MEDICINE MEETS VIRTUAL REALITY II

INTERACTIVE TECHNOLOGY & HEALTHCARE:
Visionary Applications for Simulation Visualization Robotics

January 27-30, 1994
San Diego, California
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Visionary Applications for
Simulation
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The organizers of the Conference wish to express their gratitude to the Program Committee:

Michael J. Ackerman, Ph.D., Steven T. Charles, M.D.,
Nathaniel I. Durlach, Walter J. Greenleaf, Ph.D.,
Helene M. Hoffman, Ph.D., Ralph E. Holmes, M.D.,
Patrick J. Kelly, M.D., Philip J. Mercurio, Bela L. Musits,
Makoto Nonaka, M.D., Ph.D., Glenn M. Preminger, M.D.,
Joseph M. Rosen, M.D., Jonathan Sackier, M.D.,
Col. Richard M. Satava, M.D., Faina Shtern, M.D.,
Hans B. Sieburg, Ph.D., Dave Warner, Suzanne Weghorst
and Mark D. Wiederhold, M.D., Ph.D.
The following Workshops will be presented simultaneously on Thursday afternoon. We provide this synopsis of each to assist you in choosing the most appropriate presentation for your needs.

**THURSDAY, January 27, 1994**

I. 2:00-5:30 PM
II. & III. 3:00-5:30 PM

**I. Biological Informatics: "The Science of Managing Biomedical Information"**

**Sponsored By:** Laboratory for Biological Informatics & Theoretical Medicine, UCSD

The natural and medical sciences have strongly benefitted from technological computer-driven advances that help to create and store a cornucopia of raw data and information. As a result of data-overcrowding, it has become increasingly difficult to identify hypotheses that can be used to guide experimental and clinical research. This workshop presents a variety of information and decision management technologies that facilitate the integration of data from different sources at different levels, and aid in the development of standards to allow reusability and collaborative efforts.

**Presenters:**
- Sheldon Ball (University of Mississippi, Dept. Pathology)
- Floyd Bloom (Scripps Inst., Dept. Neuropharmacology)
- Michael Huerta (Human Brain Project, NIMH)
- Ralph Martinez (University of Arizona, Dept. of Computer Science)
- Jack Park (ThinkAlong, Inc.)
- Hans Sieburg (UC San Diego, Dept. of Psychiatry)
- Stella Veretnik (UC San Diego, BITMed)
- W. Zlarko (U. Regina, Dept. of Computer Science)

**Organizer:**
Hans B. Sieburg (hsieburg@ucsd.edu); 619-543-5081 Voice; 619-543-1235 Fax
II. "Massively Parallel Processing Computers For Medical Technology Development"

**Sponsored By:** Foundation for International Scientific Advancement, La Jolla

In today's medical and biotechnology world, a total amount of information related to clinical medicine and basic research has been increasing continuously at a high speed rate. However, those who are in the healthcare industry and biomedical research are not quite ready to fully utilize such amount of information because of a lack of ways to organize and analyze it both economically and efficiently. In order to prepare a powerful information and analysis in these fields, it is essential for us to create efficient medical databases, design fast and powerful simulation approaches, and process complicated signals and image patterns. A rather inexpensive high speed computing available with massively parallel processing computers will be the key for this approach. This workshop presents the latest idea and technologies in the Massively Parallel Processing (MPP) computer world to develop such new approaches in medical and healthcare fields such as automated analysis of ultrasound signals to classify the structure and tissues in 3-dimensional images, structural analysis and homology modeling of DNA sequences, viruses and proteins.

**Presenters:**
- Dr. Adrian King, Chief Engineer, Federal Programs, Intel Corp.
- Dr. Michael Gribkov, Staff Scientist, Supercomputer Center, UCSD
- Dr. Russ Altman, Medical Information Sciences, School of Medicine, Stanford University
- Dr. Tom Brotherton, Senior Principal Engineer, Orincon Corporation
- Dr. Makoto Nonaka, Foundation for International Scientific Advancement

**Organizer:**
Makoto Nonaka, M.D., Ph.D., Foundation for International Scientific Advancement
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III. Interactive Technologies In Health Care: "The Big Picture"

Health care and education are two areas of human endeavor which are very dependent on the ability to communicate large volumes of complex information in short periods of time. Recent advances in interactive information technology have the potential to greatly enhance the capacity for more effective communication, both human-computer and human-human. This workshop will provide an up-to-date overview of interactive technologies and their intelligent implementation in health care and education. A general systems perspective on the potential for positive social impact of interactive information technologies at the global scale will be presented.

