COURSE SYLLABUS

MMVR19 NextMed

The 19th
Medicine Meets Virtual Reality Conference

FEBRUARY 9-11, 2012
NEWPORT BEACH MARRIOTT HOTEL & SPA
NEWPORT BEACH, CALIFORNIA

MMVR19 Organizing Committee

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Walter J. Greenleaf PhD
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Dave Warner MD PhD
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Mark D. Wiederhold MD PhD
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ORGANIZER:
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Organizing Committee

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Greenleaf Medical Systems

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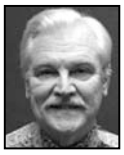
David M. Hananel
SimPORTAL/CREST, University of Minnesota



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Mayo Clinic College of Medicine

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ODA Lab, University of Central Florida

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Ozlem Yardimci PhD
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Praxair, Inc.

Member, Review Committee

Featured Speakers & Panelists

Human: Computer Interface Technology

Ramin Shahidi PhD
Director, California Institute of
Computer-Assisted Surgery

Theodore Berger PhD
Professor of Biomedical Engineering
David Packard Chair of Engineering
Director, Center for Neural Engineering
University of Southern California

Hannes Bleuler PhD
Full Professor of Robotics,
Robotic Systems Laboratory
Institute of Microengineering,
School of Engineering
Ecole Polytechnique Fédérale de Lausanne

Annie Simon PhD
Research Scientist,
Center for Bionic Medicine
Rehabilitation Institute of Chicago

James Weiland PhD
Associate Professor, Ophthalmology and
Biomedical Engineering
Deputy Director, Biomimetic
Microelectronic Systems Engineering
Research Center
University of Southern California

Computer Simulation of Plasma Medical Devices to Meet Future Challenges in Infection Control and Therapy

David Graves PhD
Professor of Chemical and
Biomolecular Engineering,
The Lam Research Distinguished
Professor in Semiconductor Processing
Department of Chemical and
Biomolecular Engineering
University of California, Berkeley

The Simulation Prescription

Richard Boyd
Chief Architect, Virtual World Labs
Director, Emerging/Disruptive Technology
Lockheed Martin Corporation

The Digital Operating Room—Present and Future

Heinz Lemke PhD
Professor of Computer Science,
Technical University of Berlin,
Research Professor of Radiology,
University of Southern California
Strategic Advisor, Innovation Center Computer
Assisted Surgery (ICCAS), University of Leipzig

HumMod, A Multilevel Mathematical of Human Physiology for Medical Training

Robert Hester PhD
Professor, Department of Physiology & Biophysics
Director, Center of Computational Medicine
University of Mississippi Medical Center

The Future of Body Computing

Leslie Saxon MD
Chief, Division of Cardiovascular Medicine
Executive Director, Center for Body Computing
Keck School of Medicine,
University of Southern California

Collaborative Work Practices: Challenges and Opportunities for Designing Healthcare IT Systems

Yunan Chen MD PhD
Assistant Professor, Department of Informatics
Donald Bren School of Information and
Computer Sciences
Institute for Clinical and Translational Science
University of California, Irvine

Exploring the Gaps between Doctors and Engineers

Robert Sweet MD FACS
Associate Professor, Urologic Surgery
Director, SimPORTAL
University of Minnesota Medical School

Timothy Kowalewski MSEE PhC
BioRobotics Lab
Department of Electrical Engineering
University of Washington

David Hananel
Associate Program Director,
SimPORTAL/CREST
University of Minnesota

Rajesh Kumar PhD
Associate Research Professor,
Department of Computer Science
The Johns Hopkins University

MMVR19

Conference Information

Conference Information

Welcome

Welcome to the ***19th MMVR/NextMed conference.*** It is a pleasure to see friends and colleagues again, and to meet those who are here for the first time. In most institutions, budgetary challenges are greater than ever. We, as organizers, are extremely grateful to everyone here for having made the effort to join us.

This year's curriculum offers more than 180 presentations: papers, posters, panels, workshops, and demos. The exhibit hall showcases commercial and academic projects. Lunch will be served in the Exhibit Hall on Thursday—be there!

Be sure to consult the syllabus addendum so you are aware of last-minute changes. Also note the schedule for individual demonstrations. These demos give you an additional opportunity for interaction with researchers, and add a more personal dimension to papers and posters.

Stop by the registration desk and say hello. We enjoy meeting participants and learning about your professional interests, why you are here, and your impressions of the conference.

We also want your stay in Newport Beach to be pleasurable as well as educational. The Fashion Island Mall across the street provides a variety of dining and shopping. There are other amenities within walking distance. If you have questions about the vicinity, please ask us or visit the hotel's concierge desk.

This year, we acknowledge the two decades that have passed since the first MMVR. Take a moment to consider how the field has evolved since 1992—the many successes (and missteps, too), the creativity, vision, and tangible results from uncountable hours of effort that have been shared at MMVR by researchers from around the world.

Mission Statement

MMVR/NextMed is organized to be an educational environment that stimulates communication and collaboration among scientists, engineers, physicians, surgeons, educators, students, military, government, and industry. It supports the development and adoption of advanced medical technologies for medical care and education. Its goal is improved precision, efficiency, and outcomes in patient care, practitioner training, and public health. Its curriculum, by combining rigorous assessment with speculative vision, aims to create forward-thinking solutions to health problems.

Course Objectives

Presentations are chosen to educate participants on:

- Simulation advances that, supported by haptics and modeling, are transforming medical education, procedural training, psychotherapy, rehabilitation, and other areas of healthcare.
- The novel imaging, visualization, and data fusion techniques that are revolutionizing diagnosis and therapy.
- Robotics and sensors that extend the reach of healthcare providers in patient assessment and treatment.
- Intelligence networks that inform provider decision-making and foster a collaborative medical environment.
- Broader goals, accomplishments, and challenges in the development and application of novel devices and methods for medical care and education.

Target Audience

- Physicians, surgeons, and other medical professionals interested in emerging tools for diagnosis and therapy.
- IT and medical device engineers who create state-of-the-art and next-generation simulation, imaging, robotics, and communication systems.
- Data technologists developing systems for gathering, processing, and distributing medical intelligence.
- Military medicine specialists confronting the needs of warfare and domestic public health.
- Biomedical futurists, investors, and policy-makers who need to understand where medicine is headed.
- Educators responsible for training the next generation of physicians and scientists.
- Students who are aiming to create the healthcare of the future.

Acknowledgements

We thank our colleagues on the Organizing Committee for their continued support during this past year. We especially acknowledge those who donated their time and expertise reviewing materials submitted during the Call for Presentations. We also thank the Proceedings editors for their contribution to this enduring record.

We thank all of you who are presenters during this year's program. The research you share is what ultimately makes this conference a worthwhile educational experience.

continued

Poster Judging

Vote for the best poster presentations! Please complete your Thursday and Friday ballots and submit them at the ballot box at the registration desk. Ten winning posters (five each day) will receive a prize.

The Satava Award

The 17th Satava Award will be presented at MMVR19. Established in 1995 to acknowledge the contribution of Richard M. Satava MD FACS, the award is presented to an individual or research group demonstrating unique vision and commitment to the improvement of medicine through advanced technology. Its prior recipients are:

Kirby Vosburgh PhD (2011)
Helene Hoffman PhD (2009)
Alan Liu PhD & Mark Bowyer MD (2008)
Naoki Suzuki PhD (2007)
Nigel John PhD (2006)
Brenda Wiederhold PhD MBA(2005)
Steven Dawson MD (2004)
Richard Robb PhD (2003)
SUMMIT, Stanford University (2002)
HIT Lab, University of Washington (2001)
Dave Warner MD PhD (2000)
Faina Shtern MD (1999)
Gerhard Buess MD (1998)
Henry Fuchs PhD (1997)
Victor Spitzer PhD & Michael Ackerman PhD (1996)
Richard Satava MD FACS (1995)

Evaluation

We welcome the input of all conference participants. Please take a few minutes to write down your reactions to this year's MMVR. Your feedback—negative and positive—will help us create the next MMVR.

Disclaimer

The information provided at this conference is intended for general medical education purposes only. All physicians should fully investigate any new product or device before implementing it in their practice. In no event will the conference organizer, Aligned Management Associates, Inc., assume responsibility for any decision made or action taken as a result of the information provided through this activity.

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MMVR19

Presentation Schedule

Presentation Schedule

THURSDAY, February 9

THURSDAY MORNING

Poster Session

7:00 - 8:30 During the dedicated poster session, presenters stand with their posters and explain their research to other attendees, while everyone enjoys continental breakfast. Posters remain up all day for browsing.

THURSDAY MORNING

Plenary Session

8:30 Karen S. Morgan & James D. Westwood
Aligned Management Associates, Inc.
Welcome

8:45 Panel

Human: Computer Interface Technology

Chair: Ramin Shahidi
California Inst of Computer-Assisted Surgery

Panelists: Theodore Berger
Ctr for Neural Engineering, Univ of Southern California

Hannes Bleuler
Robotic Systems Lab, EPFL

Annie Simon
Ctr for Bionic Medicine, Rehabilitation Inst of Chicago

James Weiland
Bioelectronic Research Lab; Univ of Southern California

10:15 Break—Exhibit Hall opens

Moderator: Richard Satava

11:00 David Graves 41
Chemical & Biomolecular Engineering, Univ of California, Berkeley
Computer Simulation of Plasma Medical Devices to Meet Future Challenges in Infection Control and Therapy

11:30 Richard Boyd 41
Virtual World Labs, Lockheed Martin
The Simulation Prescription

12:00 Break: Lunch in Exhibit Hall

THURSDAY AFTERNOON

Track A

Moderator: Thomas Sangild Sørensen

1:35 Moderator's Welcome

Modeling

1:45 Rui Hu 41
Dept of Electrical and Computer Engineering, Univ of Delaware
A Non-Photorealistic Surgery Simulation System

2:00 Vinay Menon 41
VIRMED Simulation Technology Inc.
Simulation of a Human Circulatory System

2:15 Juan Antonio Solves Llorens 41
Lab Human, I3BH, Univ Politécnica de Valencia
A Study about Coefficients to Estimate the Error in Biomechanical Models used to Virtually Simulate the Organ Behaviors

2:30 Anand Santhanam 42
Dept of Radiation Oncology, Univ of California, Los Angeles
Computational Fluid Dynamics Modeling of Airflow inside Lungs Using Heterogenous Anisotropic Lung Tissue Elastic Properties

2:45 Hoeryong Jung 42
Dept of Mechanical Engineering, KAIST
Real-Time Simulation of Interaction between Colon and Endoscope for the Colonoscopy

3:00 Farzam Farahmand 42
Sch of Mechanical Engineering, Sharif Univ of Technology
A Meshless EFG-Based Algorithm for 3D Deformable Modeling of Soft Tissues in Real-Time

3:15 Aurélien Deram 42
TIMC-IMAG / CNRS, UJF-Grenoble 1
Towards a Generic Framework for Evaluation and Comparison of Soft Tissue Modeling

3:30 Discussion

3:45 Break

Moderator: Steven Senger

Haptics

4:00 Rui Hu 42
Dept of Electrical and Computer Engineering, Univ of Delaware
An Accelerated Haptic Feedback Algorithm Utilizing Volume Reconstruction

4:15 Andre Mastmeyer 43
Inst of Med Informatics, Univ of Lübeck
Direct Haptic Volume Rendering in Lumbar Puncture Simulation

4:30 Ilana Nisky 43
Biomed Engineering Dept, Ben-Gurion Univ of the Negev
Perception of Stiffness in Laparoscopy - the Fulcrum Effect

4:45 Alexei Sourin 43
Sch of Computer Engineering, Nanyang Technological Univ
Haptic Editing of MRI Brain Data

5:00 Joseph Singapogu 43
Haptic Interaction Lab, Clemson Univ
Assessing Surgeon and Novice Force Skill on a Haptic Stiffness Simulator for Laparoscopic Surgery

5:15 Discussion

5:30 Adjourn

THURSDAY AFTERNOON

Track B

Moderator: Cali Fidopiastis

1:35 Moderator's Welcome

Physical & Mental Health Applications

1:45 Giuseppe Riva 43
Applied Technology for Neuro-Psychology Lab, Istituto Auxologico Italiano; Catholic Univ of Milan
The Effects of a Mobile Stress Management Protocol on Nurses Working with Cancer Patients: A Controlled Study

2:00 Thomas Parsons 43
Inst for Creative Technologies, Univ of Southern California
Virtual Reality Paced Serial Assessment Test for Neuropsychological Assessment of a Military Cohort

2:15 Roger Xu 44
Signal Pro cessing & Control, Intelligent Automation, Inc.
A Voice-Based Automated System for PTSD Screening and Monitoring

2:30 Albert "Skip" Rizzo 44
Inst for Creative Technologies, Univ of Southern California
STRIVE: Stress Resilience In Virtual Environments: A Pre-Deployment VR System for Training Emotional Coping Skills and Assessing Chronic and Acute Stress

2:45 Riccardo Secoli 44
Dept Mechanical and Aerospace Engingeering, Univ of California, Irvine
Using a Smart Wheelchair as a Gaming Device for Floor-Projected Games: A Mixed Reality Environment for Training Powered Wheelchair Driving Skills

3:00 Bonnie Kennedy 45
Blue Marble Rehab, Inc.
Expanding the Scope of Design and Quality Assurance in the Context of Serious Games for Rehabilitation

3:15 Discussion

3:30 Break

3:45 Workshop 33

Avatar Based Recovery Platform: New Directions in the Treatment of Chemical Dependency

(Independently Organized Adjunct Activity)

Chair: Ivana Steigman
Thrive Research, Inc.

Presentations:

Ivana Steigman
Thrive Research, Inc.
Avatar Based Recovery: An Overview

Walter Greenleaf
Thrive Research, Inc.
Use of On-Line Interactive Virtual Environments (OLIVE) in Healthcare and Psychological Services

David S. Molina
Janus of Santa Cruz; Thrive Research, Inc.

Implementing New Technologies for Treatment in a Community Clinic

Albert Garcia-Romeu
Thrive Research, Inc.

Avatar Based Recovery in the Treatment of Opiate Addiction: A Pilot Study

5:45 Adjourn

THURSDAY AFTERNOON

Track C

1:35 Panel 33

Technical and Organizational Requirements for the Implementation of Adaptive Learning: A Case Study In Collaboration

(Independently Organized Adjunct Activity)

Chair: Todd Graham
Accella Learning Company, LLC

Additional Presenters:

Bryan Bergeron
Accella Learning Company, LLC; Massachusetts Inst of Technology

Andrew H. Cline
School of Medicine, Univ of Louisville; National Ctr for Biomedical Research and Training, Louisiana State Univ

Ross E. Dworkin
Accella Learning Company, LLC; Blue Grotto Technologies, Inc.

3:15 Break

3:30 Workshop 34

Using Technology to Assess Simulation Performance of Active Participants, Transform Passive Observers into Activated Learners

(Independently Organized Adjunct Activity)

Organizers:

Susan Eller
Simulation Technology and Immersive Learning, Feinberg Sch of Medicine, Northwestern Univ

Paul Pribaz
Simulation Technology and Immersive Learning, Feinberg Sch of Medicine, Northwestern Univ

5:30 Adjourn

THURSDAY POSTERS

Simulation Design & Development

Calvin Kwan 45
Dept of Surgery, Northwestern Univ, Feinberg Sch of Medicine

Moving Past Normal Force: Capturing and Classifying Shear Motion Using 3D Sensors

Peder Pedersen 45
Dept of Electrical and Computer Engineering, Worcester Polytechnic Inst

Personal Low-Cost Ultrasound Training System

John Qualter 45
Div of Educational Informatics, New York Univ Sch of Medicine

The Biodigital Human: A Web-Based 3D Platform for Medical Visualization and Education

Joseph Samosky 45
Simulation and Med Technology Research and Development Ctr, Sch of Medicine & Swanson Sch of Engineering, Univ of Pittsburgh

A Novel Automated Drug Simulant Recognition System for Naturalistic Real-Time Medical Simulation

Jörg Wulf 45
3B Scientific GmbH

Three-Dimensional Micro-Imaging (µCT) Based Physical Anatomic Teaching Models: Implementation of a New Learning Aid for Routine Use in Anatomy Lectures

Ayano Kikuchi 46
Graduate Sch of Engineering, Chiba Univ

Development of a VR-Based Injection Training System using a Standardized Patient

Felix Hamza-Lup 46
Computer Science and Information Technology, Armstrong Atlantic State Univ

Haptic Simulator for Liver Diagnostics through Palpation

Vikram Nandhan 46
Ctr for Simulation Technology and Immersive Learning, Northwestern Univ

The Use of Pressure Sensors in an Aesthetic Dermoscopy Simulator to Improve the Diagnosis of Cancerous Skin Lesions

Modeling

Ganesh Sankaranarayanan 46
Mechanical Aerospace and Nuclear Engineering, Rensselaer Polytechnic Inst

A Simulation Framework for Tool Tissue Interactions in Robotic Surgery

Pierre-Frederic Villard 46
LORIA, Nancy Univ

A Method to Compute Respiration Parameters for Patient-based Simulators

Alexander Herzog..... 46
Dept of Mechanical, Aerospace and Nuclear Engineering , Rensselaer Polytechnic Inst

Model Order Reduction of Neural Connectivity for Computationally Feasible Whole Brain Modeling

Learning & Metrics

Ross Dworkin 47
Blue Grotto Technologies, Inc.

