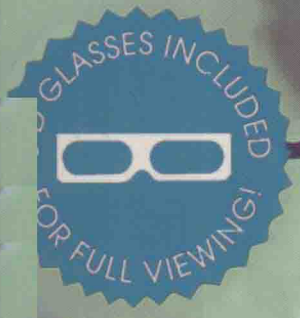
Virtual Reality ExCursions

WITH PROGRAMS IN C

Christopher Watkins
Stephen R. Marenka



Bring your PC to life!

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WITH PROGRAMS IN C

Christopher D. Watkins
Stephen R. Marenka

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This book is printed on acid-free paper. ♾

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Thanks go to Adam Schiffman of The Graphics Alternative for production of his copyrighted image "silver surfers" found on the front cover of this book. The Graphics Alternative consults for 3D Animation, 2D Imaging, and Video. The Graphics Alternative is located at 190 El Cerrito Plaza #107, EL Cerrito, CA 94530, and TGA can also be contacted by voice at 510-528-1652 or BBS at 510-524-2780.

Thanks go to Mitch Kolbe of 34 W. Orange Street, Tarpon Springs, Florida for providing the photorealistic paintings used as texture maps. Mr. Kolbe has worked on such projects as one of America's largest murals, The Cyclorama, which depicts the Civil War in Atlanta in 1864. Several projects followed the completion of The Cyclorama; these included museum background murals, which required molding, casting, and fiberglass sculpture, as well as work for the U.S. Fish and Wildlife Service, Epcot Center, and Disney World. Since 1985 Mr. Kolbe has been fully dedicated to the creation of fine art oil paintings. He presently resides in the original studio of the famous artist George Innes Jr. in Tarpon Springs, Florida.

Algorithm, Inc. of 3776 Lavista Road, Suite 100A, Atlanta, GA 30084 produces tools for ray tracing, volume rendering, 3-D modeling and VR, animation, image processing, and interactive image warping and morphing. Contact us at the above address or call/fax (404) 634-0920 for more information regarding our products.

And special thanks again go to our parents, wives, and friends for their love and patience with us during this project.

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Biographies

Christopher D. Watkins is founder and president of *Algorithm, Inc.*, an Atlanta-based scientific research and engineering company that produces software for medical imaging and visualization, photorealistic rendering, virtual reality, and animation. He is an electrical engineer, an experienced programmer, and coauthor of *Photorealism and Ray Tracing* (M&T Books, 1992) and *Modern Image Processing: Warping, Morphing and Classical Techniques* (Academic Press, 1993). He received his degrees from The Georgia Institute of Technology and is a member of the IEEE and of the ACM/SIGGRAPH.

Stephen R. Marenka is an electrical engineer from the Georgia Institute of Technology, specializing in intelligent control, data reduction techniques, and human-computer interfaces for multiplatform computing (VAX/VMS, Unix, Macintosh, and PC systems). He is working on his MS in electrical engineering control systems. He is also a coauthor of *Modern Image Processing: Warping, Morphing and Classical Techniques* (Academic Press, 1993) and is a member of the IEEE Control Systems and Computer Societies.

It's All in the Name

You will be encountering some unusual words and terms which surround virtual reality research and development, some of which follow.

> display—a device (as a cathode-ray tube) that gives information in visual form in communications

The term display as used in the virtual environments field of research is applied more generally, such as:

> display—a device that gives information in communications

Now we may use the term display in reference to a visual display—a computer screen, an auditory display—a stereo or other sound source, and a haptic display—motion, tactile, or force-feedback equipment.

> haptic—relating to or based on the sense of touch

The term haptic includes all displays that present information to the loosely defined sense of touch, including tactile, texture, force-feedback, motion, and pressure.

Virtual environments research in modern times is often traced to Ivan Sutherland's 1965 paper "The Ultimate Display," presented to the triennial conference of the International Processing Societies. Sutherland described "a program of research in computer graphics which has challenged and guided the field ever since." Sutherland said that one must look at a computer display screen as a window through which one beholds a *virtual world*. "The challenge to computer graphics is to make the window look real, sound real, and the objects act real. Indeed, in the ultimate display, one will not look at that world through a window, but will be immersed in it, will change viewpoint by natural motions of head and body, and will interact directly and naturally with the object in the world, hearing and feeling them, as well as seeing them." Such research has proceeded under a variety of names, including *virtual environments, virtual reality, artificial reality,* and *synthetic experience.* (Fuchs and Fisher)

> virtual—being in effect but not in actual fact

environment—the conditions, circumstances, and influences surrounding and affecting an organism.

reality—of or relating to practical or everyday concerns or activities

Many of the top researchers in the field, including Frederick Brooks at the University of North Carolina in Chapel Hill and Scott Fisher, formerly of NASA Ames Research Center and now of Telepresence Research, prefer the usage of the term *virtual environments* to describe the field. Jaron Lanier, formerly of VPL Research, coined and prefers the term *virtual reality*. Myron Krueger coined and prefers the term *artificial reality*, which refers to a specific subset of research defined in his book *Artificial Reality*.

This book uses the terms virtual environment and virtual reality indiscriminately. Also, we specifically include parallel lines of research which may not be wholly immersive in nature (since very few systems, if any, can totally immerse all of the senses at this point in time anyway).

The term DataGlove is VPL Research's trademark name for a hand-based input device, further defined in the glossary. You will soon encounter other terms which may be unfamiliar to you; please refer to the glossary in the appendix for definitions of these and other important relevant concepts.

Initialization

Welcome to a magical land where anything is possible and the physical laws of the real world no longer apply, the land of virtual reality. In this book we make an excursion into this realm to learn about its history, the defining boundaries of the land, and all the fascinating things happening within its borders. In the first chapter we explore the current applications in the vast field of virtual reality. The second chapter presents a brief history of the field and its founders. Chapter 3 comprises human perception and how it works. We cover some interesting notes and much of the hot debate in the field in Chapter four. The fifth chapter describes many of the complexities involved in implementing virtual environments on real equipment. There is lots of good stuff in the appendix; we highly recommend that you take a look. Enjoy the ride!

If we perceive our role aright, we then see more clearly the proper criterion for success: a toolmaker succeeds as, and only as, the *users* of his

tool succeed with his aid. However shining the blade, however jeweled the hilt, however perfect the heft, a sword is tested only by cutting. That swordsmith is successful whose clients die of old age.

—F. Brooks, "Grasping Reality Through Illusion: Interactive Graphics Serving Science"

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