**Topics include:**
- INTERFACE TECHNOLOGIES
- INTERACTIVE TECHNIQUES
- VIRTUAL REALITY
- EDUCATIONAL MULTIMEDIA
- MEDICAL INFORMATION SYSTEMS
- COMMUNICATION TECHNOLOGIES

**Presenters:**
- Dave Warner, Medical Neuroscientist (Human Performance Institute, Loma Linda University Medical Center)
- Jeff Sale, Research Physiologist (Department of Physiology, Loma Linda University)

**Organizer:**
Dave Warner (davew@well.sf.ca.us); 909-799-6190 Voice; 909-799-6106 Fax
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Friday

TECHNOLOGY ASSESSMENT: Who Will Pay - And Why?

Welcome & Introduction. Col. Richard M. Satava, M.D.

Moderator: David J. McIntyre, M.D.

8:00

Assessment of Emerging Technology's "Value Added":
The Integrated Cost, Quality, And Access Model
Michael J. Torma, M.D.

8:15

Panel Discussion: Diane S. Millman, J.D., Paul Radensky, M.D., J.D.,
John E. Abele, Steven T. Charles, M.D., Faina Shtern, M.D.,
Melvyn Greberman, M.D., MPH

DATA FUSION: More Than the Sum of the Parts

Moderator: Ralph E. Holmes, M.D.

9:15

Virtual Simulations Through High Performance Computing. Don Stredney

9:25

The Cybermouse Simulator for the Rational Design of Treatment Strategies.
Hans B. Sieburg, Ph.D.

9:45

Neural Networks in Medical Diagnosis. Mark D. Wiederhold, M.D., Ph.D.

10:00

Break & Exhibits

APPLICATIONS: New Visions for New Technologies

Moderator: Glenn M. Preminger, M.D.

10:30

The ARPA Biomedical Technology Program. Col. Richard M. Satava, M.D.

10:40

Telepresence and Telemedicine: Cost-Effective Access to Care.
Joseph M. Rosen, M.D.

10:55

Angio-CAT: Advances in Image-Based Therapy. Harvey Eisenberg, M.D.

11:10

The Virtual Embryo: VR Applications in Human Developmental Anatomy.
Michael D. Doyle, Ph.D.

11:20

Rehabilitation and Disability Solutions. Walter J. Greenleaf, Ph.D.

11:35

Towards the Delivery Room of the Future. John P. Brennan, M.D.

11:45

Surgical Room of the Future: Design and Implementation Project. Kenneth Kaplan

12:00

Hands-On: Haptic Feedback in Surgical Simulation. Beth A. Marcus, Ph.D.

12:15

Virtual Images in the Treatment of Parkinson's Disease Akinesia. Suzanne Weghorst

12:30

Magnetic Source Imaging: Combined Magnetoencephalographic-MRI Imaging of
Human Cortical Function and Dysfunction. Christopher C. Gallen, M.D., Ph.D.
12:45 Discussion

1:00 Lunch & Exhibits

**Friday**

**Surgery**: *Images of the New Paradigm*

**Moderator**: David J. McIntyre, M.D.

2:00 Advanced Imaging Technologies for Endoscopic Surgery. Glenn M. Preminger, M.D.

2:15 Surgical Simulation: Perspective and Future. John Flynn

2:25 Cybersurgery. Adrie C.M. Dumay, Ph.D.

2:35 Ixion's Laparoscopic Surgical Skills Simulator. David Hon

2:50 Virtual Reality in Surgery & Medical Education. Jonathan R. Merril, M.D.