The Application of Technology for the Creation of "Retention Profiles" for Use in Adaptive Learning and the Delivery of Remedial Material

Calvin Kwan 47
Dept of Surgery, Northwestern Univ, Feinberg Sch of Medicine

Introducing Simulation Technology to New Faculty: Do Not Let Them Play

Nathan Delson..... 47
Dept of Mechanical and Aerospace Engineering, Univ of California, San Diego

Expert vs. Novice Endpoint Angle and Motion in a Laryngscopy Simulator

Simulator Validation

Lawrence Salud 47
Dept of Surgery, Northwestern Univ, Feinberg Sch of Medicine

Modification of Commercially Available Simulators to Elicit Decision Making Behavior

David Rojas 47
SickKids Learning Inst, SickKids Hospital

An Online Practice and Educational Networking System for Technical Skills: Learning Experience in Expert Facilitated vs. Independent Learning Communities

Johan Creutzfeldt..... 48
CLINTEC and Ctr for Advanced Med Simulation and Training, Karolinska Inst and Karolinska Univ Hospital

Behavioural Ratings in Cardiopulmonary Resuscitation after Multiplayer Virtual World and Scenario Based Full Scale Simulator Training

Psychological Health

Andrea Gaggioli 48
Dept of Psychology, Catholic Univ of Milan

An Open Source Mobile Platform for Psychophysiological Self Tracking

Andrea Gaggioli 48
Dept of Psychology, Catholic Univ of Milan

EEG Alpha Asymmetry in Virtual Environments for the Assessment of Stress-Related Disorders

Giovanni Albani 48
Dept of Neurosciences, Ist Auxologico Italiano - Piancavallo-Verbania

Virtual Help for Real Surgery: The Case of Awake Surgery

Giuseppe Riva 48
Applied Technology for Neuro-Psychology Lab, Istituto Auxologico Italiano; Catholic Univ of Milan

Learning Island: The Development of a Virtual Reality System for the Experiential Training of Stress Management

Raphael Rose..... 48
Dept of Psychology, Univ of California, Los Angeles

Characteristics of a Sample of Graduate Students Interested in Self-Guided, Multimedia, Computer-based Stress Management and Resilience Training

Tomislav Zbozinek 48
Dept of Psychology, Univ of California, Los Angeles

Usefulness and Usability of a Self-Guided, Multimedia, Computer-Based Stress Management And Resilience Training Program

José Mosso Vázquez..... 49
Univ Panamericana; Hospital General y Regional No. 25, IMSS; Clínica Pisanty, ISSSTE

3 Virtual Scenarios in 3D for Obesity Treatment in Mexico

Physical Rehabilitation

Stepan Obdrzalek 49
Dept of Electrical Engineering and Computer Science, Univ of California, Berkeley

Real-Time Human Pose Detection and Tracking for Tele-Rehabilitation in Virtual Reality

Timothy Judkins 49
Robotics & ElectroMechanical Systems, Intelligent Automation, Inc.

Development of a Virtual Therapist for Exercise Motivation for Smart Phones

Alvaro Uribe Quevedo 49
Integrated Automation and Robotics Lab, Mechanical Design Dept, Faculty of Mechanical Engineering, Univ of Campinas, Brazil

3DUI Assisted Lower and Upper Member Therapy

Sensors

Robert Tan 49
Dept of Bioengineering, Univ of California, Los Angeles

Conductometric Catheter-Mounted Pressure Sensor

Plasma Medicine

Magesh Thiyagarajan..... 49
Plasma Engineering Research Lab, Texas A&M Univ - Corpus Christi

THP-1 Leukemia Cancer Treatment Using a Portable Plasma Device

Magesh Thiyagarajan..... 50
Plasma Engineering Research Lab, Texas A&M Univ - Corpus Christi

Portable Plasma Medical Device for Infection Treatment

University of Nebraska Research Projects (Group One)

Mary Bernhagen 50
Dept Anesthesiology, Univ of Nebraska Med Ctr

Telementoring for Airway Management Between a Far Forward Special Operations Location to a Major Medical Center Using Inexpensive Telemedicine Solutions

Ben Boedeker 50
Dept Anesthesiology, Univ of Nebraska Med Ctr

Virtual Intubation Training at a Remote Military Site

David Boedeker 50
Univ of Nebraska Omaha

Development of Medical Engagement Training Toolkits to Support Special Operations Military Assistance Programs in Austere Environments

Nikola Miljkovic..... 50
Univ of Nebraska Med Ctr; Research Service, Omaha VA Med Ctr

Use of a Cardiac Algorithm in a Preoperative Evaluation Clinic-A Pilot Study

Thomas Nicholas 51
Dept Anesthesiology, Univ of Nebraska Med Ctr

Performance Comparison of Laryngoscopy and Suction Techniques in a Hemorrhagic Airway Manikin Simulator: Direct Laryngoscopy with Yankauer vs Storz CMAC with Attached Suction Tip

Steven Schmidt 51
Dept Emergency Medicine, Univ of Nebraska Med Ctr

A Comparison of an Integrated Suction Blade versus a Traditional Videolaryngoscope Blade in the Endotracheal Intubation of a Hemorrhagic Cadaver Model – A Pilot Study

FRIDAY, February 10

FRIDAY MORNING

Poster Session

7:00 - 8:30 During the dedicated poster session, presenters stand with their posters and explain their research to other attendees, while everyone enjoys continental breakfast. Posters remain up all day for browsing.

FRIDAY MORNING

Plenary Session

Moderator: Henry Fuchs

8:30 Moderator's Welcome

8:40 Heinz Lemke 52
Inst for Technical Informatics, Technical Univ Berlin
The Digital Operating Room—Present and Future

9:00 Robert Hester 52
Dept of Physiology & Biophysics, Univ of Mississippi Medical Ctr
HumMod, A Multilevel Mathematical of Human Physiology for Medical Training

9:30 Leslie Saxon 52
Keck School of Medicine; Univ of Southern California
The Future of Body Computing

10:00 Break

Moderator: Robert Sweet

10:20 Yunan Chen 52
Donald Bren Sch of Information and Computer Sciences & Inst for Clinical and Translational Science, Univ of California, Irvine
Collaborative Work Practices: Challenges and Opportunities for Designing Healthcare IT Systems

10:50 Panel

Exploring the Gaps between Doctors and Engineers

Chairs: Robert Sweet
Urologic Surgery, Univ of Minnesota Medical Sch

Timothy Kowalewski
BioRobotics Lab, Univ of Washington

Additional Panelists:

David Hananel
SimPORTAL/CREST, Univ of Minnesota

Rajesh Kumar
Dept of Computer Science, The Johns Hopkins Univ

11:50 **Presentation of the 17th Satava Award**

12:10 Break (Lunch on your own)

FRIDAY AFTERNOON

Track A

Moderator: Carla Pugh

1:35 Moderator's Welcome

Simulation – Design & Development

1:45 W. LeRoy Heinrichs 53
Innovation in Learning, Inc.
SBAR 'Flattens the Hierarchy' Among Caregivers

2:00 Bryan Bergeron 53
Accella Learning Company
Distributed Adaptive Simulation Through Standards-Based Integration of Simulators and Adaptive Learning Systems

2:15 Woojin Ahn 53
Ctr for Modeling, Simulation and Imaging in Medicine, Rensselaer Polytechnic Inst
A Framework for Web Browser-Based Medical Simulation Using WebGL

2:30 Lawrence Salud 53
Dept of Surgery, Northwestern Univ, Feinberg Sch of Medicine
Clinical Examination Simulation: Getting to Real

2:45 Joseph Samosky 53
Simulation and Med Technology Research and Development Ctr, Sch of Medicine & Swanson Sch of Engineering, Univ of Pittsburgh
BodyWindows: Enhancing a Mannequin with Projective Augmented Reality for Exploring Anatomy, Physiology and Medical Procedures

3:00 Jason Kutarnia 53
Electrical and Computer Engineering, Worcester Polytechnic Inst
Generation of 3D Ultrasound Training Volumes from Freehand Acquired Data

3:15 Discussion

3:30 Break

Moderator: Li Felländer-Tsai

3:45 Bill Kapralos 54
Faculty of Business and Information Technology, Univ of Ontario Inst of Technology
Developing Effective Serious Games: The Effect of Background Sound on Visual Fidelity Perception with Varying Texture Resolution

4:00 Don Stredney 54
Biomed Applications, OSC
Virtual Simulation of Mouse Anatomy and Procedural Techniques

4:15 Diego Rivera-Gutierrez 54
Dept of Computer & Information Science & Engineering, Univ of Florida
Shader Lamps Virtual Patients: the Physical Manifestation of Virtual Patients

4:30 Betty Mohler 54
Max Planck Inst for Biological Cybernetics
Enhancing Medical Communication Training Using Motion Capture, Perspective Taking and Virtual Reality

4:45 Yunhe Shen 54
Ctr for Research in Education and Simulation Technologies (CREST), Med Sch Simulation Program, Univ of Minnesota
Virtual Trainer for Intra-Detrusor Injection of Botulinum Toxin to Treat Urinary Incontinence

5:00 Tansel Halic 55
Dept of Mechanical, Aerospace and Nuclear Engineering, Rensselaer Polytechnic Inst
A Resource Management Tool for Real-Time Multimodal Surgical Simulation

5:15 Florian Beier 55
Inst for Computational Medicine, Univ of Heidelberg
An Aneurysm Clipping Training Module for the Neurosurgical Training Simulator NeuroSim

5:30 Discussion

5:45 Adjourn

FRIDAY AFTERNOON

Track B

Moderator: Pierre Jannin

1:35 Moderator's Welcome

Imaging, Visualization & Navigation

1:45 Cristian Linte 55
Biomed Imaging Resource, Mayo Clinic
Augmented Environments for Minimally Invasive Therapy: Implementation Barriers from Technology to Practice

2:00 Jannick Rolland 55
Inst of Optics, Univ of Rochester
Virtual Skin Biopsy with Gabor Domain Optical Coherence Microscopy

2:15 Naoki Suzuki 55
Inst for High Dimensional Med Imaging, The Jikei Univ Sch of Medicine
System Development for Unrestrictive View and 4D Shape Acquisition in Abdominal Cavity Operation using Virtual Space

2:30 Juan Antonio Solves Llorens 56
Lab Human, I3BH, Univ Politécnica de Valencia
MRI Skin Segmentation for the Virtual Deformation of the Breast under Mammographic Compression

2:45 David Bouget 56
INSERM / INRIA / CNRS, Univ Rennes 1, Unité/Projet VisAGeS U746
Surgical Tools Recognition and Pupil Segmentation for Cataract Surgical Process Modeling

3:00 Sean Chen 56
BioMed Engineering, McGill Univ
Augmented Reality Visualization for Guidance in Neurovascular Surgery

3:15 Discussion

3:30 Break

Moderator: Jannick Rolland

3:45 Sushravya Raghunath 56
Mayo Clinic College of Medicine
Detail-on-Demand Visualization for Lean Understanding of Lung Abnormalities

Robotics

4:00 Pietro Valdastri 56
STORM Lab, Vanderbilt Univ
A Novel Surgical Robotic Platform based on Trans-Abdominal Active Magnetic Links

4:15 Tim Beyl 57
Inst for Process Control and Robotics, Karlsruhe Inst of Technology
Haptic Feedback in OP:Sense - Augmented Reality in Telemanipulated Robotic Surgery

Diagnostic & Therapeutic Tools

4:30 Shyam Natarajan 57
Dept of Bioengineering, Univ of California, Los Angeles
A Transurethral Catheter-based Ultrasound System for Multi-Modal Fusion

4:45 Qian Zhao 57
Dept of Electronic Engineering, Chinese Univ of Hong Kong; The Johns Hopkins Univ
A Decision Fusion Strategy for Polyp Detection in Capsule Endoscopy

5:00 Evin Gultepe 57
Dept of Chemical and Biomolecular Engineering, Chemistry; Inst for Nanobiotechnology, The Johns Hopkins Univ
Thermo-Responsive, Tetherless Microsurgical Tools

5:15 Amit Mulgaonkar 57
Ctr for Advanced Surgical and Interventional Technology (CASIT) & Dept of Biomed Engineering, Univ of California, Los Angeles
A Prototype Stimulator System for Noninvasive Low Intensity Focused Ultrasound Delivery

5:30 Discussion

5:45 Adjourn

FRIDAY AFTERNOON

Track C

1:35 Focus Session & Panels 35

Analysis of Honest Signals for Psychological Health Assessment

(Independently Organized Adjunct Activity)

Chairs: Russell Shilling
DARPA

Albert "Skip" Rizzo
Inst for Creative Technologies, Univ of Southern California

Presentations:

Russell Shilling
DARPA
Introduction to Detection and Computational Analysis of Psychological Signals

Albert "Skip" Rizzo
Inst for Creative Technologies, Univ of Southern California
Telemedical and Online Intelligent Virtual Human Guided Healthcare Support Leveraging User State Sensing

Louis-Philippe Morency
Inst for Creative Technologies, Univ of Southern California
Multimodal Perception and Learning

Alex "Sandy" Pentland
Massachusetts Inst of Technology
Honest Signals

Rohit Prasad
Raytheon BBN Technologies
Text and Voice Analytics for Psychological Distress Detection

Roy Stripling
CRESST, Univ of California, Los Angeles
Evaluation and Assessment of DCAPS Systems

Discussion & Demos

5:30 Adjourn

FRIDAY POSTERS

(A dedicated poster discussion session will be held prior to the morning plenary session.)

Imaging, Visualization & Navigation

Jay Carlson 58
Dept of Electrical Engineering, Univ of Nebraska - Lincoln
A Compact High-Definition Low-Cost Digital Stereoscopic Video Camera for Rapid Robotic Surgery Development

Ali Soroush 58
Sch of Mechanical Engineering, Sharif Univ of Technology
Design and Implementation of an Improved Real-Time Tracking System for Navigation Surgery Using the Fusion of Optical and Inertial Tracking Methods

Karl Krissian 58
Dept of Computer Science, Univ de Las Palmas de Gran Canaria
AMILab Software: Medical Image Analysis, Processing and Visualization

Oliver Burgert 58
Reutlingen Univ
Multi-Dimensional Presentation State - Towards a DICOM Mechanism for Consistent Presentation of Higher Dimensional Medical Imaging Data

Andoni Beristain 58
Vicomtech-IK4
Volume Visual Attention Maps (VVAM) in Ray-Casting Rendering

Anderson Maciel 58
Inst de Informática, Univ Federal do Rio Grande do Sul
Anatomic Hepatectomy Planning through Mobile Display Visualization and Interaction

Karl-Hans Englmeier 59
Inst for Biological and Med Imaging (IBMI), Helmholtz Zentrum Munich
A New Heterogeneity Analysis Method for Comparison of DCE-MRI Time Curves in Breast Tumors for Therapy Monitoring

Mathias Hofer 59
Univ Leipzig
Potential of the Navigated Controlled Surgery at the Lateral Skull Base with the Navigated Control Unit (NCU 2.0)

Constantinos Loukas 59
Med Physics Lab-Simulation Ctr, Sch of Medicine, Univ of Athens
Visual Tracking of Laparoscopic Instruments in a Hough Space

Surgical Simulation – Design & Development

Sergei Kurenov 59
Dept of Surgical Oncology, Roswell Park Cancer Inst
Enhanced Tissue Interaction For Robotic Surgery Simulation

Lauren Davis 59
Simulation Technology & Immersive Learning, Northwestern Univ Feinberg Sch of Medicine
Computer Aided Design as a Tool for Development of a Neonatal Chest Tube Simulator

Asaki Hattori 59
Inst for High Dimensional Med Imaging, The Jikei Univ Sch of Medicine
Training System for NOTES and SPS Surgery Robot that Enables Spatiotemporal Retrospective Analysis of the Training Process

Oliver Schuppe 60
Inst for Computational Medicine, Univ of Heidelberg
An Optical Tracking System for a Microsurgical Training Simulator

Magnus Eriksson 60
Sch of Technology and Health, KTH Royal Inst of Technology
A 6 Degrees-of-Freedom Haptic Milling Simulator for Surgical Training of Vertebral Operations

Aaron Oliker 60
BioDigital Systems; NYU Sch of Medicine
Step-Based Cognitive Virtual Surgery Simulation: An Innovative Approach to Surgical Education

Vishal Patel 60
Dept of Surgery and Cancer, Imperial College London
Multi-User Trauma Patient Scenario in Virtual Worlds

Vishal Patel 60
Dept of Surgery and Cancer, Imperial College London
Virtual Worlds are an Innovative Tool for Medical Device Training in a Simulated Environment

Vishal Patel 60
Dept of Surgery and Cancer, Imperial College London

The Application of an Interactive Virtual World Simulation for Evaluation of the Handoff Process in Healthcare

Ganesh Sankaranarayanan 60
Mechanical Aerospace and Nuclear Engineering, Rensselaer Polytechnic Inst

ToolTrackTM: A Compact, Low-Cost System for Measuring Surgical Tool Motion

Ganesh Sankaranarayanan 60
Mechanical Aerospace and Nuclear Engineering, Rensselaer Polytechnic Inst

Use of a Linear Motion Stroke Potentiometer as a High Precision Sensor for Linear Translation in a Laparoscopic Ligating Loop Simulation

Surgical Simulation Metrics

Chun-Kai Huang 61
Univ of Nebraska Med Ctr

Investigating the Muscle Activities of Performing Surgical Training Tasks Using a Virtual Simulator

Marie-Eve LeBel 61
Div of Orthopaedic Surgery, Dept of Surgery, Univ of Western Ontario

Creating a Representative Map for Arthroscopy Simulation

Arun Nemani 61
Ctr for Modeling, Simulation and Imaging in Medicine, Rensselaer Polytechnic Inst

Automated Real Time Peg and Tool Detection for the FLS Trainer Box

Anna Skinner 61
AnthroTronix Inc.

