Guest Editor's Introduction: Computer Graphics in Medicine

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Medical visualization began its romance with the computer in the early 1970s. The first generation of computed tomography (CT) scanners revolutionized radiology by generating spatially accurate images of internal anatomy, never before seen in medicine. For example, brain disorders previously visualized by invasive multiple stereo radiographs could be seen, accurately located, and diagnosed on CT consoles with little risk to patients. Subsequently, computer graphics and other digital visualization techniques encountered few obstacles to clinical utility. The radiology community embraced this new technology and has not let go.

Since then, computer graphics has steadily increased its role in the routine clinical operations of medical imaging departments and outpatient centers. Computer graphics has benefitted magnetic resonance (MR), ultrasound, and other medical imaging methods. Though early users of computer graphics simply applied techniques borrowed from 3D modeling and animation, the 1980s introduced techniques indigenous to medical image data. Cuberille and volumetric visualization techniques, for example, were inspired by an unrelenting quest to see more of the anatomic structure contained in a CT or MR stack of images than was possible with a series of 2D views alone.

This effort to tap the intuitive power of the mind—the part that interprets visual information—continues. Somehow we must unburden the radiologist, the molecular biologist, and other medical imaging professionals from the mental task of integrating huge image data sets. We must use the computer to unleash the brain's lightning-fast ability to understand images. Over the millenia our visual system has become optimized to recognize dimension, perspective, color, form, texture, and time-varying visual phenomena. When the computer delivers data in a form our visual cortex can sort, we can easily recognize and understand complex and subtle relationships. This knowledge improves medical treatment and benefits health care in general.

This special issue of *CG&A* delivers recent advances in computer graphics in medicine. In an effort to combine the computer's ability to rapidly manipulate massive amounts of data and the brain's split-second ability to understand images, Jayaram Udupa and Dewey Odhner report on a new data structure and algorithms. Segmentation and reconstruction techniques are critical steps in modeling anatomic structure and manufacturing prostheses. Two articles, one by Yoshihisa Shinagawa and Tosiyasu Kunii and another by Åke Wallin, show new techniques to help automate these modeling challenges.

Removing occluding anatomy to clarify diagnosis or simplify the generation of anatomic models is tricky, time consuming, and often frustrating. Derek Ney and Elliot Fishman introduce easy-to-use editing tools for 3D medical data, optimized by clinical use. Hans-Peter Meinzer, Michael Vannier, and their colleagues propose ideas to minimize the difference between computer representations of human anatomy and the actuality. The closer such models come to reality, the more accurately a rehabilitative procedure can respond to underlying structural defects. Clinicians can use such techniques to correct these severe disorders and even predict the cosmetic results.

Computer graphics contributes greatly to the practice of medicine. The articles in this special issue show you how. ❑

Acknowledgments

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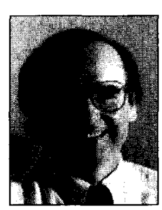

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Rhodes obtained a BS in aerospace engineering from the University of Michigan and MS and PhD degrees in computer science from UCLA. He is a member of the IEEE Computer Society, RSNA, ACM, and Tau Beta Pi. He is co-chair of the Computer Assisted Radiology (CAR) conference series and an editorial board member of *IEEE CG&A*.

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