3:05 Choreographed Instrument Movements During Laparoscopic Surgery: Needle Driving, Knot Tying, and Anastomosis Techniques. Zoltan Szabo, Ph.D.

3:15 The Artma Virtual Patient: 3D Monitoring of Endoscopic Surgery. Michael Truppe, M.D.


3:40 Virtual Reality Meets Interventional MRI. Robert B. Lufkin, M.D.

3:50 Real Reality: Being There With Real-Time Open Access MRI. Leon Kaufman, Ph.D.

4:05 Teleneurosurgery: An Approach to Enhance the Dexterity of Neurosurgeons. Karun Shimoga, Ph.D.

4:15 Enhancing Reality in the Operating Room. William E. Lorensen

4:30 The Virtual Clinic: A Virtual Reality Surgical Simulator. Kevin T. McGovern

4:45 VR-OP Theater for Minimally Invasive Techniques. Volker Urban, M.D.

4:55 VR-Neurosurgical Approach Simulation and Strategic Planning System. N.M. Huewel, M.D.

5:10 Discussion

5:30 Reception & Exhibits

**Saturday**

**Education and Training**: *The Best and Highest Use*

**Moderator**: Jack C. Fisher, M.D.

7:45 AM 3DVIEWNX: A Data-, Machine-, and Application-Independent Software System for Multidimensional Image Visualization and Analysis. J.K. Udupa, Ph.D.

7:55 Surgery Simulation with Analyze/AVW: A Visualization Workshop for 3-D Display and Analysis of Multimodality Medical Images. Richard A. Robb, Ph.D.

8:05 Dimensional Visualization-Applications for Healthcare and Education. Jonathan Prince, D.D.S.

8:20 Virtual Reality and the Medical Curriculum: Integrating Extant and Emerging Technologies. Helene M. Hoffman, Ph.D.
8:35  The Visible Human Project.  *Michael J. Ackerman, Ph.D.*

8:55  Discussion

**INTERFACE: Speaking the Same Language**

**Moderator:**  *Helene M. Hoffman, Ph.D.*

9:10  Psychophysical Considerations in the Design of Human/Machine Interfaces for Teleoperators and Virtual Environment Systems.  *Nathaniel I. Durlach*


9:40  **Break & Exhibits**

10:10  The 3rd Hand & Missing Nose: Heterogeneous Anthropomorphic Mapping for VR.  *Col. Richard M. Satava, M.D.*

10:25  There's More to VR Than What You Wear.  *Myron Krueger, Ph.D.*

10:40  DataGlove and DataSuit for Ergonomics, Human Factors, and Physical Medicine & Rehabilitation.  *Walter J. Greenleaf, Ph.D.*

11:00  Towards Virtual Reality of "Tissue Squeezing": A Feasibility Study.  *Narender P. Reddy, Ph.D.*

11:10  A 3-D Medical Data Visualization of Temporal/Spatial Relationships.  *Scott Hassan*

11:20  Visual Programming in Medical Research.  *Alan Barnum-Scrivener*

11:30  Virtual Environment for Eye Surgery Simulation.  *John Pelfer, M.A.*

11:40  Discussion

12:00  **Lunch & Exhibits**

**Saturday**  

**TELEROBOTICS: Reach Out and Touch Something**

**Moderator:**  *Patrick J. Kelly, M.D.*

1:00  The Teleoperated Microsurgical Robot and Associated Virtual Environment.  *Ian Hunter, Ph.D.*

1:15  Remote Robotic Operations at 3000 Miles-Dextrous Telemanipulation With Time-Delay Via Calibrated Virtual Reality Task Display.  *Paul S. Schenker, Ph.D.*

1:25  Telepresence Systems for Application in Minimally Invasive Surgery.  *Elmar H. Holler*

1:35  Dexterity Enhancement in Microsurgery Using Telemicro-Robotics.  *Steven T. Charles, M.D.*

1:55  A Robot for Total Hip Replacement Surgery.  *Bela L. Musits*

2:15  Biocontrollers for Surgical and Rehabilitation Applications.  *Hugh Lusted, Ph.D.*

2:30  Image-Guided Command and Control of a Surgical Robot.  *Janez Funda, Ph.D.*