Assessment of Laparoscopic Surgical Skill Acquisition and Retention

Surgical Simulator Validation

Jeffrey Cheung 61
SickKids Learning Inst, SickKids Hospital

Evaluation of Tensiometric Assessment as a Measure of Skill Degradation

Joseph Singapogu 61
Haptic Interaction Lab, Clemson Univ

Haptic Tasks for Physical Laparoscopic ("Box") Trainers to Differentiate Surgeon Skill

John Qualter 62
Div of Educational Informatics, New York Univ Sch of Medicine

Integration of Surgical Simulation in Plastic Surgery Residency Training

Haptics

Hannes Bleuler 62
Robotic Systems Lab (LSRO), EPFL

Haptic Handles for Robotic Surgery

Liliane dos Santos Machado 62
Dept of Informatics, Univ Federal da Paraiba

An Experimental Study on CHVE's Performance Evaluation

Timothy Judkins 62
Robotics & ElectroMechanical Systems, Intelligent Automation, Inc.

Development of the KineSys MedSim: A Novel Hands-Free Haptic Robot for Medical Simulation

Robotics

Omid Motlagh 62
Mechanical and Manufacturing Engineering, Univ Putra Malaysia

Evaluation of Robot Motion Control Algorithms for Service Robots

Omid Motlagh 62
Mechanical and Manufacturing Engineering, Univ Putra Malaysia

A Navigation Algorithm for Service Robots in Cluttered Environments

Farzam Farahmand 63
Sch of Mechanical Engineering, Sharif Univ of Technology

Design of a 4 DOF Laparoscopic Surgery Robot for Manipulation of Large Organs

Sergei Kurenov 63
Dept of Surgical Oncology, Roswell Park Cancer Inst

A Simple Master-Slave Control Mapping Setup to Learn Robot-Assisted Surgery Manipulation

Tamás Haidegger 63
Dept of Control Engineering and IT, Budapest Univ of Technology and Economics

Technology Supporting Hand Hygiene Control—Heritage of Semmelweis

Intelligence Networking

José Mosso Vázquez..... 63
Univ Panamericana; Hospital General y Regional No. 25, IMSS; Clínica Pisanty, ISSSTE

iPhone G3 for Telemedicine in Emergency Surgery — Report of 46 cases at the HGR No. 25 of the IMSS

Cory Leeson..... 63
Simulation and Med Technology R&D Ctr & Dept of Bioengineering, Univ of Pittsburgh

PleurAlert: An Augmented Chest Drainage System with Electronic Sensing, Automated Alerts and Internet Connectivity

University of Nebraska Research Projects (Group Two)

Mary Bernhagen..... 63
Dept Anesthesiology, Univ of Nebraska Med Ctr

Using the Battlefield Telemedicine System (BTS) to Train Deployed Medical Personnel in Complicated Medical Tasks – A Proof of Concept

Ben Boedeker..... 64
Dept Anesthesiology, Univ of Nebraska Med Ctr

User Preference Comparing a Conventional Videolaryngoscope Blade vs. a Novel Suction Videolaryngoscope Blade in Simulated Hemorrhagic Airway Intubation

Gail Kuper..... 64
Dept Anesthesiology, Univ of Nebraska Med Ctr

Utilization of a Civilian Academic Center as Force Multiplier in Support of NATO Special Operations Medicine – A Pilot Demonstration

Nikola Miljkovic..... 64
Univ of Nebraska Med Ctr; Research Service, Omaha VA Med Ctr

Use of a Malleable Bougie and Curved Forceps with Videolaryngoscopy in Airway Management Training in a Cadaver Model– A Pilot Study

Jeffrey Morgan..... 64
Womack Army Med Ctr

Tele-Orthopaedics: United States Army European Regional Medical Command

Thomas Nicholas..... 64
Dept Anesthesiology, Univ of Nebraska Med Ctr

Nasotracheal Intubation in a Difficult Airway using the Storz C-MAC Videolaryngoscope, the Boedeker Bougie Endotracheal Introducer, and the Boedeker Curved Forceps

SATURDAY, February 11

7:30 Continental Breakfast

SATURDAY MORNING

Track A

Moderator: Patrick Cregan

8:25 Moderator's Welcome

Simulation Validation

8:30 Allen Andrade 65
Lab of E-Learning and Multimedia Research & Geriatric Research, Education, and Clinical Ctr (GRECC), Bruce W. Carter VA Med Ctr; Univ of Miami Miller Sch of Medicine

Using Anthropomorphic Avatars Resembling Sedentary Older Individuals as Models to Enhance Self-Efficacy and Adherence to Physical Activity: Psychophysiological Correlates

8:45 Stefan Marks 65
Sch of Computing & Mathematical Sciences, Auckland Univ of Technology, New Zealand

Design and Evaluation of a Medical Teamwork Training Simulator using Consumer-Level Equipment

9:00 Sandrine de Ribaupierre 65
Corps for Research in Instructional and Perceptual Technologies (CRIPT), Schulich Sch of Medicine and Dentistry, Univ of Western Ontario

Evaluation of Neuroanatomical Training Using a 3D Visual Reality Model

9:15 Li Felländer-Tsai 65
CLINTEC, Karolinska Inst

Training Diagnosis and Treatment of Cervical Spine Trauma Using a New Educational Program for Visualization through Imaging and Simulation (VIS): A First Evaluation by Medical Students

9:30 Allen Andrade 66
Lab of E-Learning and Multimedia Research & Geriatric Research, Education, and Clinical Ctr (GRECC), Bruce W. Carter VA Med Ctr; Univ of Miami Miller Sch of Medicine

Medical Students' Attitudes toward Obese Patient Avatars of Different Skin Color

9:45 Discussion

10:00 Break

Moderator: David Hananel

Surgical Metrics

10:15 Camille Williams 66
Wilson Centre & Grad Dept of Rehab Science, Univ of Toronto

The Benefits of Fundamentals of Laparoscopic Surgery (FLS) Training on Simulated Arthroscopy Performance

10:30 Daniel Bailey 66
Univ of Illinois at Chicago

Concurrent and Face Validity of a Capsulorhexis Simulation with Respect to Human Patients

10:45 Gregory Wiet 66
Nationwide Children's Hospital

Translating Surgical Metrics into Automated Assessments

Surgical Simulator Validation

11:00 Kristen Pitzul 66
Div of General Surgery, Univ Health Network

Validation of Three Virtual Reality Fundamentals of Laparoscopic Surgery (FLS) Modules

11:15 Marie-Eve LeBel 67
Div of Orthopaedic Surgery, Dept of Surgery, Univ of Western Ontario

Force Sensing-Based Simulator for Arthroscopic Skills Assessment in Orthopaedic Knee Surgery

11:30 Discussion

11:45 Adjourn

SATURDAY MORNING

Track B

8:30 Focus Session 36

Wearable Augmented Reality for Medical First Response & Situational Awareness

(Independently Organized Adjunct Activity)

Chairs: Jayfus T. Doswell
Juxtopia LLC

Kenneth Wilson
Trauma Surgery, Morehouse Sch of Medicine

Peter Kazanzides (invited)
Ctr for Computer Integrated Surgical Systems & Technology (CISST), The Johns Hopkins Univ

Diane Adams
Health Informatics Information Technology (HIIT), American Public Health Assoc (APHA)

Presentations:

Maia Anderson
Sch of Nursing, Sojourner Douglass College

Wearable Augmented Reality for Emergency Public Health Care Response

Corey Dicken
Dept of Electrical Engineering, Morgan State Univ

Ruggedized Subsystems for Wearable Augmented Reality for use in Casualty Care Settings

Jayfus T. Doswell
Juxtopia LLC

Context-Aware Augmented Reality System Architecture for Medical First Response and Situational Awareness

Peter Kazanzides (invited)
Ctr for Computer Integrated Surgical Systems and Technology (CISST), The Johns Hopkins Univ

Wearable Augmented Reality for Surgical Navigation and Situational Awareness

Manohar Mareboyana
Dept of Computer Science, Bowie State Univ

Object Recognition for Wearable Augmented Reality During Casualty Care

Gail Nicholson (invited)
Naval Warfare Center

Usability and Human Factors in Wearable Augmented Reality Systems

Sachin Shetty
Electrical & Computer Engineering, Tennessee State Univ

Advanced Embedded Computer System for the Wearable AR HMD

Sharad Sharma
Dept of Computer Science, Bowie State Univ

WARN: Wearable Augmented Reality Note for Casualty Care Documentation

Jamal Uddin
Dept of Chemistry, Coppin State Univ

NanoPower: Nanotechnology Power for Wearable Augmented Reality During Long Incident Operations

Kenneth Wilson
Trauma Surgery, Morehouse Sch of Medicine

Wearable Augmented Reality for Remote Trauma Care Assistance

11:45 Adjourn

MMVR19

Exhibits

Exhibits

Exhibit Hours

THURSDAY, FEBRUARY 9

10:15 - 11:00 AM	Exhibits Open. Break in Exhibit Hall
12:00 - 1:30 PM	Lunch in Exhibit Hall
3:15 - 4:00 PM	Break in Exhibit Hall
4:00 PM	Exhibits Close

FRIDAY, FEBRUARY 10

10:20 - 10:50 AM	Exhibits Open. Break in Exhibit Hall
3:30 - 4:00 PM	Break in Exhibit Hall
4:00 PM	Exhibits Close

On Thursday and Friday, exhibits are open continuously from mid-morning break through mid-afternoon break.

Exhibitors

DIVERSIONARY THERAPY TECHNOLOGIES

DTT is the leading provider of clinically trialed medical devices and solutions. DITTO™ is a waterproof, portable device which reduces anxiety, specifically for children undergoing medical procedures. It enables clinicians to focus on treatment while DITTO™ immerses and distracts the child. Learn more at www.dtt-usa.com.

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www.dtt-usa.com / www.dtt.net.au

HOLOEYE SYSTEMS INC

HOLOEYE Systems Inc (HSI) was founded to focus on the distribution of OEM LCOS microdisplay products and components for specialty markets such as the medical, automotive, aerospace and defense industries. HSI works closely with its sister company HOLOEYE Photonics AG in Berlin Germany. HSI offers technical design and development services, manufacturing services and mid- to long-term strategies for supply chain management.

Of particular interest for 3D medical displays, HSI has licensed the real time holographic 3D display technology of SeeReal Technologies of Dresden Germany (www.seereal.com). HSI is pursuing a wide range of applications from near to eye displays to direct view monitors. This technology provides a solution to true holographic stereo viewing that can be realized with today's technology. A proof of concept demonstration is located at HSI in Carlsbad CA.

HSI has strategic partnerships with leading LCOS microdisplay manufacturing companies, to distribute LCOS microdisplays products and components. HSI provides expertise in technical optics, imaging, and display technologies, with LCOS-hardware and implementation of design solutions. Typical products include Near to Eye (NTE) and Heads-up-Displays (HUD) optical metrology (fringe projection systems), holographic security systems (dynamic data storage), and optical networking applications (optical router).

Technical Expertise

- Holographic 3D Displays
- See-Through and Occluded Near to Eye Display
- Head up Displays
- High Resolution Viewfinders
- Virtual Control Panels
- Holographic Projection Systems
- Wavefront Correction
- Beam Shaping and Steering
- Fringe Projection
- Spatial Light Modulators (Amplitude and & Phase)
- Diffractive Optical Elements (Static & Dynamic)

Medical Applications

- Holographic 3D Monitor
- LCOS Microdisplays
- LCOS Microdisplays in Biotechnology

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MOTION ANALYSIS

Motion Analysis Corporation, founded in 1982 and headquartered in Santa Rosa, California, is a leading ISO 9001:2000 developer and manufacturer of real-time 3-D digital optical motion capture and analysis systems that non-invasively measure and record the movement of humans and objects.

The Company's proprietary systems, based on over twenty five years of development, consists of digital, high-speed cameras, proprietary 3-D marker tracking software, and proprietary and licensed application-specific software to capture in real-time the three-dimensional movements of the body and display it in a VR environment. In addition, complete kinematic and kinetic segmental data can be computed and graphed.

The Company's systems are deployed in a wide range of industries, including: military/industrial, medical, research, and entertainment. The Company's systems are considered the market leader in every industry they serve.

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Vice President of Sales
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www.motionanalysis.com

NDI (NORTHERN DIGITAL INC.)

Established more than 30 years ago, NDI is accepted as the 'gold standard' for advanced spatial measurement technology. Our products are trusted for accuracy and reliability in a broad range of applications including image-guided surgery, industrial measurement, and biomechanics research. With over 15,000 installations in more than 30 countries, NDI's success has been built on our ability to understand our customers and their applications.

The NDI portfolio comprises a broad range of products, each designed to provide a measurement solution to precisely meet customer requirements. Our optical product lines, Optotrak and Polaris, are designed to specifically meet the needs of their different markets. Optotrak is utilized in biomechanical research and industrial measurement, whilst the Polaris family is optimized for use in image-guided surgery. Our electromagnetic product, Aurora, was specifically designed to provide a measurement solution for use in medical applications in which a line-of-sight to the target isn't possible. Following a process of continuous improvement, collaborative cooperation with our customers, coupled with our in-depth knowledge of optical and electromagnetic technologies, results in products that quickly become the industry standards in their fields of use.

NDI's technical expertise combined with our portfolio of navigation technologies and application experience has enabled NDI to become a premier supplier of advanced spatial measurement systems to the OEM medical community. And successfully meeting the needs of both small and large medical OEMs remains the cornerstone of NDI's success. Year after year, NDI has proven itself as a reliable, quality, and dedicated partner

In many disciplines using NDI technology, clinicians are performing surgeries that were unimaginable ten years ago. For example, surgeons can now make smaller, less invasive incisions, dramatically reducing patient recovery times. Tumors previously considered inoperable can now be successfully removed. NDI is proud to be a key partner in driving these innovative therapies forward.

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PHOENIX TECHNOLOGIES INC.

PhoeniX Technologies Inc. (PTI) manufactures the industry leading Visualeyez™ family of 'Active Optical', Real-Time 3D motion capture systems. As of 2011, a Visualeyez™ system has become the first ever to reach the International Space Station.

Visualeyez™ systems are used in a variety of research, analysis, engineering and clinical applications for highly accurate capture of motions in the fields of Telemedicine, Virtual Reality, Physical Rehabilitation, Prosthesis, Human Factor Analysis, Robotics, Haptics, Sports Science, Biomechanics as well as a number of other areas. PTI's professional grade mocap systems are extremely reliable, portable, tetherless, easy to setup and use and are offered at very 'cost effective' prices.

Visualeyez™ systems do not require any manual calibration (even when multiple motion tracking units are used), which is a mundane time-consuming process still inherent with all other systems in the world. With the VZAutoCal™ software, calibration of a Visualeyez™ system is done automatically in less than 2 seconds. Continuous updating of the calibration is also possible by simply activating the 'Adaptive' function. This would keep the system at top accuracy throughout a long capture, freeing the user from any concerns about accuracy drifts. This software is now bundled free with all multi-tracker systems. The new patent-pending VZInstaCal™ will further allow accurate subject motion data to be captured even when the trackers themselves are in motion too!

Recently PTI further launched the world first mocap system with 'Distributed Tactile Feedback' function. For the first time users can send tactile stimuli, initiate physical

response, define intolerable or acceptable motion ranges, and accurately track the 3D motions of a subject at the same time.

The Visualeyez™ VZ4050, a new small format Motion Tracker measuring just 62cm in length and 2.2kg in weight was also launched recently by PTI for human factor analysis applications in tight spaces (as well as in large spaces). This tracker offers the same real-time capabilities of a VZ4000 tracker and the patented wide-angle sensing technology (90 degrees in both pitch and yaw; 106 degrees diagonally at 5m). A single VZ4000 or VZ4050 tracker by itself can already capture 3D motion data of up to 512 tiny markers in real-time.

Contact: Sales Manager
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www.ptiphoenix.com

POLHEMUS

Polhemus pioneered motion tracking 40 years ago, introducing head tracking technology for the U.S. Military—something they still do today. Continuing to offer cost effective solutions has paved the way for other leading markets, including Virtual Reality, Biomechanics, and Health Care.

Along with their accuracy, low latency and simplicity, our motion trackers provide 6 Degrees-of-Freedom measurement, with sensors that are easily embedded and affordable. This has made Polhemus technology a top choice for use in some of the world's most sophisticated and commercially successful VR training simulators. Polhemus powers VRSim's SimWelderTM welding simulator and Medsim's UltraSim® ultrasound simulator—just to name a few.

Polhemus continues to bring new products to market—the latest being G4—the wearable, wireless tracker designed with rehabilitation, PT, human factors and biomechanics in mind. G4 is completely tetherless, yet still provides 6DOF high fidelity tracking with the level of accuracy electromagnetic is known for.

