framework for virtual-environment interaction based on *proprioception*, a person's sense of the position and orientation of his body and limbs. I describe three forms of body-relative interaction:

- Direct manipulation—ways to use body sense to help control manipulation
- Physical mnemonics—ways to store/recall information relative to the body
- Gestural actions—ways to use body-relative actions to issue commands

Automatic scaling is a way to bring objects instantly within reach so that users can manipulate them using proprioceptive cues. Several novel virtual interaction techniques based upon automatic scaling and our proposed framework of proprioception allow a user to interact with a virtual world intuitively, efficiently, precisely, and lazily.

Two formal user studies evaluate key aspects of body-relative interaction. The virtual docking study compares the manipulation of objects co-located with one's hand and the manipulation of objects at a distance. The widget interaction experiment explores the differences between interacting with a widget held in one's hand and interacting with a widget floating in space.

Lessons learned from the integration of body-relative techniques into a real-world system, the Chapel Hill Immersive Modeling Program (CHIMP), are presented and discussed.

ACKNOWLEDGMENTS

Thanks to

Frederick P. Brooks Jr., Gary Bishop, Henry Fuchs, Anselmo Lastra, John Tector, and Carlo H. Sequin for serving on my doctoral dissertation committee;

Frederick P. Brooks Jr., my advisor, for his insights, inspiration, and for making it all so clear;

Gary Bishop for many fruitful years of collaboration and for not minding too much that my dissertation didn't have wires and accelerometers coming out of it;

Henry Fuchs for the inspiration of his boundless energy, enthusiasm, and love of knowledge;

Anselmo Lastra for his kindness, advice, and for keeping Pixel-Planes 5 alive long enough for me to graduate;

Carlo Sequin for asking the hard questions, and for helping me to keep it simple;

John Tector for the many wonderful conversations about architecture and design;

Warren Robinett for leading me to the University of North Carolina;

Rick Zobel for paving the way for my investigations into immersive design;

Robert Zeleznik for his invaluable contributions to this work;

Linda Houseman, Dave Harrison, Todd Gaul, and Peggy Wetzel for all of their help during the years;

Hans Weber and Greg Welch for being such good friends and for the meetings of the IHBI at the TOTH[1];

Erik Erikson for Vinimini, G2, Speed Racer, and for keeping it fun;

Eliza Graves for the laughter and the smiles;

My parents for all they have done for me through the years;

Dylan for the incredible joy he has brought to my life;

Baby X for the many wonderful years to come;

and most importantly,

Sandra for her unwavering love, support, faith, and devotion, and for, more than anyone else, making it all possible.

Financial support for this work came from the following agencies: Defense Advanced Research Projects Agency, Link Foundation, Lockheed Missiles and Space, Inc. (indirect DARPA)

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[1]Institute for Half-Baked Ideas at the Top of the Hill

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