2:40  Robotically Enhanced Surgery.  *Yulun Wang, Ph.D.*

2:50  Discussion
Saturday

3:00 to 5:30  **SUBMITTED PAPERS**  
(Two simultaneous sessions from which participants may choose)

**SESSION "A"**

**Moderator:**  Hans B. Sieburg, Ph.D.

3:00  A First Approach to Virtual Reality for Hyperthermia Treatment Planning.  
_Gabriele Faulkner, Ph.D._

_Uwe G. Kuehnepfēl, Ph.D._

3:30  Virtual Reality for Improved Control in Endoscopic Surgery.  _Matthias Wepler_

3:45  A Virtual Environment for Laparoscopic Surgical Training.  _R. Bowen Loftin, Ph.D._

4:00  Cost Effective "Virtual" Learning. Applications of CD-I Technology in Healthcare Training.  
_Jiren Parikh_

4:15  The Neurostation: Applications in Minimally Invasive Neurosurgery.  _Kurt R. Smith, D.Sc._

4:30  Integrated Multimodality Visualization in Stereotactic Neurologic Surgery.  _Bruce Kall, M.S._

4:45  Wandering Through the Body: Modern Computer-Assisted Surgery.  
_Donald W. Kormos, Ph.D._

5:00  Transperitoneal Laparoscopic Lumbar Discectomy.  _David W. Cloyd, M.D._

**SESSION "B"**

**Moderator:**  Mark D. Wiederhold, M.D., Ph.D.

3:00  The Effects of Platelet Activating Factor (PAF) on Microvascular Activity in A Real Time System.  
_Lauren Gabelman, M.S._

3:15  VOX-L Medical Navigator: Stereoscopic Interactive Volume Visualization for Medical Data.  
_Joshua Lateiner_

3:30  Integrating Finite Element Analyses into Pre-Operative Surgical Planning and Simulation of Total Joint Replacement Surgery.  _Anthony M. DiGioia III, M.D._

3:45  Computer Assisted Surgical Instrument Control.  _Joseph B. Petelin, M.D._

4:00  The Medical Reality Sculptor.  _Timothy Poston_

4:15  Imaging and Display of Anatomic Movement in Three Dimensions.  _Erik Viirre, M.D., Ph.D._

4:30  Head-Coupled Computer Graphics Display Devices.  _Mark Bolas_

4:45  Tactile Feedback Enhancement to Laparoscopic Tools.  _A. David Johnson, Ph.D._

6:00 PM  Exhibits Close
TELEMEDICINE: The Global Health Community

Moderator: Faina Shtern, M.D.

7:45AM Interactive Technologies in the Clinic: The Real World. Dave Warner

8:00 A Telemedicine Testbed for Developing and Evaluating Telerobotic Tools for Rural Health Care. Michael F. Burrow

8:15 An Alternative to Our Existing Health Care Delivery Systems. Jay H. Sanders, M.D.

8:30 Remote Consultation and Diagnosis Via the Global Medical Informatics Consortium Networks. Ralph Martinez, Ph.D.

8:45 A High-Speed Viewing Console for Diagnostic Radiology. William J. Dallas, Ph.D.

9:00 Access to Quality Cost-Effective Specialty Care: The Canadian Remote Consultative Network. Penny Jennett, Ph.D.

9:15 Perspectives of Virtual Reality as Science and Technology. John D. Hestenes, Ph.D.


9:55 Activities of the European Committee on Standardization in Medical Informatics. Georges J.E. De Moor, M.D.

10:15 Bringing Telematics Into Health Care in the European Communities. Jens P. Christensen, M.S.E., MBA

10:35 SUMMARY PANEL DISCUSSION: Improving Quality, Continuity, and Access to Healthcare While Reducing Cost

Moderator: Col. Richard M. Satava, M.D.

Faina Shtern, M.D., Makoto Nonaka, M.D., Ph.D., Nathaniel I. Durlach, John D. Hestenes, Ph.D., Rudy Mattheus, M.Sc., Melvyn Greberman, M.D., MPH

12:00 Adjourn