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SENSABLE

Sensable is the world leader in force-feedback haptics, with over 10,000 of its systems installed worldwide in diverse applications such as medical skills training and assessment, stroke rehabilitation, training for the visually impaired, 3D modeling and dental CAD/CAM. At MMVR Sensable is showcasing a wide range of haptics applications written using the OpenHaptics Toolkit with the QuickHaptics microAPI to control its industry-leading PHANTOM® haptic devices.

Sensable will be displaying a new Phantom device with their latest generation "Ethernet communication controller boards" and is announcing the availability of v3.1 of its OpenHaptics developer's toolkit.

New Ethernet communication controller capabilities:

- Uses native OS driver, so no driver installations or updates are needed.
- Phantom can be connected either through DHCP or locally linked to the host computer.
- Power in a very small form factor. One board can control up to 6 motors, 6 encoders, 3 potentiometers, 6 digital inputs, 6 I2C inputs, etc.
- Flexibility in a small form factor. Can easily accommodate expansion boards in the future.
- Computational powerhouse: On board DSP (Digital Signal Processor) with 64 MB RAM. (Computations like "Device Kinematics", "God-Object proxy algorithm" can be offloaded on to the board, freeing up host computer resources.)
- High frequency switching amplifiers which share and dissipate energy efficiently to prevent the DC motors from burning out.
- Adaptations for Omni and Premium line of devices coming soon.

OpenHaptics 3.1 released for Windows:

- Microsoft Visual studio 2010 compatible.
- Allows for both 32-bit and 64-bit development on 64-bit Windows.
- Host of other enhancements and improvements.

Current customers can download it from the DSC: http://dsc.sensable.com/. We will ship with all new commercial developer licenses.

Contact:
181 Ballardvale Street
Wilmington, MA 01887
Phone: 781-937-8315
www.sensable.com

SENSEGRAPHICS

SenseGraphics develops, co-develops and commercializes custom built medical simulators tailored to the specific requirements of the customer. Successful customer reference work includes the Simodont Dental trainer from MOOG in the Netherlands, ScanTrainer Ultrasound training simulator from Medaphor in the UK, simulators for the next-generation robotic surgery systems from Titan Medical in Canada, as well as the Haystack simulator for ultrasound guided peripheral nerve blocks from NDRC in Ireland.

SenseGraphics is devoted to the science of multi-modal interaction and real 3D stereo visualization, with the vision to facilitate and support research- and commercial application development in the medical field. The flagship product H3DAPI sets the standard for multimodal research, medical and industrial application development in real 3D stereo graphics with haptics as available under both Open Source and commercial license. Through the open source community, www.H3D.org, SenseGraphics has been able to quickly spread its software amongst researchers and gain broad, world-wide user support for H3DAPI by offering Wikis, tutorials and free support based forums. SenseGraphics is also offering haptics hardware and 3D Display solutions for co-location of haptics and 3D stereo visualization.

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THE TELEMEDICINE & ADVANCED TECHNOLOGY RESEARCH CENTER (TATRC)

For the 2012 Annual MMVR Conference, the U.S. Army Medical Research & Materiel Command (USAMRMC) and The Telemedicine & Advanced Technology Research Center (TATRC) have decided to take a novel approach. TATRC will extend the definition of "telemedicine," to show how advanced medical technologies, will impact the provision of healthcare to the military, as well as to the civilian sector.

This exhibit will focus and highlight the successful collaboration with our extramural Partners and their projects who have teamed with TATRC in an effort to improve joint medical readiness, provide greater battlespace medical awareness, and more effectively employ our medical forces in the 21st century. It is the Mission of the Telemedicine & Advanced Technology Research Center (TATRC) to explore science and engineering technologies ahead of programmed research, leveraging other programs to maximize benefits to military medicine. To this end, TATRC directs military medical research in emerging health promotion, information and training technologies. TATRC also initiates, sponsors, promotes, and oversees programs and partnerships in medical science and engineering that augment military medical programs. With the strategic application of funding from congressional special interest programs, small business innovative research (SBIR/STTR), AMEDD advanced medical technology initiatives (AAMTI), and other sources, TATRC accelerates the implementation of novel science and engineering technology applications through validation studies, translational research, and demonstration projects. As a result, TATRC has become a network of experts and capabilities positioned to rapidly address urgent DoD needs.

Please stop by TATRC's advanced technology showcase for an interactive, thought-provoking and exciting experience demonstrating how technology will enhance life on the battlefield, in military medicine and beyond.

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MMVR19

Independently Organized Adjunct Activities Descriptions

Thursday Afternoon
TRACK B

3:45 Workshop

Avatar Based Recovery Platform: New Directions in the Treatment of Chemical Dependency

Chair: Ivana Steigman
Thrive Research, Inc.

Presentations:

Ivana Steigman
Thrive Research, Inc.

Avatar Based Recovery: An Overview

Walter Greenleaf
Thrive Research, Inc.

Use of On-Line Interactive Virtual Environments (OLIVE) in Healthcare and Psychological Services

David S. Molina
Janus of Santa Cruz; Thrive Research, Inc.

Implementing New Technologies for Treatment in a Community Clinic

Albert Garcia-Romeu
Thrive Research, Inc.

Avatar Based Recovery in the Treatment of Opiate Addiction: A Pilot Study

The Thrive Research team will present an overview and provide a live demonstration of our Avatar Based Recovery Program, a technological treatment intervention platform combining online and virtual reality environments to support patients' recovery and track their clinical progress from home or clinic. Presenters will discuss the history and rationale behind the use of On-Line Interactive Virtual Environments (OLIVE) in providing healthcare and psychological services, and the experience of providing substance abuse counseling using Avatar Based Recovery for treatment of opiate addiction.

Speakers will also offer commentary regarding clinical work and research using VR in a community clinic setting, and the experience of training counselors to use this technology. The presentations will touch on the research design and methods used to study Avatar Based Recovery, and results from a pilot study gathering clinical data with recovering opiate addicts and their drug counselors at Janus of Santa Cruz. Findings will include clinical data as well as patients' and counselors' comments on their experience using the platform. Afterwards, we will provide a live online demonstration of our Avatar Based Recovery platform, and open the floor for questions and discussion regarding use of new technologies to supplement and support traditional substance abuse treatment.

Thursday Afternoon
TRACK C

1:35 Panel

Technical and Organizational Requirements for the Implementation of Adaptive Learning: A Case Study In Collaboration

Chair: Todd Graham
Accella Learning Company, LLC

Additional Presenters:

Bryan Bergeron
Accella Learning Company, LLC; Massachusetts Inst of Technology

Andrew H. Cline
School of Medicine, Univ of Louisville; National Ctr for Biomedical Research and Training, Louisiana State Univ

Ross E. Dworkin
Accella Learning Company, LLC; Blue Grotto Technologies, Inc.

Learning Objectives:

Panel Discussion Attendees will learn:

How to maximize long-term benefits of grant funding

Challenges and advantages of business-academic collaboration

Potential pitfalls of working with a geographically distributed team and how to avoid them

The many weeks you invested in preparing a grant application paid off – you've got that government contract in hand. Now what? If you're not careful, that SBIR or BAA money – or waiting patiently for it - can derail your business. On the other hand, in this economy, capital can breathe life into your company and help create a

vibrant future for you and your team. But how can you insure the success? You can't, but you can set up your organization to maximize the odds of success.

Key members of the Accella team will share their experiences on three phases of a Congressional Grant focused on practical Intelligent Tutoring System (ITS) technology development and deployment. They will highlight the myriad technical, logistical, and financial challenges they encountered over the course of this grant. Topics range from how to handle periodic reporting requirements and making the best of virtual meeting technologies to securing IRB exemption status.

A short demonstration of our technology will illustrate some of the technical challenges we encountered and how we addressed them. The majority of the session will be devoted to open discussion.

Thursday Afternoon
TRACK C

3:30 Workshop

Using Technology to Assess Simulation Performance of Active Participants, Transform Passive Observers into Activated Learners

Organizers:

Susan Eller
Simulation Technology and Immersive Learning
Feinberg Sch of Medicine, Northwestern Univ

Paul Pribaz
Simulation Technology and Immersive Learning
Feinberg Sch of Medicine, Northwestern Univ

Overview

A typical simulation scenario involves an active learner(s) and several passive observers of the hot-seat performance. This workshop will demonstrate technology that allows the instructor to capture assessments of the active learners, capture time-to metrics, and transform the otherwise passive observers by having them function as raters.

Learning theory framework supports that active learning increases memory retention. (Mayer, 2008) A way to engage the otherwise passive observers is by having them function as raters during the scenario. Following Mayer's model, the use of a simple checklist focuses the observers attention on some of the desired behaviors; selecting this information assists with transforming sensory memory into working memory.

The observers are trained on the scale/tool and how to use the electronic technology. During the simulation event, both the activated learners and the expert facilitator use the electronic tool to assess performance behavior. These assessments are then also captured as video instances that are marked on a timeline for use during video assisted debriefing.

During debriefing, the expert facilitator identifies and closes performance gaps on the active learners. (Rudolph, Simon, Dufresne, & Raemer, 2006) Having a representation of the activated learners mental model in the form of a checklist allows the facilitator to assess for and correct knowledge gaps. This checklist can exist in paper or electronic form with several additional benefits; most notable that the activated learners often provide peer feedback regarding the hot seat performance that they noted while filling out the checklist.

The electronic tool can accomplish all of the benefits of a paper checklist with additional benefits:

• Capture of electronic instances that can be used for video assisted debriefing.

• The electronic tool can provide time stamps of the behaviors, so that time-to metrics can be assessed. i.e. time to CPR or defibrillation in resuscitation scenario.

• Raters can record multiple instances of a performance within a given scenario; important if the behavior is repeated or self-corrected during the scenario.

• Performance data exists in electronic form that can easily be exported in to statistical software.

• Course directors can watch and rate captured video performances as mechanism for inter-rater reliability between multiple facilitators of program.

Learning Objectives:

After the session, participants will be able to:

• Use technology to gather real-time performance data on both active simulation participants and observers.

• Apply technology to transfer otherwise passive observers into active learners.

• Describe ability for faculty to identify performance gaps in both active participants and observers.

• Utilize this data to customize the debriefing experience for individualized adult reflective experiential learning.

References:

Mayer. R. E. (2008). Learning and instruction. Saddle River, NJ: Pearson Education.

Rudolph, J. W., Simon, R., Dufresne, R. L., & Raemer, D. B. (2006). There's no such thing as "nonjudgmental" debriefing: a theory and method for debriefing with good judgment. Simulation in Healthcare: The Journal of The Society for Medical Simulation, 1(1), 49-55.

Friday Afternoon
TRACK C

1:35 Focus Session & Panels

Analysis of Honest Signals for Psychological Health Assessment

Chair: Russell Shilling
DARPA

Albert "Skip" Rizzo
Inst for Creative Technologies, Univ of Southern California

Presentations:

Russell Shilling
DARPA

Introduction to Detection and Computational Analysis of Psychological Signals

Albert "Skip" Rizzo
Inst for Creative Technologies, Univ of Southern California

Telemedical and Online Intelligent Virtual Human Guided Healthcare Support Leveraging User State Sensing

Louis-Philippe Morency
Inst for Creative Technologies, Univ of Southern California

Multimodal Perception and Learning

Alex "Sandy" Pentland
Massachusetts Inst of Technology

Honest Signals

Rohit Prasad
Raytheon BBN Technologies

Text and Voice Analytics for Psychological Distress Detection

Roy Stripling
CRESST, Univ of California, Los Angeles

Evaluation and Assessment of DCAPS Systems

As many as 30 percent of warfighters returning from Iraq or Afghanistan suffer clinical levels of major depressive disorder, post-traumatic stress disorder, or traumatic brain injury. Many more are experiencing subclinical levels. The military's suicide rate has risen sharply, compared with the general population. Medical and psychological health care for returning service members is a significant concern for DoD.

Previously known as Healing Heroes, the Detection and Computational Analysis of Psychological Signals (DCAPS) program seeks to identify technologies and analysis techniques to assess psychological status by analyzing subtle cues and trends in complex clusters of personal and group behaviors. Among other measures, DCAPS will look for "Honest Signals," which are subtle behavioral cues that are not under conscious control. It will do this by identifying behavioral or psychological cues that can help detect psychological status and could be linked to depression, stress, suicide or other psychological health issues. Cues of interest will include facial affect, posture, voice stress, speech content, online behaviors, sleep patterns, and social interactions. DCAPS will leverage various social networks as well as standalone applications developed on personal computer and mobile technologies. The goal is to identify behavioral (honest) signals of interest that can be extracted from daily behaviors using these online and mobile tools.

These same informatics tools will also be used by DoD to supplement services, access, and policies as the basis for new approaches for delivering psychological health care information and outreach to Service Members, Veterans, and their families. For example, successful detection and analysis of honest signals could provide deeper insight to a clinician who is interacting within a telemedicine treatment format with a patient who is at a remote location. As well, these same sig-

nals could be a source of perceptual input that would support a more engaged interaction with an autonomous virtual human support agent, guide or coach to help a patient in their anonymous quest for relevant healthcare information and service. All applications must be deemed safe and will be validated for efficacy. Privacy, ethical, security and demonstrated effectiveness are paramount goals of this program.

The objectives of this session are to:

• Discuss the unique challenges for the users of the DCAPS technology;

• Discuss advancement in various stages of DCAPS development, including (but not limited to) the extraction of emotion from text, using technology to elicit behavioral signals, interpersonal dynamics between human and agent systems; and,

• Provide a venue for open dialogue toward better understanding and addressing the needs of those who suffer from PTSD, to include discussions about assessment/ethical considerations, as well as transition strategies for DCAPS and similar innovative technologies.

Those attending this session may have a range of interests, from better understanding the kind of work being conducted at DARPA, to learning about research that provides support to service members with PTSD/TBI.

Saturday Morning
TRACK B

8:30 Focus Session

Wearable Augmented Reality for Medical First Response & Situational Awareness

Chairs: Jayfus T. Doswell
Juxtopia LLC

Kenneth Wilson
Trauma Surgery, Morehouse Sch of Medicine

Peter Kazanzides (invited)
Ctr for Computer Integrated Surgical Systems & Technology (CISST), The Johns Hopkins Univ

Diane Adams
Health Informatics Information Technology (HIIT), American Public Health Assoc (APHA)

Presentations:

Maia Anderson
Sch of Nursing, Sojourner Douglass College

Wearable Augmented Reality for Emergency Public Health Care Response

Corey Dicken
Dept of Electrical Engineering, Morgan State Univ

Ruggedized Subsystems for Wearable Augmented Reality for use in Casualty Care Settings

Jayfus T. Doswell
Juxtopia LLC

Context-Aware Augmented Reality System Architecture for Medical First Response and Situational Awareness

Peter Kazanzides (invited)
Ctr for Computer Integrated Surgical Systems and Technology (CISST), The Johns Hopkins Univ

Wearable Augmented Reality for Surgical Navigation and Situational Awareness

Manohar Mareboyana
Dept of Computer Science, Bowie State Univ

Object Recognition for Wearable Augmented Reality During Casualty Care

Gail Nicholson (invited)
Naval Warfare Center

Usability and Human Factors in Wearable Augmented Reality Systems

Sachin Shetty
Electrical & Computer Engineering, Tennessee State Univ

Advanced Embedded Computer System for the Wearable AR HMD

Sharad Sharma
Dept of Computer Science, Bowie State Univ

WARN: Wearable Augmented Reality Note for Casualty Care Documentation

Jamal Uddin
Dept of Chemistry, Coppin State Univ

NanoPower: Nanotechnology Power for Wearable Augmented Reality During Long Incident Operations

Kenneth Wilson
Trauma Surgery, Morehouse Sch of Medicine

Wearable Augmented Reality for Remote Trauma Care Assistance

Health care providers ranging from emergency medical first responders and surgeons to combat casualty care providers may benefit from a completely mobile and hands-free

method of retrieving and documenting medical data while accessing, on-demand, decision support services to improve the delivery of care to patients or the injured. Wearable Augmented Reality (AR) for first response and casualty care shows promise to provide a hands-free and mobile platform for delivering on-demand medical information and a mechanism to facilitate hands-free documentation of medical care.

Additionally, there are many challenges emergency medical first responders (e.g., emergency medical technicians, paramedics, etc.) face when they arrive on the scene and while performing incident operations. These challenges range from CBRNE (chemical, biological, radiological, nuclear, explosive) attacks to penetrating trauma (e.g., gunshot wound(s)), natural disaster threats, and lack of consistent visibility in environments where the emergency responder is attempting quick response. These challenges that emergency responders face are further compounded by incident operations that require time-urgent responses while they attend to casualties and perform the work necessary to complete a clinical procedure. In the post-event stage (i.e., 72 hours after the incident), responders may also assess potential exposures, conduct rescues, and attempt recovery activities in constantly changing and complex hazardous environments without adequate situational awareness.

This session will empanel experts in wearable AR and medical first response and how wearable AR may be used as an intervention for providing medical situational-awareness to combat casualty care providers, medical first responders, public health care workers, and surgeons to improve health care delivery to patients and the casualty. Session presenters will discuss the details of a fully-integrated optical see-through based wearable AR platform may provide medical first response teams with on-demand assistance to provide evidence based treatment to satisfy the aforementioned first response needs and improve the delivery of casualty care throughout the disaster response continuum.

