BOOK REVIEW

Stereo Computer Graphics and Other True 3D Technologies

David F. McAllister, Ed., 267 pages. ISBN 0-691-08741-5. Princeton University Press, Princeton, NJ 08540 (1993) $75.

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Stereo imaging is here to stay. For imaging professionals, it seems to be imperative to be knowledgeable about these methods. Stereo imaging does not appear to be a fad, which, if ignored, will have the fate of pet rocks. Fortunately, McAllister has edited a series of contributions in *Stereo Computer Graphics and Other True 3D Technologies* into a good overview of the field. As seems appropriate for a book on stereo graphics, it provides more than one viewpoint on the subject. McAllister has assembled a distinguished group of contributors to this book. The experience of these contributors and the insights they provide are extremely valuable.

Stereo imaging is a combination of software and hardware, and both aspects are adequately covered. It is assumed that the reader is familiar with computer graphics, and the many aspects of this field are not covered. However, specialized issues such as color quantization and hidden surface elimination for stereo images are covered. Particularly interesting is the number of methods used to display stereo images; the hardware configurations and methods are quite extensive. Clearly one has to develop software that is suited for the output devices.

The beginning of the book covers the nomenclature of stereo imaging and describes the characteristics of the human "wetware" for seeing and processing stereo images. The remainder of the book explains how to get software and hardware to present stereo and other true 3-D images to the human eye. Contributors in following chapters give additional nomenclature and often repeat definitions. Although this is redundant, it is generally helpful and keeps the chapters a bit more self-contained. It is often distracting for a reader to have to flip through pages to find a definition. However, a universal glossary would have been helpful to the reader.

The second chapter describes notions of depth cues and of stereo image composition. This chapter offers good "rules of thumb" for composition. For readers beginning stereo imaging, following these rules will produce satisfying results without tedious experimentation. We wish we had possessed some of this knowledge prior to embarking on some of our own stereo image creations. Of course, as one becomes more familiar with stereo imaging, varying from the rules can produce desirable outputs.

Because many of the systems assume the user is attached to a computer and the computer is displaying images in real time, issues of user control come to the forefront. Stereo imaging has special problems with computer control, such as image disparity control, perspective, and parallax. The chapter by Lipton introduces these problems in an easily understood manner. Concepts contained in this chapter are a must for anyone interested in stereo imaging.

The clarity of the second chapter is not carried into the third chapter, which is concerned with hardcopy output. We had to reread this chapter several times in order to understand what the contributor had in mind. There are many holes in the dissertation and it is quite choppy in presentation. The section on holography is very short on physics and assumes the reader is already well versed in holography. In other sections, some of the references, such as the "stealth negative," require previous knowledge of the subject material. The editor should have applied editorial discretion and reworked the paragraph in order to make this more accessible to the reader. This chapter would be confusing to someone new to stereo imaging.

The next contribution describes human visual perception issues. This is an extremely important topic. Sense of depth is indeed an illusion, and knowing the mechanisms of why the illusion works is central to any stereo imaging system. A large number of subtopics are covered, and the presentation makes for interesting reading. Of course, once the mechanism of stereo imaging is understood, the natural inclination is to begin to compute images to apply the knowledge. This is precisely the goal of the following chapter. Many technical details are spelled out and described in terms that are needed for anyone interested in generating computer graphic stereo images.

The majority of the remaining text is devoted to display methods and implementation aspects, such as user controls. Display methods for stereo imaging are broadly broken into autostereo systems and those systems that require special equipment. Autostereo systems do not require the viewer to be encumbered with special equipment or viewing apparatus. It is surprising to see all the means in which stereo images can be displayed. These include rotating mirrors, lenticular sheets, barrier screens, sequential fields, moving slits, and liquid crystal display (LCD) devices. The section on LCD devices was especially interesting, and we found ourselves rereading that chapter several times. The specific technological implementations of some of these methods are given, along with the performance requirements for systems constrained by human perception. Many of these chapters go into detail about a particular imaging system. Sometimes the contributor seems to be producing a product offering instead of describing a technology. Material about product offerings is more suitable for a periodical, rather than a book. These sections are useful, but the reader will not find general principles described as clearly as in earlier chapters.

The final chapter deals with volumetric rendering. Often volumetric rendering is accomplished by extending computer graphics methods. The approach described in this chapter actually displays the volume as a physical three-dimensional entity. This chapter is interesting, and, unlike many contributions, the references have a large number of patent disclosures.

Some illustrations exhibit jagged lines and appear to have been constructed with a low-resolution laser printer and not reduced for inclusion in the text. Jagged lines are visible in Figs. 3.9, 5.2, and 6.2, and some of the line art appears to have been rather sloppily constructed, as exhibited in Fig. 3.6. On the other end of the quality spectrum, the text includes some good color plates showing stereo pairs, and most of the illustrations in Chap. 9 look

as if they were drawn by a professional draftsman to be included in a patent application. Even the part reference numbers required for patent figures were left in! A few of the figure descriptions include the reference numbers and sound like the legalese written for examiners at the U. S. Patent and Trademark Office, and not for the interested readers of a text on stereo computer graphics. The editor should have insisted the author translate the legalese and patent jargon into more common technical parlance.

This book is a compilation of chapters written by several authors, and it is the responsibility of the editor to merge individual contributions into a cohesive and readable text. Although the editor does a largely credible job, there are instances where more aggressive editing would be appreciated. Both the quality of the illustrations and of the writing varies between the contributing authors. The editor should have made these variations less distracting to the reader.

Some authors, and in particular, the nonacademics, focused their chapters on the approaches used by their companies. Several times we questioned whether the material should have been printed on glossy pages, because it had the feel of an advertisement for the author's product line. To the editor's credit, the book does not cover up the "infomercial" nature of these sections and boldly lists them with titles like "Our Current Products" in the table of contents. While particular products come and go, the basic set of concepts is likely to persist and reappear in other guises. Unfortunately, it is left to the reader to sort out what is specific to a particular implementation and what is of general interest. Greater emphasis on broad descriptions of technologies and their foundations would have benefited the reader.
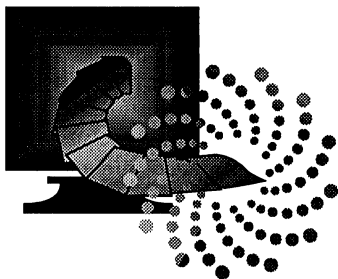
At a price of $75, this book seems a bit expensive. Perhaps the publisher should have refrained from the extra cost of acid-free paper and put the money into better graphics and higher quality line art. This is, after all, a book on graphics, and although much of the book contains reference material of a timeless nature, many chapters include material describing hardware that will be quite dated long before acidic paper would yellow.

Overall, the book provides valuable information on the terminology of stereo computer graphics and the latest in hardware devices for display. It would serve as a good introduction to stereo imaging for anyone with a basic idea of computer graphics, and is a recommended buy for those interested in a good presentation of the subject.

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