MMVR19

Presentation Summaries

Thursday's Presentation Summaries

THURSDAY Morning, February 9
PLENARY SESSION

David Graves

Computer Simulation of Plasma Medical Devices to Meet Future Challenges in Infection Control and Therapy

Ionized gas, low temperature plasma technology has recently been applied to various problems in medicine and healthcare, ranging from disinfection and antisepsis to cancer therapy, wound healing and various dermatological and dental applications, among others. However, the technology is still in its early stages and many different possibilities can be envisioned, including helping to address major potential future challenges in healthcare such as the growing menace of antibiotic resistance, bioterrorism and pandemic infections. A big challenge for plasma technology, however, is controlling the devices so that they are both effective and safe. One important tool to do this is computer simulation. In this talk, I will outline some of the ways that computer simulation is likely to help advance the technology from exploration of basic physics, chemistry and biology to direct control of the devices.

Richard Boyd

The Simulation Prescription

We have a timely opportunity to reduce waste in the healthcare system by using mature, advanced techniques from the aviation industry to model and simulate clinical health care environments in order to enable virtual systems engineering and systems integration. By creating hierarchical simulated models of health care systems and then validating these models against their real-world equivalents, we can create a virtual system-of-systems engineering tool—a virtual laboratory for systems engineering and systems integration. Not only will such a system allow us to preflight test equipment before introducing it into clinical environments, but the resulting simulation will result in a flight simulator for robust training.

As with comparable tools in flight simulation, simulation tools for health care will make analysis and training fast, safe, measureable, and reproducible. This will be a significant step forward in health care, which has trailed other fields in the adoption of software simulations, partly due to technological issues and partly due to behavioral barriers. Those who would benefit from this effort include hospitals and hospital chains, integrated health care providers, insurers, government health care agencies, and medical device makers. Each faces critical issues that we can help address through virtual systems engineering.

THURSDAY Afternoon, February 9
TRACK A

Modeling

Rui Hu

A Non-Photorealistic Surgery Simulation System

Surgery simulation (SS) plays an important role in surgery planning, surgeon training, and telemedicine. A long-standing problem in SS is how to integrate coherent visual illustrations to deformation. In this paper, we present a new non-photorealistic surgery simulation system that combines force visualization and dynamic pencil-stroke illustration. We estimate the elastic force field in real-time and integrate it with the contact force to for m a combined force map. Then, our rendering module is able to dynamically compute the principal directions on deforming organ models and apply color coded, pencil-style strokes onto the model for illustrating deformations. We implement these modules on GPU using NVidia's CUDA. Our system can faithfully and coherently reveal geometric deformation of organs under the force field.

Vinay Menon

Simulation of a Human Circulatory System

This article describes a mathematically based circulatory model derived using bond graph methods. The model consists of lumped elements such as venous, arterial, peripheral, pulmonary vein and artery segments. A heart model is simulated using 4 chambers (left and right atriums and ventricles). The heart pump mechanism is operated by a simple piston based models for each of the chambers. The simulation consists of 20 (states) first order differential equations. and simulated with Matlab and Simulink. The simulation computes flow rate and pressures in each segment. System, pump parameters and blood volume are provided for the model.

Juan Antonio Solves Llorens

A Study about Coefficients to Estimate the Error in Biomechanical Models used to Virtually Simulate the Organ Behaviors

In this paper, a set of coefficients commonly used in Medical Image to estimate the committed error comparing two images is presented, which, combined together,

allow to determine the similarity between volumes. Furthermore, an analysis of the behavior of these coefficients is performed to determine those coefficients that better discriminate the fit error, proving that these are Jaccard coefficient and a modification of Hausdorff coefficient. In addition, the combination of both coefficients is applied to compare two given biomechanical models of the lamb liver.

Anand Santhanam

Computational Fluid Dynamics Modeling of Airflow inside Lungs Using Heterogenous Anisotropic Lung Tissue Elastic Properties

The aim of this paper is to visualize the 3D lung and tumor motion and the airflow inside lungs during breathing using subject-specific permeability and porosity properties. A flow-structure interaction technique that simultaneously models flow within the airway and anisotropic deformation of the lung lobes is investigated. The three-dimensional (3D) lung geometry is reconstructed from the end-expiration 3D CT scan datasets of humans with lung cancer. The lung is modeled as a poro-elastic medium with anisotropic elastic property (non-linear Young's modulus) obtained from optical flow registration of 4D CT scans for the same patients. The results show the 3D anisotropic lung deformation along with the airflow pattern inside the lungs. The effect on both the spatio-temporal volumetric lung displacement and the regional lung hysteresis using nonlinear elasticity is also presented.

Hoeryong Jung

Real-Time Deformation of Colon and Endoscope for the Colonoscopy Simulation

This paper proposes a novel simulation framework for the real-time deformation of the colon and endoscope using a skeleton-driven deformation method. Cylindrical lattices and a centerline are employed as the skeletons, and a mass-spring model is applied to the skeletons for the mechanics-based simulation. The centerline-based collision detection and resolution algorithm is applied to simulate the interaction between the colon and endoscope. The proposed simulation framework is integrated with a colonoscopy simulation. Simulation results show that the proposed method allows real-time simulation (30Hz) using the colon model composed of up to 241,440 meshes.

Farzam Farahmand

A Meshless EFG-Based Algorithm for 3D Deformable Modeling of Soft Tissue in Real-Time

The meshless element-free Galerkin method was generalized and an algorithm was developed for 3D dynamic modeling of deformable bodies in real time. The efficacy of the algorithm was investigated in a 3D linear viscoelastic model of human spleen subjected to a time-varying compressive force exerted by a surgical grasper. The model remained stable in spite of the considerably large deformations occurred. There was a good agreement between the results and those of an equivalent finite element model. The computational cost, however, was much lower, enabling the proposed algorithm to be effectively used in real-time applications.

Aurélien Deram

Towards a Generic Framework for Evaluation and Comparison of Soft Tissue Modeling

Numerous models have been developed to describe the mechanical behavior of soft tissue in virtual reality medical environments. Very high credibility must be established before clinicians trust simulations for diagnostic or treatment. Validating models to obtain the right compromise between precision and computational efficiency for the targeted medical application is a long, costly and time-consuming task. We have developed an open-source framework for helping scientists in the difficult problem of evaluating and comparing bio-mechanical models in a more systematic and automatic manner.

Haptics

Rui Hu

An Accelerated Haptic Feedback Algorithm Utilizing Volume Reconstruction

Surgery simulation (SS) is playing an increasing role in medical education. A long standing problem in SS is how to integrate fast yet realistic haptic feedback to the system. In this paper, we propose an algorithm to accelerate the recently proposed volume-based haptic feedback approach. Unlike existing techniques that require separately scanning along all three axes, we only scan the volume once along one axis and recover the penetration information along the other two based on geometric constraints and heuristics. This significantly reduces the computational cost and doubles the haptic refresh rate, which significantly improves the stability of haptic feedback.

Andre Mastmeyer

Direct Haptic Volume Rendering in Lumbar Puncture Simulation

The preparation phase for surgical simulations often comprises the segmentation of patient data, which is needed for realistic visual and haptic rendering. Expert segmentation of 3D patient data sets can last from several hours to days. In this paper we introduce a direct haptic volume rendering approach for lumbar punctures. Preparation time spent for segmentation is much shorter and compared to our reference system nearly identical force output at the needle tip can be observed. The number of structures to be completely segmented by an expert is reduced from 11 to 3 tissues in abdominal data sets with 300 slices.

Ilana Nisky

Perception of Stiffness in Laparoscopy - the Fulcrum Effect

We explored how the perception of stiffness can be distorted in Minimally Invasive Surgery. We combined mechanical simulator with haptic device, and implemented linear springs at the tip of the simulated laparoscopic device. To explore the influence of mechanical advantage, we set different values of the ratio between internal and external length of the tool. We found that nonsymmetrical ratio causes bias in the perceived stiffness when tangential probing is compared to radial by novices. Interestingly, haptic experts did not show similar perceptual bias.

Alexei Sourin

Haptic Editing of MRI Brain Data

Automated brain segmentation may leave errors which can be identified by comparing the location of the actual MRI voxels with reference to the reconstructed pial polygonal surface of the brain. Location of the segmentation errors can be marked by displaying color spots on the brain surface followed by its interactive editing, as we previously proposed. In this paper, a new haptic friction-based approach of identifying and correcting errors has been discussed. The user can feel as different friction the discrepancy along the reconstructed surface by moving a haptic proxy along it followed by rubbing the surface as if it is being polished. The proposed approach does not only limit its application in editing of medical data, but can also be successfully used for visually impaired group as this dynamic friction-based editing helps any novice user identify error prone area just by touching the surface.

Joseph Singapogu

Assessing Surgeon and Novice Force Skill on a Haptic Stiffness Simulator for Laparoscopic Surgery

Though several simulators and training methods are available for basic laparoscopic skills, few have addressed force-based skills. In this work, we discuss a haptic simulator for rendering virtual materials with different stiffness profiles. A force-based task was designed on the simulator and the performance of surgeons and novices was analyzed. Results indicate that surgeons and novices differ in their ability to use the haptic device to reproduce target stiffness levels. This work provides an important step towards quantifying haptic skill metrics for the design of training regimens leading to proficient laparoscopy.

THURSDAY Afternoon, February 9
TRACK B

Physical & Mental Health Applications

Giuseppe Riva

The Effects of a Mobile Stress Management Protocol on Nurses Working with Cancer Patients: A Controlled Study

Oncology nurses face extraordinary stresses that may lead to emotional exhaustion, a feeling of emotional distance from patients and burnout. The presentation describes the preliminary results of a study to test the effects of an innovative 4-week 8-session self-help stress management training for oncology nurses supported by mobile tools (Nokia N70 smarthphone). The sample included 16 female oncology nurses with permanent status employed in different oncology hospitals in Milan, Italy. The study used a between-subjects design, comparing the experimental condition (mobile phone stress management protocol) with a control group (neutral videos through mobile phones). In addition to a significant reduction in anxiety state at the end of each session, the experimental group demonstrated a significant improvement in affective change in terms of anxiety trait reduction and coping skills acquisition at the end of the protocol.

Thomas Parsons

Virtual Reality Paced Serial Assessment Test for Neuropsychological Assessment of a Military Cohort

The assessment and treatment of traumatic brain injury (TBI) has become a difficult challenge for the DoD medical health system. Clinical neuropsychologists are

being asked to make statements regarding a soldier's functional skills, ability to return to active duty, and competence in tasks of community living. Given the increasing prevalence of blast injuries to the head, and the fact that many brain injuries may have no external marker of injury, there is need for researching innovative assessment methods in detecting blast-related brain injury. To address these issues, two virtual reality-based Paced Auditory/Visual Serial Addition Tests (PA/VSAT) were developed that involve the participant being immersed in a Virtual Iraqi City as serial addition stimuli are presented. This study is an initial validation of the VRPASAT and VRPVSAT as assessments of neurocognitive functioning. When compared to the paper-and-pencil version of the test, as well as the Automated Neuropsychological Assessment Metrics, the VRPASAT and VRPVSAT appear to have enhanced capacity for providing an indication of a participant's performance while immersed in a military relevant simulation.

Roger Xu

A Voice-Based Automated System for PTSD Screening and Monitoring

Comprehensive evaluation of PTSD includes diagnostic interviews, self-report testing and physiological reactivity measures. It is often difficult and costly to diagnose PTSD due to patient access and the variability in symptoms presented. Additionally, potential patients are often reluctant to seek help due to the stigma associated with the disorder. A voice-based automated system that is able to remotely screen individuals at high risk for PTSD and monitor their progress during treatment makes great strides in alleviating the barriers to cost effective PTSD assessment and progress monitoring. In this paper, we present a voice-based automated Tele-PTSD Monitor (TPM) system currently in development, designed to remotely screen, monitor, and provide assistance to clinicians in diagnosing PTSD. The TPM system can be accessed via a Public Switched Telephone Network (PSTN) or the Internet. The acquired voice data is then sent to a secure server to invoke the PTSD Scoring Engine (PTSD-SE) where a PTSD mental health score is computed. If the score indicates that the user is likely to have identifiable PTSD symptoms, the system will notify clinicians (via email or text messaging) for confirmation and for an appropriate intervention. The TPM system requires only voice input and computer-based automated scoring, making it low cost and easily field-deployable.

Albert "Skip" Rizzo

STRIVE: Stress Resilience In Virtual Environments: A Pre-Deployment VR System for Training Emotional Coping Skills and Assessing Chronic and Acute Stress Responses

Numerous reports indicate that the incidence of post-traumatic stress disorder (PTSD) in returning OEF/OIF military personnel is creating a significant healthcare challenge. These findings have served to motivate research on how to better develop and disseminate evidence-based treatments for PTSD. One emerging form of treatment for combat-related PTSD that has shown promise involves the delivery of exposure therapy using immersive Virtual Reality. Initial outcomes from open clinical trials have been positive and fully randomized controlled trials are currently in progress to further validate this approach. Based on our research group's success in the use of VR to emotionally engage persons undergoing exposure therapy for PTSD, we have begun development in a similar VR-based approach to deliver stress resilience training in military personnel prior to their initial deployment. The STRIVE project aims to create a set of combat simulations (derived from our existing Virtual Iraq/Afghanistan exposure therapy system) that can be used as contexts for the experiential learning of cognitive-behavioral emotional coping strategies prior to deployment to better prepare military presonnel for the types of emotional challenges that are inherent in the combat environment.

Riccardo Secoli

Using a Smart Wheelchair as a Gaming Device for Floor-Projected Games: A Mixed Reality Environment for Training Powered Wheelchair Driving Skills

For children with a severe disability, such as can arise from cerebral palsy, becoming independent in mobility is a critical goal. Currently, however, driver's training for powered wheelchair use is labor intensive, requiring hand-over-hand assistance from a skilled therapist to keep the trainee safe. This paper describes the design of a mixed reality environment for semi-autonomous training of wheelchair driving skills. In this system, the wheelchair is used as the gaming input device, and users train driving skills by maneuvering through floor-projected games created with a multi-projector system and a multi-camera tracking system. A force feedback joystick assists in steering and enhances safety.

Bonnie Kennedy

Expanding the Scope of Design and Quality Assurance in the Context of Serious Games for Rehabilitation

The purpose of this presentation is to expose listeners to an alternative perspective on serious game design and quality assurance specifically for games used in rehabilitation. Quality assurance for game design for rehabilitation builds upon traditional game design by adding requirements for rigorous measurement of human performance and task transfer while preserving the playfulness of games. We begin with the widely recognized game testing protocol and enhance its scope addressing appeal, barriers to play, learning/neuroplasticity and scientific rigor.

THURSDAY POSTERS

Simulation Design & Development

Calvin Kwan

Moving Past Normal Force: Capturing and Classifying Shear Motion Using 3D Sensors

In our previous research, we used simulated breast models instrumented with direct (normal) force sensors for training and assessment. However, normal force sensors cannot delineate, in detail, all of the performance measures we wish to understand regarding the clinical breast examination. This study incorporated the use of newly developed shear force sensors in order to establish a framework for quantifying the hands-on skills used during the clinical breast examination.

Peder Pedersen

Personal Low-Cost Ultrasound Training System

To meet the challenge of making realistic training opportunities in medical ultrasound readily available, a PC based low cost personal ultrasound training system has been developed. The training experience is provided by scanning a generic, curved and compliant scan surface with a sham transducer, containing position and orientation sensors, while the PC displays both a virtual subject and a virtual transducer, along with an ultrasound image obtained from a 3D image volume.

John Qualter

The Biodigital Human: A Web-Based 3D Platform for Medical Visualization and Education

NYU School of Medicine's Division of Educational Informatics in collaboration with BioDigital Systems LLC (New York, NY) has created a virtual human body dataset that is being used for visualization, education and training and is accessible over modern web browsers.

Joseph Samosky

A Novel Automated Drug Simulant Recognition System for Naturalistic Real-Time Medical Simulation

The ability for a medical simulator to automatically recognize and respond to a “drug” injected during a training exercise offers powerful capabilities for objective assessment and real-time interaction. To address some of the limitations of available mannequin drug recognition systems, we developed a novel sensing system that recognizes an IV-injected agent based on an inherent property of the fluid. Our system uses varying concentrations of saline to represent different drugs and identification is made via conductivity measurement. The system also determines the volume administered and the time over which the dose is injected. Simulant solutions in IV bags (e.g., simulated Hextend or crystalloids) can be identified even if the bag is placed at a distance from the body. The system may offer advantages for field training exercises, as no external components need be attached to the syringe or IV bag.

Jörg Wulf

Three-Dimensional Micro-Imaging (µCT) Based Physical Anatomic Teaching Models: Implementation of a New Learning Aid for Routine Use in Anatomy Lectures

The aim of our project is the development and implementation of µCT based plastic anatomical models to make them commercially available as an anatomy learning tool for students at all levels. High resolution µCT of human ossicles and trabecular bone was performed. After image processing, application of rapid prototyping and rapid manufacturing technologies, enlarged physical teaching models, magnified by a factor of 20, were built and provided an accurate representation of the human anatomy.

Ayano Kikuchi

Development of a VR-Based Injection Training System Using a Standardized Patient

We propose the VR based injection training system using Standardized Patient (SP) with an original haptic needle which can represent a haptic expression. SP is trained to realistically portray a real patient. In the proposed system, trainee can virtually puncture SP using the haptic needle. In addition, the haptic needle can represent a haptic expression of needle insertion of the virtual anatomical model. By using the proposed system, trainee can feel virtual puncture as well as operating for real patient.

Felix Hamza-Lup

Haptic Simulator for Liver Diagnostics through Palpation

Haptic interfaces have the potential to revolutionize simulation and training in medical diagnosis and noninvasive surgery. Furthermore, mechanical properties of biological tissue for both histological and pathological considerations are often required in medical diagnosis. We provide a short overview of the most popular frameworks, APIs and toolkits for haptic user interface development emphasizing their potential for medical simulation. We present the development of an affordable visuo-haptic simulator designed to improve practice-based education in noninvasive surgery. Such systems, can positively affect the next generations of learners by enhancing their knowledge in connection with real-life situations while they train in mandatory safe conditions.

Vikram Nandhan

The Use of Pressure Sensors in an Aesthetic Dermoscopy Simulator to Improve the Diagnosis of Cancerous Skin Lesions

Dermoscopy has been proven to effectively diagnose potentially malignant skin lesions. However, a more hands on and in depth experience is needed to educate future doctors on the technique. By applying the use of force sensitive resistors to an aesthetically designed back, this model simulates dermoscopy and educates students on the process of diagnosis. The simulator will test the ability of medical students to retain knowledge of the process over the span of two weeks. In addition, overall class results will reveal the strengths and weaknesses of the current education system and will allow educators to adjust the curriculum accordingly.

Modeling

Ganesh Sankaranarayanan

A Simulation Framework for Tool Tissue Interactions in Robotic Surgery

Robotic surgery is preferred over other traditional methods due to reduced complications and improved ergonomics for the operating surgeon. They are also a perfect platform for telesurgery. Automated surgery in which the robot is allowed to do various surgical tasks with minimal intervention is getting wider attention recently. In this paper, we introduce a simulation framework that can realistically simulate tool tissue interactions in robotic surgery, which can be used to design and test various control methodologies for automated surgical tasks. We present preliminary results from simulating a simple mode of a surgical robot interacting with a volumetric model while performing a grasping and hold task.

Pierre-Frederic Villard

A Method to Compute Respiration Parameters for Patient-based Simulators

We propose a method to automatically tune a patient-based virtual environment training simulator for abdominal needle insertion. The key attributes to be customized in our framework are the elasticity of soft-tissues and the respiratory model parameters. The estimation is based on two 3D Computed Tomography (CT) scans of the same patient at two different time steps. Results are presented on five patients and show that our new method leads to better results than our previous studies with manually tuned parameters.

Alexander Herzog

Model Order Reduction of Neural Connectivity for Computationally Feasible Whole Brain Modeling

In order to understand the effects of blast loading on the human brain, a computational model of the whole brain must first be created. Current models discretize the brain into regions of interest but the question of neural element size is important. Individual neurons are too numerous to simulate, while behaviorally distinct regions of the brain are too large and vague to produce accurate results [1]. This paper presents research that is in progress of implementing a trajectory piece-wise linear (TPWL) model order reduction technique [2] for simulating many neural elements. TPWL reduces the state-space of a dynamic system and breaks it up into many

linear models each selected based on a training simulation. The nonlinear and coupled dynamics of the Hodgkin-Huxley equations present challenges that require alterations in the implementation of the standard TPWL technique.

Learning & Metrics

Ross Dworkin

The Application of Technology for the Creation of "Retention Profiles" for Use in Adaptive Learning and the Delivery of Remedial Material

Educating students with courses at differing levels of difficulty commensurate with their current experience and knowledge may improve their learning. Similarly, scheduling review of material based on the students current knowledge and ability to learn may yield benefit as well. In essence, reviewing material with a pupil just before they forget is a more efficient way to learn. This new paradigm will require the development of individual "Retention Profiles" for each student. A "Retention Profile" indicates an individual's proclivity to retain information. Specifically it is a "decay" curve indicating knowledge degradation as a function of time and is specific to categories of knowledge such as concepts, facts and methods as well as complexity. An individual's retention curve will influence curriculum, courses and the delivery of remedial material in an adaptive learning environment. In this paper we present techniques and technology used to garner these retention parameters including web surveys, emails and text messaging. We discuss how these parameters can be used to generate the retention curve and how the characteristic of a student is used within an adaptive learning system. We also introduce several considerations for the standards necessary to make retention profile parameters available in an open architecture environment.

Calvin Kwan

Introducing Simulation Technology to New Faculty: Do Not Let Them Play

As part of our simulation-based curriculum design process, we require faculty instructors to formally examine or test the simulators they wish to use for instruction. This testing requirement is invaluable and especially important when using mannequin-based simulations. We discovered that despite the formally labeled and defined clinical presentation, as determined by the simulator manufacturer, it is more important to teach according to the consensus of experienced clinicians.

Nathan Delson

Expert vs. Novice Endpoint Angle and Motion in a Laryngscopy Simulator

An instrumented mannequin for airway intubation was used by experts and novices. The motion of the laryngoscope, and head and laryngoscope angles where tracked near the endpoint of the procedure. Statistically significant differences between experts and novices where found in the amount of head tilt and in the consistency of direction of lift. These differences between experts and novices can be used for assessment and real-time guidance during training sessions.

Simulator Validation

Lawrence Salud

Modification of Commercially Available Simulators to Elicit Decision Making Behavior

In recent years, simulation training has emerged as an innovative method to decrease error and teach complex procedures. Simulation is also a valuable tool for evaluating investigatory and analytic thinking. By adding a specific, clinically oriented modification to a commercially available simulator, we were able to illicit first-year emergency medicine resident perceptions, actions and cognitive decisions.

David Rojas

An Online Practice and Educational Networking System for Technical Skills: Learning Experience in Expert Facilitated vs. Independent Learning Communities

This study explored the activities of trainees learning technical skills using an educational networking tool with and without expert facilitation. Medical students (participants) were video-recorded practicing suturing and knot tying techniques and the resulting videos were uploaded to an educational networking site. Participants were then divided into two groups (one group containing an expert facilitator while the other group did not) and encouraged to comment on the videos within their group others videos, half with an expert facilitator and half without. We monitored the number of logins and comments posted and all participants completed an exit survey. There were no differences between the activities the two groups ($p = 0.387$). We conclude that the presence of an expert within collaborative Internet environments in not necessary to promote interactivity amongst the learners.

Johan Creutzfeldt

Behavioural Ratings in Cardiopulmonary Resuscitation after Multiplayer Virtual World and Scenario Based Full Scale Simulator Training

Teamwork behavior is of importance for successful outcome during cardiopulmonary resuscitation (CPR). Using the A TEAM scale we studied how previous multiplayer virtual world- and scenario based full scale simulator CPR training affected team behavior during simulated CPR. Data indicate that virtual world training as well as scenario based full scale simulator training of CPR affects central teamwork parameters during assessment in a simulated environment. However modification and validation of the scale is necessary for CPR training.

Psychological Health

Andrea Gaggioli

An Open Source Mobile Platform for Psychophysiological Self Tracking

Self tracking is a recent trend in e-health that refers to the collection, elaboration and visualization of personal health data through ubiquitous computing tools such as mobile devices and wearable sensors. Here, we describe the design of a mobile self-tracking platform that has been specifically designed for clinical and research applications in the field of mental health. The smartphone-based application allows collecting a) self-reported feelings and activities from preprogrammed questionnaires; b) electrocardiographic (ECG) data from a wireless sensor platform worn by the user; c) movement activity information obtained from a tri-axis accelerometer embedded in the wearable platform. Physiological signals are further processed by the application and stored on the smartphone's memory. The mobile data collection platform is free and released under an open source licence to allow wider adoption by the research community (download at: http://sourceforge.net/projects/psychlog/).

Andrea Gaggioli

EEG Alpha Asymmetry in Virtual Environments for the Assessment of Stress-Related Disorders

In this study we consider neurophysiological aspects for the assessment of stress-related disorders. EEG Alpha Asymmetry could represent an effective method to be used in virtual environment. Nonetheless new protocols needs to be defined. In this study we present two perspective methods and a case study.

Giovanni Albani

Virtual Help for Real Surgery: The Case of Awake Surgery

Awake surgery can be highly stressful for patients. In fact, being awake, patients could feel more pressure and to perceive that the environmental demands are taxing or exceed their adaptive abilities. Using coping skills that have been learnt during the virtual experience, patients can reduce their stress and improve their collaboration and - in general - the outcome of the intervention.

Giuseppe Riva

Learning Island: The Development of a Virtual Reality System for the Experiential Training of Stress Management

Psychological Stress occurs when an individual perceives that environmental demands tax or exceed his or her adaptive capacity. Following this view, that underlines the role of the situated experience of the patient in experiencing a stressor, the EU Interstress project is exploring the potential of using Second Life virtual simulation technology to administer a stress management experiential training. The structure of the environment and the contents of the course are described and discussed.

Raphael Rose

Characteristics of a Sample of Graduate Students Interested in Self-Guided, Multimedia, Computer-based Stress Management and Resilience Training

Computer and Internet based behavioral health programs are acceptable and have proven efficacy and may provide an important option in the future for increasing access to evidenced-based behavioral health care. We report on the characteristics of a sample (N = 233) of stressed but otherwise healthy graduate students at UCLA who expressed interest in participating in a self-guided, computer-based stress management and resilience training program that was developed for NASA.

Tomislav Zbozinek

Usefulness and Usability of a Self-Guided, Multimedia, Computer-Based Stress Management And Resilience Training Program

As rated by participants (N = 32), the researchers examined the usefulness and usability of a self-guided, interactive, computer-based stress management and resilience training multimedia computer program. The

program contains evidenced-based stress management techniques (i.e., cognitive-behavioral therapy) that are presented to the user in six weekly sessions. The overall program was rated as very useful (M = 5.78) on a 1-7 Likert scale (1 = Not at all useful, 4 = Moderately useful, and 7 = Extremely useful).

José Mosso Vázquez

3 Virtual Scenarios in 3D for Obesity Treatment in Mexico

We present 3 virtual scenarios to treat obesity in Mexico. In 2010, there were 112,336,538.0 citizens in Mexico country, of which, there were a prevalence of overweight in adults over 20 year of age of 79.9 and 58.8 for obesity. On the other hand, the prevalence in children between 5-11 years of age was 34.6 for overweight and 18.2 for obesity (First place in the worldwide). The scenarios were designed and developed with the proposal to show and teach patients how the human mind works, how the brain works and how to select Mexican and typically food for well being because we consider that the lack of education of well being is the origin in the majority of the cases of Obesity in Mexico. Therefore, the treatment of obesity is an intensive education but in a virtual world, picking up knowledge of basic education until neuroscience concepts. Our results, like so much in our first patients, because the scenarios are developed in an immersive environment and with typical food and easy concepts.

Physical Rehabilitation

Stepan Obdrzalek

Real-Time Human Pose Detection and Tracking for Tele-Rehabilitation in Virtual Reality

We present the real-time algorithm for human pose detection and tracking from vision-based 3D data for tele-rehabilitation in virtual environments. We employ stereo camera(s) to capture 3D avatar of geographically dislocated patient and therapist in real-time, while sending the data remotely and displaying it in a virtual scene. The pose detection and tracking algorithm extracts the kinematic parameters from each participant and determines the pose similarity. The pose similarity score is used to quantify patient's performance and provide real-time feedback for remote rehabilitation.

Timothy Judkins

Development of a Virtual Therapist for Exercise Motivation for Smart Phones

After brain injury, many patients have emotional and motivational problems that impede their rehabilitation. There is a need for methods to provide motivation for these individuals, both at home and in the clinic, to keep patients engaged in therapy. Here, we present an innovative Personal Affective Therapist for Rehabilitation of Individuals with Cognitive ImpAirments (PATRICIA) that provides motivation and encouragement for exercise.

Alvaro Uribe Quevedo

3DUI Assisted Lower and Upper Member Therapy

3DUIs have recently become popular as they allow more immersive experiences enhancing the user interaction by taking advantage of human anatomy. As developers and researchers have become aware of the potential of these interfaces outside the gaming environment, their interest has turned to develop applications in medicine by enhancing user experience while aiding the therapy process in controlled and monitored environments. Using mainstream 3DUIs available in the market, this work presents the development of virtual environment and its navigation through captured gestures for assisting lower and upper member motion therapy.

Sensors

Robert Tan

Conductometric Catheter-Mounted Pressure Sensor

A novel pressure sensor designed to be implanted via catheterization has been developed. This new design measures the conductance of salt water contained in an elastic silicone tube. As pressure is applied to the sensor, a region of the silicone tubing is collapsed, changing the dimensions of the tubing and electrical resistance.

Plasma Medicine

Magesh Thiyagarajan

THP-1 Leukemia Cancer Treatment Using a Portable Plasma Device

This research study examined the effect of non-thermal portable atmospheric air plasma system on leukemia cancer cells. Acute monocytic leukemia cells (THP-1)

were exposed to atmospheric pressure non-thermal plasma. To assess death caused by plasma exposure, cells were subjected to trypan blue exclusion assays and a kill-curve and assessment of death overtime were compiled using data from the assays. In addition to this, DNA was harvested from treated and untreated samples to determine if apoptotic ladders were present. Results have indicated that non-thermal plasma can cause cell death in THP-1 cells overtime, and the death that occurs corresponds directly to the amount of time that the cells were exposed to ionized plasma. Preliminary fluorescent imaging of the treated cells revealed that higher treatment doses are not only more likely to induce cellular death but are likely to induce necrotic death, while lower treatment doses that are capable of inducing death may induce apoptotic or programmed cellular death. Ideally the results obtained from these experiments will allow for further investigation of the effects of ionized non-thermal plasma on melanoma cell lines and will lead to an inexpensive method for treating early stage skin cancer and cancerous lesions.

Magesh Thiyagarajan

Portable Plasma Medical Device for Infection Treatment

The purpose of this study was to determine the effects of plasma treatment on bacteria in liquid phases. We predict that the plasma gas can penetrate the liquid culture media and plasma treatment will efficiently kill the bacteria at unique time and distance parameters. It is also hypothesized that less stringent plasma treatment will negatively affect the growth rate of some species of bacteria and possibly their pathogenicity. The bacteria were exposed to hot and cold plasma at various time lengths and distance parameters. Our results indicated that 2 minutes of hot plasma treatment with the plasma torch 5 cm away from the liquid culture is effective in killing/sterilizing cultures of S. aureus, S. pyogenes, Salmonella spp, N. meningitidis, and E. coli. Five minutes of cold plasma with the probe immersed 1-2 cm inside the liquid culture were needed to kill the bacteria. The portable nonthermal plasma system can be used for infection treatment and wound healing applications affected by the microbes studied in this research.

University of Nebraska Research Projects (Group One)

Mary Bernhagen

Telementoring for Airway Management Between a Far Forward Special Operations Location to a Major Medical Center Using Inexpensive Telemedicine Solutions

Critically ill patients in remote settings have limited access to specialized care. Telemedicine / telementoring can improve access to quality care, although VTC equipment is costly. This study showed that an inexpensive internet telecom software program can be effectively employed in the intubation training of a remote trainee.

Ben Boedeker

Virtual Intubation Training at a Remote Military Site

To provide medical support to the far forward battlefield, training in advanced medical technologies is essential for military healthcare providers. To meet this challenge, the use of modern video communication technologies and novel medical devices can be implemented. This study demonstrates the combined use of modern video conferencing technology and video laryngoscopy equipment in the virtual laryngoscopy training of deployed military medical personnel.

David Boedeker

Development of Medical Engagement Training Toolkits to Support Special Operations Military Assistance Programs in Austere Environments

The Medical Seminar (MEDSEM) is a medical operation that shares culturally appropriate medical information with a defined indigenous population based upon a "train the trainer" concept. This work describes the development of a hand washing training toolkit designed to support a MEDSEM action in Afghanistan.

Nikola Miljkovic

Use of a Cardiac Algorithm in a Preoperative Evaluation Clinic-A Pilot Study

The preoperative evaluation is vital in providing information to reduce the risks associated with the anesthesia

and surgery and improve the quality of care. In the VA Nebraska-Western Iowa Health Care System, we introduced a computer-based cardiac algorithm as part of the preoperative evaluation software. Following the pre-op examination and use of the algorithm, the provider completed a survey regarding their perceived usefulness of the algorithm software. The survey results showed that effective preoperative evaluation can be performed using a preoperative evaluation clinic, users are receptive to the computer-based format and, in most cases, prefer to have the algorithm software available for use in preoperative assessment.

Thomas Nicholas

Dept Anesthesiology, Univ of Nebraska Med Ctr

Performance Comparison of Laryngoscopy and Suction Techniques in a Hemorrhagic Airway Manikin Simulator: Direct Laryngoscopy with Yankauer vs. Storz CMAC with Attached Suction Tip

Airway management of the hemorrhagic airway can be a difficult skill to master as trainee exposure to this difficult airway may be limited. In this study, we employed a hemorrhagic airway simulator along with a videolaryngoscope and the Storz Boedker-Doerges (BD) suction blade. These devices provided improved intubation performance in this model with respect to traditional direct laryngoscope (DL) and VL blades. This study shows that use of a hemorrhagic simulator could be an effective and valuable training tool in difficult airway intubation training.

Steven Schmidt

A Comparison of an Integrated Suction Blade versus a Traditional Videolaryngoscope Blade in the Endotracheal Intubation of a Hemorrhagic Cadaver Model - A Pilot Study

In this pilot study, we evaluated two types of videolaryngoscope blades (integrated suction vs. traditional) with the Storz CMAC videolaryngoscope in intubating a lightly embalmed hemorrhagic cadaver model. No significant differences were found between the devices in the success rates for the intubations. Subjects indicated a preference for the integrated suction blade in hemorrhagic airway intubation.

Friday's Presentation Summaries

FRIDAY Morning, February 10
PLENARY SESSION

Heinz Lemke

The Digital Operating Room - Present and Future

Based on current research and development activities, a timeline with five stages of maturity levels for the Digital Operating Room (DOR) during the first quarter of the twenty-first century will be outlined.

In particular, there are several areas of technology development for the DOR such as (1) Devices, including signal detection and recording, robotics, guidance systems and simulation technologies, which allow precision in the delivery of personalized operative healthcare; (2) IT Infrastructure and Standards, including DICOM, IHE, EMR, and Therapy Imaging and Model Management System (TIMMS) infrastructure for the storage, integration, processing and transmission of patient specific data; and (3) Functionalities, including specific interventional processes, patient specific modelling, optimization of surgical workflow as well as TIMMS engines and repositories. Each of these areas is following its own characteristic development and validation cycle and methods. For an overall systematic assessment of clinical pay-off and supporting benefits of the DOR, including on how to further improve the clinical impact of interventional procedures, international and interdisciplinary cooperation is essential and called for.

Robert Hester

HumMod, A Multilevel Mathematical of Human Physiology for Medical Training

We have developed HumMod, a time-dependent model of integrative human physiology, comprised of 5000 variables describing cardiovascular, respiratory, renal, neural, endocrine, and metabolic physiology. The model is constructed from empirical data obtained from peer-reviewed literature. The quantitative physiological relationships are described in Extensible Markup Language (XML) files. The XML description of physiology in HumMod's modeling environment allows users to easily add or change detailed descriptions of human physiology. The model accurately predicts both qualitative and quantitative changes in clinical and experimental responses. Users can simulate different physiological and pathophysiological situations by interactively altering numerical parameters and viewing time-dependent responses. We have developed both a standalone version of Hummod, along with a modular version of HumMod designed to interact with external software/hardware, such as virtual worlds, avatars, or mannequins. HumMod provides a multilevel modeling environment to understand the complex interactions of integrative physiology.

Leslie Saxon

The Future of Body Computing

There are more than 5 billion mobile phone subscribers worldwide. The rapid and continuing rise of mobile phone penetration around the world means that there is now the opportunity to place a medical diagnostic and communications tool in the hands of nearly everyone on the planet, making patient-to-physician discourse more efficient, and less paternalistic. "Body Computing," or networked medicine, describes wireless devices (including medical devices and smart phones) that can continuously transmit real-time physiologic data to physicians, patients, and caregivers. That term has evolved to describe a healthcare model that combines the power of mobile technology, popular consumer electronics, wireless communications, entertainment, social networking, and software engineering to dramatically improve healthcare delivery.

Yunan Chen

Collaborative Work Practices: Challenges and Opportunities for Designing Healthcare IT Systems

Collaborative work is essential in healthcare practices, where doctors, nurses, specialists, caregivers, and many others work together to manage a patient case. Because of this, healthcare IT systems should be designed to support work collaboration and to address certain collaboration intensive tasks, e.g. coordination and communication during patient handoffs. Nevertheless, previous literature has shown that the lack of proper understanding of collaborative behaviors has led to various "misfits" between actual work practices and the system being deployed in healthcare settings. These "misfits" may lead to miscommunication, information loss, inefficiencies, workflow incompatibilities, or even medical errors. My research focuses on using Computer Supported Collaborative Work (CSCW) methodologies to address design issues in the healthcare domain. In this talk, I will describe findings from our ongoing projects in studying Electronic Medical Record (EMR) systems, and discuss how EMRs can be designed to better facilitate collaborative work practices.

FRIDAY Afternoon, February 10
TRACK A

Simulation – Design & Development

W. LeRoy Heinrichs

SBAR 'Flattens the Hierarchy' Among Caregivers

As a young ensign in the US Navy on a nuclear submarine, Doug Bonacum had to brief the captain of the ship following his night-time shift, reporting about potentially dangerous situations that might emerge. He described the "situation, background, assessment, and recommendation". This nascent SBAR communication tool served temporarily to flatten the hierarchy between the ensign and the ship's captain. Years later at KP, Bonacum developed SBAR for facilitating effective conversations between obstetricians and nurses. We implement SBAR to facilitate communication in CliniSpace among caregivers in this 3D immersive, virtual learning environment.

Bryan Bergeron

Distributed Adaptive Simulation Through Standards-Based Integration of Simulators and Adaptive Learning Systems

We have developed a distributed, standards-based architecture that enables simulation and simulator designers to leverage adaptive learning systems. Our approach, which incorporates an electronic competency record, open source LMS, and open source microcontroller hardware, is a low-cost approach to integrating simulators, software-based courseware, and competency-based evaluation systems.

Woojin Ahn

A Framework for Web Browser-Based Medical Simulation Using WebGL

This paper presents a web browser-based software framework that provides accessibility, portability, and platform independence for medical simulation. Typical medical simulation systems are restricted to the underlying platform and device, which limits widespread use. Our framework allows realistic and efficient medical simulation using only the web browser for anytime anywhere access using a variety of platforms ranging from desktop PCs to tablets. The framework consists of visualization, simulation, and hardware integration modules that are fundamental components for multimodal interactive simulation. Benchmark tests are performed to validate the rendering and computing performance of our framework with latest web browsers including Chrome and Firefox. The results are quite promising opening up the possibility of developing web-based medical simulation technology.

Lawrence Salud

Clinical Examination Simulation: Getting to Real

Verschuren and Hartog's six-stage methodology for design-oriented research is a process that is ideally suited to the development of artifacts that meet a desired outcome. We discuss the methodology and its relevance to simulation development for establishing a wide variety of realistic models that can be used for assessment.

Joseph Samosky

BodyWindows: Enhancing a Mannequin with Projective Augmented Reality for Exploring Anatomy, Physiology and Medical Procedures

Augmented reality offers the potential to radically extend and enhance the capabilities of physical medical simulators such as full-body mannequin trainers. We have developed a system that transforms the surface of a mannequin simulator into both a display screen and an input device. The BodyWindows system enables a user to open, size and reposition multiple viewports onto the simulator body. We demonstrate a dynamic viewport that displays a beating heart, and such viewports could be used to display real-time physiological responses to interventions the user applies to the mannequin, such as injection of a simulated drug. Viewport windows can be overlapping and show anatomy at different depths, creating the illusion of "cutting" multiple windows into the body to reveal structures at different depths from the surface. We employ a low-cost interface based on an IR light pen and the Nintendo Wiimote. We also report experiments using the Microsoft Kinect computer vision sensor to provide a completely hand-gesture based interface.

Jason Kutarnia

Generation of 3D Ultrasound Training Volumes from Freehand Acquired Data

We have developed a low cost ultrasound training system running on a laptop in which the user scans a 3D model of the patient using a 5 DoF sensor. A critical component of this system is the generation of ultrasound training volumes, which need to cover a complete body region in order to provide a realistic scan-

ning experience. This research attempts to develop stitching techniques to generate large global volumes from smaller overlapping volumes acquired using free-hand techniques.

Bill Kapralos

Developing Effective Serious Games: The Effect of Background Sound on Visual Fidelity Perception with Varying Texture Resolution

Despite the benefits associated with virtual learning environments and serious games and their gaining popularity, there are open, fundamental issues regarding simulation fidelity and multi-modal cue interaction and their affect on immersion, transfer of knowledge, and retention. Here we describe the results of a study that examined the effect of background sound on our perception of visual fidelity defined with respect to texture resolution. Results indicate that the perception of visual fidelity is dependent on ambient (background sound) and more specifically, white noise can have detrimental effects on our perception of high quality images. This study is part of a larger effort in developing an understanding of virtual environment fidelity, multi-modal interactions, user-specific factors and their effect on knowledge transfer and retention.

Don Stredney

Virtual Simulation of Mouse Anatomy and Procedural Techniques

Translational science requires the use of mouse models for the characterization of disease and evaluation of treatment therapies. However, often there is a lack of comprehensive training for scientists in the systemic and regional anatomy of the mouse that limits their ability to perform studies involving complex interventional procedures. We present our methodologies for the development, evaluation, and dissemination of an interactive 3D mouse atlas that includes designs for presenting emulation of procedural technique. We present the novel integration of super-resolution imaging techniques, depth-of-field interactive volume rendering of large data, and the seamless delivery of remote visualization and interaction to thin clients.

Diego Rivera-Gutierrez

Shader Lamps Virtual Patients: the Physical Manifestation of Virtual Patients

We introduce the notion of Shader Lamps Virtual Patients (SLVP)—the combination of projector-based Shader Lamps Avatars and interactive virtual humans. This paradigm uses Shader Lamps Avatars technology to give a 3D physical presence to conversational virtual humans, improving their social interactivity and enabling them to share the physical space with the user. The paradigm scales naturally to multiple viewers, allowing for scenarios where an instructor and multiple students are involved in the training. We have developed a physical-virtual patient for medical students to conduct ophthalmic exams, in an interactive training experience. In this experience, the trainee practices multiple skills simultaneously, including using a surrogate optical instrument in front of a physical head, conversing with the patient about his fears, observing realistic head motion, and practicing patient safety. Here we present a prototype system and results from a preliminary formative evaluation of the system.

Betty Mohler

Enhancing Medical Communication Training Using Motion Capture, Perspective Taking and Virtual Reality

The aim of many medical training centers is to increase the effectiveness of medical training simulations by helping trainees gain a better understanding of the importance of communication and teamwork. This work presents the first steps towards developing an on-line application to improve medical training effectiveness. We captured two scenarios – one with students and one with practitioners to produce both an immersive virtual environment and an on-line application. Our application enables trainees to view the scenario from different perspectives or to freely explore the environment. We aim to integrate it into the medical student curriculum at the University of Tuebingen.

Yunhe Shen

Virtual Trainer for Intra-Detrusor Injection of Botulinum Toxin to Treat Urinary Incontinence

Here we introduce a new virtual reality (VR) based simulation system for training the urological procedure of intra-detrusor botulinum toxin (Botox®) injections into the bladder. 6 cases with different bladder anatomy and 3 subtasks are included in the curriculum; this design is guided by several expert urologists according to clinical needs and experience. These virtual bladder models can be deformed by a cystoscope model or penetrated by a needle model. Data of location and dose per injection are collected during the training. After compared among various options, magnetic motion-tracking devices are chosen and integrated onto replicas of cystoscopic instruments as the VR interface for the specific operation. A web/database based learning management platform (LMP) is developed for online data access and validation studies of the training system.

Tansel Halic

A Resource Management Tool for Real-Time Multimodal Surgical Simulation

The development of a multimodal surgical simulation is a very complex and challenging task. A typical surgical simulation involves several components such as physics engine, visual engine, haptic rendering etc. Since different modalities and user interactions introduce real-time constraints, the software framework has to optimize both the hardware and software resources to achieve high performance. In this work, we introduce a resource management tool that was built into our Software Framework for Multimodal Interactive Simulations (SoFMISTM) [1] to adaptively manage computational resource at run-time for varying computational loads. We present several benchmark test results to validate and demonstrate the capabilities of the resource management tool. Our results show that our framework successfully utilized the hardware resources and improved the performance of the overall simulation under varying computational load.

Florian Beier

Inst for Computational Medicine, Univ of Heidelberg

An Aneurysm Clipping Training Module for the Neurosurgical Training Simulator NeuroSim

Having introduced NeuroSim, the prototype of a neurosurgical training simulator at MMVR18, we present our first medical training module. NeuroSim is based on virtual reality and uses real-time algorithms for simulating tissue. It provides a native interface by using a real surgical microscope and original instruments. Having implemented some abstract tasks to train basic skills like hand-eye coordination or the handling of the microscope last year, we now present a medical module where an aneurysm has to be clipped. NeuroSim has been developed in cooperation with the neurosurgical clinic of the University of Heidelberg and VRmagic GmbH in Mannheim.

FRIDAY Afternoon, February 10
TRACK B

Imaging, Visualization & Navigation

Cristian Linte

Augmented Environments for Minimally Invasive Therapy: Implementation Barriers from Technology to Practice

Virtual and augmented environments for medical applications have been explored and developed over the past three decades in an effort to facilitate the performance of minimally invasive procedures. These environments must faithfully represent the real surgical field and require seamless integration of pre- and intra-operative imaging, surgical tracking and display technology into a common framework registered to the patient. However, in spite of their reported benefits, few mixed reality environments have been successfully translated into clinical use. Several challenges that contribute to the slow progress of integrating these environments into clinical practice are presented here and discussed in terms of both technical and clinical limitations. This article should raise awareness among both developers and end-users toward facilitating a greater presence of such environments into the operating rooms of the future.

Jannick Rolland

Virtual Skin Biopsy with Gabor Domain Optical Coherence Microscopy

We report in-vivo volumetric optical coherence microscopy images of the skin, with resolution at the cellular level. With resolution of 2 mm both laterally and axially, structures below the skin as deep as 1 mm may be imaged at various anatomic locations. Custom optical instrumentation was designed, built, and integrated to achieve this unprecedented optical imaging resolution, in three dimensions, at clinically feasible configuration and speed.

Naoki Suzuki

System Development for Unrestrictive View and 4D Shape Acquisition in Abdominal Cavity Operation using Virtual Space

Laparoscopic surgery has been used for various areas of abdominal cavity. However, the laparoscope has limitation of its field of view and mobility. Our aim is to

develop a new video camera system that acquires multiple viewpoints in the abdominal cavity. We designed a camera array that consisted of eight small camera modules. The camera array can change its shape so that it can be inserted into the abdominal cavity through trocar. Surgeon can change the viewpoint by switching camera output without physically moving the camera. Using eight camera's images, we also tried to reconstruct 3D textured shape of the surgery field.

Juan Antonio Solves Llorens

MRI Skin Segmentation for the Virtual Deformation of the Breast under Mammographic Compression

Breast Magnetic Resonance Image skin has similar intensity levels than dense tissue, and may produce segmentation errors if not managed correctly. In this work a novel skin segmentation method is presented and validated by experts, aimed to obtain as many pixels belonging to the real skin as possible. Segmented skin will be used to build a breast biomechanical model to register X-Ray Images with Magnetic Resonance Images in the future, using a virtually deformed Magnetic Resonance Image.

David Bouget

Surgical Tools Recognition and Pupil Segmentation for Cataract Surgical Process Modeling

In image-guided surgery, a new generation of Computer-Assisted-Surgical (CAS) systems based on information from the Operating Room (OR) has recently been developed to improve situation awareness in the OR. Our main project is to develop an application-dependant framework able to extract high-level tasks (surgical phases) using microscope videos data only. In this paper, we present two methods: one method to segment the pupil and one to extract and recognize surgical tools. We show how both methods improve the accuracy of the framework for analysis of cataract surgery videos, to detect eight surgical phases.

Sean Chen

Augmented Reality Visualization for Guidance in Neurovascular Surgery

In neurovascular surgery, and in particular surgery for arteriovenous malformations (AVMs), the surgeon must map pre-operative images to the patient on operating room (OR) table in order to understand the topology and locations of vessels below the visible surface. This type of spatial mapping is not trivial, is time consuming, and may be prone to error. Using augmented virtuality (AV) we can register the microscope/camera image to pre-operative patient data in order to show the surgeon vessels and information which lie below the visible surface of the patient. In this work we describe a prototype system, developed using open source software and built with off-the-shelf hardware, for AV visualization for AVM neurosurgery.

Sushravya Raghunath

Detail-on-Demand Visualization for Lean Understanding of Lung Abnormalities

In some respects, the lung is an anatomical bog- having limited referential landmarks. Nonetheless, precise understanding of the abnormalities that inflict this organ is crucial to effective clinical diagnosis and treatment. However, wading interactively through a three-dimensional scan of the lung poses a visual quagmire to the radiologist, resulting in significant interpretive differences due to inter and intra observer variation. Despite the continuing progress in quantitative imaging, lack of unambiguous visualization with accurately, relevant cues severely hinders the clinical adoption of many computational tools. We address this unmet need through a lean visualization paradigm wherein information is presented hierarchically to provide an interactive macro-to-micro view of lung pathologies. At the macro level, the structural and functional information is summarized into a synoptic glyph that is readily interpreted and correlated to a priori known disease states. The glyphs are "patho-spatio-temporally" tagged to facilitate navigation through the level-of-detail scales, down to the micro level values in the image voxels, providing quantitative interpretation of tissue type and the confidence level in the quantitation. A novel volume compositing scheme is proposed to specify and guide to the optimal site for surgical lung biopsy. This intuitive, interactive interface for rapid and unambiguous navigation towards the clinical endpoint harnesses the power of bio-informatics technology to provide an efficient, clinically relevant and comprehensive summary of pulmonary disease, including precise location, spatial extent and intrinsic character.

Robotics

Pietro Valdastri

A Novel Surgical Robotic Platform based on Trans-Abdominal Active Magnetic Links

This paper introduces the concept of trans-abdominal active magnetic link, which promises to enable minimally invasive robotic surgery to be accomplished through

a single, 12 mm diameter port in the abdomen. This consists of transferring controlled motion to surgical tools across the body wall using magnetic fields. An external device will change the magnetic field from the outside of the patient's skin, thereby causing magnetically coupled surgical tools to move inside the body. Possible solutions are described and their performances are compared by means of simulations and bench testing.

Tim Beyl

Haptic Feedback in OP:Sense - Augmented Reality in Telemanipulated Robotic Surgery

In current research, haptic feedback in robot assisted interventions plays an important role. However most approaches to haptic feedback only regard the mapping of the current forces at the surgical instrument to the haptic input devices, whereas surgeons demand a combination of medical imaging and telemanipulated robotic setups. In this paper we describe how this feature is integrated in our a robotic research platform OP:Sense. The proposed method allows the automatic transfer of segmented imaging data to the haptic renderer and therefore allows to enriches the haptic feedback with virtual fixtures based on imaging data. Anatomical structures are extracted from pre-operative generated medical images or virtual walls are defined by the surgeon inside the imaging data. Combining real forces with virtual fixtures can guide the surgeon to the regions of interest as well as helps to prevent the risk of damage critical structures inside the patient. We believe that the combination of medical imaging and telemanipulation is a crucial step for the next generation of MIRS-systems.

Diagnostic & Therapeutic Tools

Shyam Natarajan

A Transurethral Catheter-based Ultrasound System for Multi-Modal Fusion

Current methods of prostate cancer diagnosis and therapy rely on accurate imaging of the prostate using real-time ultrasound. Transurethral ultrasound (TUUS) may improve upon the current gold standard through improved 3D visualization and co-registration (fusion) with CT and MRI. A prototype transurethral ultrasound (TUUS) catheter-based transducer array and system was developed, featuring 32 elements with a diameter of 18F (6mm). A robust, multi-channel ultrasound transceiver was also developed to enable TUUS imaging using pulse-echo and frequency-based signal processing methods. A final system will be suitable for prostate diagnosis and therapy applications using multi-modal image fusion.

Qian Zhao

A Decision Fusion Strategy for Polyp Detection in Capsule Endoscopy

Wireless capsule endoscopy (CE) is now routinely used for non-invasive diagnosis of small bowel diseases. But, it still requires manual assessment of the approximately 50,000 studies images. Literature has therefore investigated the means to automatically detect and analyze various anomalies in CE images to improve reading efficiency and reduce variability. We propose such a computer aided diagnosis (CAD) approach to detect small bowel polyps. For supervised classification of polyps, we investigate fusion of multiple classifiers using color, texture and edge features. The combined AdaBoost classifier, evaluated using 1200 CE images, outperformed individual classifiers and achieved a _90% classification accuracy.

Evin Gultepe

Thermo-Responsive, Tetherless Microsurgical Tools

Medical procedures have evolved from invasive to minimally invasive techniques while the ultimate goal is non-invasive surgery. We purpose a step in this direction by the creation and utilization of sub-millimeter scale tools, microgrippers, that close autonomously in response to body temperature. The microgrippers have been used to perform both ex vivo and in vivo biopsy tasks. The highlights of this technique are that the microgrippers can be fabricated and actuated en masse, are small enough to pass through standard surgical catheters and hard to reach places in the body, can be designed with sharp tips strong enough for tissue excision, can be magnetically guided without the need for any wires or tethers to complete the task.

Amit Mulgaonkar

A Prototype Stimulator System for Noninvasive Low Intensity Focused Ultrasound Delivery

A prototype Low Intensity Focused Ultrasound (LIFU) stimulator system for non-invasive neuromodulation in a large animal model was developed and tested. We have conducted a feasibility study on a Göttingen minipig, demonstrating reversible, targeted transcranial neuromodulation. The hypothalamus of the minipig was repeatedly stimulated with LIFU which evoked temporally correlated increases in both heart rate and blood pressure.

FRIDAY POSTERS

Imaging, Visualization & Navigation

Jay Carlson

A Compact High-Definition Low-Cost Digital Stereoscopic Video Camera for Rapid Robotic Surgery Development

Robotic surgical systems require vision feedback systems, which often consist of low-resolution, expensive, single-imager analog cameras. These systems are extended to three dimensions by simply doubling the cameras and outboard control units, and feeding the video streams into a 3D display. This paper presents a fully-integrated digital stereoscopic imaging system employing high-definition sensors and a class-compliant USB video interface. This system can be used with low-cost PC hardware, and consumer-level 3D display for tele-medical surgical applications including military medical support, disaster relief, and space exploration.

Ali Soroush

Design and Implementation of an Improved Real-Time Tracking System for Navigation Surgery Using the Fusion of Optical and Inertial Tracking Methods

The fusion of the optical and inertial tracking systems seems an attractive solution to solve the shadowing problem of the optical tracking systems, and remove the time integration troubles of the inertial sensors. We developed a fusion algorithm for this purpose, based on the Kalman filter, and examined its efficacy to improve the position and orientation data, obtained by each individual system. Experimental results indicated that the proposed fusion algorithm could effectively estimate the 2 seconds missing data of the optical tracker.

Karl Krissian

AMILab Software: Medical Image Analysis, Processing and Visualization

AMILab is a free software for image analysis, pro- cessing and visualization. It provides convenient visualization tools for 2D and 3D images and it is highly extensible through its own scripting language. We describe the main visualization features and the scripting language of AMILab. The software includes an automatic C++ wrapping system which permits fast development of new visualization tools and image processing algorithms

Oliver Burgert

Multi-Dimensional Presentation State - Towards a DICOM Mechanism for Consistent Presentation of Higher Dimensional Medical Imaging Data

Multi-dimensional patient data, such as time varying volume data, data of different imaging modalities, surface segmentations etc. are of growing importance in the clinical routine. For many use cases, it is of major importance to replicate a certain visualization of a data set created on one machine on a different computer using different software tools. Up until now, there exists no standardized methodology for this consistent presentation. We propose an extension of the Digital Imaging und Communications in Medicine (DICOM) called "Multi-dimensional Presentation State" and outline scope and first results of the standardization process.

Andoni Beristain

Volume Visual Attention Maps (VVAM) in Ray-Casting Rendering

This paper presents an extension of visual attention maps into 3D, where eye fixation points become cylinders, and the visual attention map becomes a volume. This Volume Visual Attention Map (VVAM) is used to dynamically enhance ray-casting based direct volume rendering visualization online. The practical application of this idea into the biomedical image visualization field is explored for interactive visualization.

Anderson Maciel

Anatomic Hepatectomy Planning through Mobile Display Visualization and Interaction

Anatomic hepatectomies are resections in which compromised segments or sectors of the liver are extracted according to the topological structure of its vascular elements. While medical images are fundamental in the surgery planning procedure, the process of analysis of such images slice-by-slice is still tedious and inefficient. In this work we propose a strategy to efficiently and semi-automatically segment and classify patient-specific liver models in 3D through a mobile display device. With such strategy, the exploration of the internal anatomy occurs directly on the surface of the real body as if the doctor had "X-ray vision". The method is based on volume visualization of standard CT datasets and allows accurate estimation of functional remaining liver volume. Experiments showing effectiveness of the method are presented, and quantitative and qualitative results are discussed.

Karl-Hans Englmeier

A New Heterogeneity Analysis Method for Comparison of DCE-MRI Time Curves in Breast Tumors for Therapy Monitoring

The signal curves in perfusion dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) of breast tumors give us valuable information about tumor angiogenesis. We introduce a new similarity measure which takes the pattern of the signal curves into account. The introduced method is evaluated on 15 DCE-MRI breast datasets of different kinds of tumors. The evaluation shows a significantly better performance of the new similarity measure. Therefore Clustering of DCE-MRI gives us information about how many different signal curves are present in a tumor. This information helps the estimation of the number of compartments and the complexity of the tumor system and can be used during image-guided monitoring during therapy.

Mathias Hofer

Potential of the Navigated Controlled Surgery at the Lateral Skull Base with the Navigated Control Unit (NCU 2.0)

Segmentation for navigated control was in the first generation very time consuming. In the present version (NCU 2.0) the risk structure is segmented (instead of the work space), this leads to an enormous decrease in preparation time. In additional, new safety functions were integrated. The segmentation feasibility was tested on patient data and proved to be successful. The automatic stop function was tested on petrous bone models and showed no damage to the facial nerve.

Constantinos Loukas

Visual Tracking of Laparoscopic Instruments in a Hough Space

This paper describes an approach to tracking laparoscopic instruments based solely on visual information. The two edges of the linear instrument are identified as maxima within a scalable search window in the Hough space. For each new frame the window is moved according to the velocity of the instrument identified in the previous frame. The computational cost of the Hough transform is further reduced by considering edge features inside a mask determined by the search window. The technique has been successfully applied in sequences of a simulation task and a surgical procedure.

Surgical Simulation – Design & Development

Sergei Kurenov

Enhanced Tissue Interaction For Robotic Surgery Simulation

We enhance support for advanced tissue interaction in robotic surgery simulation, for essential actions such as grabbing, cutting and cauterizing as well as maneuvering techniques such as lifting organs and holding in place. The approach leverages an extension of the opensource BulletPhysics package to model collision detec- tion and interact with deformable bodies.

Lauren Davis

Computer Aided Design as a Tool for Development of a Neonatal Chest Tube Simulator

Various complications can be caused by improper chest tube insertion on neonates. However, the only way to learn this skill is to practice when the opportunity is presented in the neonatal intensive care unit or emergency department. A simulation device for chest tube placement is one way that complications can be averted while teaching the procedure. The model that was developed simulates a term neonate. A model with this capability does not currently exist. Using the neonatal chest tube simulator, medical professionals and students can practice placing a chest tube, emergency needle thoracentesis, and removing fluid in the pleural space, before attempting the procedure clinically.

Asaki Hattori

Training System for NOTES and SPS Surgery Robot that Enables Spatiotemporal Retrospective Analysis of the Training Process

Within the digestive organ surgery robot R&D project, our research team aims to develop a surgical robot training device with an interface identical to that of the actual device. The training device uses an organ model that changes shape in real time to train operators to grab, cut open, and cut off soft tissues and close wounds using the actual device. To increase the effectiveness of the training device, we added functions to save the movements of the robot in training and changes in the operation field. By recreating the situation during training, we were able to analyze in four dimensions (4D) various changes in the operation field that the operator cannot see during training. This new function not only enabled us to analyze the contents of the training in detail, but also to report any problems in development and design of the actual device.

Oliver Schuppe

An Optical Tracking System for a Microsurgical Training Simulator

Nowadays, medical training simulators based on virtual reality are used in various fields of application. To achieve a high degree of immersion, a realistic and native user interface is needed. We implemented an optical tracking system in order to track original instruments in a microsurgical training simulator. Two different approaches are presented: In a marker-based setup, the forceps have to be equipped with markers. As a step towards a markerless tracking system, an approach with a partly coloured forceps is presented. Both methods were implemented and resulted in working real-time tracking modules.

Magnus Eriksson

A 6 Degrees-of-Freedom Haptic Milling Simulator for Surgical Training of Vertebral Operations

In the research presented here, the aim has been to develop a new kind of haptic milling simulator that will be used in curriculum for surgical training of vertebral operations. One central goal has been to create a simulator where the user interaction gives a realistic impression due to the milling process of virtual modeled bone tissue.

Aaron Oliker

Step-Based Cognitive Virtual Surgery Simulation: An Innovative Approach to Surgical Education

BioDigital Systems, LLC in collaboration with New York University Langone Medical Center Department of Reconstructive Plastic Surgery has created a complex, real-time, step-based simulation platform for plastic surgery education. These simulators combine live surgical footage, interactive 3D visualization, text labels, and voiceover as well as a high-yield, expert-approved testing mode to create a comprehensive virtual educational environment for the plastic surgery resident or physician.

Vishal Patel

Multi-User Trauma Patient Scenario in Virtual Worlds

Trauma is a major cause of morbidity and mortality worldwide. Healthcare professionals treating trauma patients may benefit from low-cost, accessible, reproducible virtual environments in which to train. We describe the methodology and results of a study to determine the feasibility of low-cost virtual worlds to provide a suitable environment for training and assessment of UK-based trauma teams.

Vishal Patel

Virtual Worlds are an Innovative Tool for Medical Device Training in a Simulated Environment

Medical infusion devices are an integral component within the delivery of healthcare management. The aim of this study was to develop a training simulation in the virtual world of Second Life‰ for the management of adverse events associated with infusion devices. Forty nurses were subsequently recruited to participate within the simulation and assess its feasibility.

Vishal Patel

The Application of an Interactive Virtual World Simulation for Evaluation of the Handoff Process in Healthcare

Handoff is a principal component of healthcare communication. This study sought to evaluate the impact of handoff quality and its effect on subsequent patient assessment and management through the use of virtual patients with surgical pathology in Second Life‰.

Ganesh Sankaranarayanan

ToolTrackTM: A Compact, Low-Cost System for Measuring Surgical Tool Motion

Accurate measurement of tool motion in minimally invasive procedures is an essential component of proficiency assessment. This is particularly important to automate the scoring procedures in, e.g., the Fundamentals of Laparoscopic Surgery (FLS) trainer box. Existing techniques are bulky, require extensive modifications to the surgical tool or trocar mechanism and are expensive. In this work, we propose a new system - the ToolTrackTM consisting of an optical mouse sensor and a MEMS inertial unit that can be easily integrated with any laparoscopic tool, provide accurate and reliable sensing, is light weight and low cost.

Ganesh Sankaranarayanan

Use of a Linear Motion Stroke Potentiometer as a High Precision Sensor for Linear Translation in a Laparoscopic Ligating Loop Simulation

The Virtual Basic Laparoscopic Skills Trainer (VBLaST) is a virtual reality trainer that replicates the Fundamentals of Laparoscopic Surgery (FLS) tasks for training in minimally invasive surgery. For the ligation loop task, we have developed a novel hardware interface using a linear motion stroke potentiometer to accurately sense the linear translation of the ligation loop and a mechanism to attach the tool interface to a PHANToM Omni for

force feedback. Testing shows that the interface provided a realistic feel and control of the loop similar to the endoloop device used in FLS ligation loop task.

Surgical Simulation Metrics

Chun-Kai Huang

Investigating the Muscle Activities of Performing Surgical Training Tasks a Using Virtual Simulator

The objective of this study was to determine the muscle activities of upper extremity while performing fundamental surgical training tasks. Six subjects performed virtual cutting tasks and their muscle activities of upper extremity were measured. The results demonstrated a significant increase in muscle activities in both proximal and distal parts of upper extremity, which are the common areas of occurrence of injury after prolonged practice. This study suggests that both shoulder complex and upper extremity are essential prime movers to perform surgical training tasks. Muscles in both areas should be monitored for performance assessment in future studies.

Marie-Eve LeBel

Creating a Representative Map for Arthroscopy Simulation

The goal of this research was to create accurate task decompositions for arthroscopic shoulder and knee procedures. The methodology used has previously shown to be effective in other minimally invasive surgeries. Future research will integrate these task decompositions into surgical simulators and, along with movement and force data, will help create evaluation tools for surgical students.

Arun Nemani

Automated Real Time Peg and Tool Detection for the FLS Trainer Box

This study proposes a method that effectively tracks trocar tool and peg positions in real time to allow real time assessment of the peg transfer task of the Fundamentals of Laparoscopic Surgery (FLS). By utilizing custom code along with OpenCV libraries, tool and peg positions can be accurately tracked without altering the original setup conditions of the FLS trainer box. This is achieved via a series of image filtration sequences, thresholding functions, and Haar training methods.

Anna Skinner

Assessment of Laparoscopic Surgical Skill Acquisition and Retention

Currently, a need exists for a more comprehensive understanding of the nature of laparoscopic surgical skill acquisition and decay, objective metrics with which to assess these skills over time, and simulation-based training that supports rapid acquisition, longitudinal retention, and targeted retraining for sustainment of these critical and perishable skills. This study examined both traditional and novel metrics of laparoscopic surgical skills, including novel, instrumented glove (iGlove) metrics for PreTest, training, PostTest, and 6-month Follow-up, as well as comparison to expert performance.

Surgical Simulator Validation

Jeffrey Cheung

Evaluation of Tensiometric Assessment as a Measure of Skill Degradation

This pilot study explored the use of tensiometry as a measure of retention of knot tying skills. Medical students learned a one-handed square knot tying technique. Their final performances were video recorded and these videos were uploaded on to an on a website. Students were divided into two groups: an observational learning group that had access to videos before a retention test, and a control group that did not. After a two-week retention period, all students came back and performed one more trial to test the amount of retention of the skill. Tensiometry was used to measure strengths of the knots before and after the retention period. The scores showed no significant difference between the groups ($p>0.308$) or tests ($p>0.737$). We interpret the results to suggest that tensiometry is not sensitive enough to detect degradation in the performance of fundamental clinical skills as they are forgotten after being taught.

Joseph Singapogu

Haptic Tasks for Physical Laparoscopic ("Box") Trainers to Differentiate Surgeon Skill

In this work, we present four tasks primarily testing haptic laparoscopic skill that can be simulated in a conventional box trainer. Results from examining expert surgeon and novice performance on these tasks is presented as evidence that these tasks can be used for training more advanced laparoscopic skill in a box trainer.

John Qualter

Integration of Surgical Simulation in Plastic Surgery Residency Training

BioDigital Systems, LLC in collaboration with New York University Langone Medical Center Department of Reconstructive Plastic Surgery has created an interactive, step-based latissimus musculocutaneous flap simulator. Preliminary testing of fourteen residents (PGY1-6) demonstrates that simulator training results in significant improvement in an objective assessment of surgical knowledge ($p < 0.0006$, pre-training score: 81.0%, post-training score 92.7%). This study is the first in the field of plastic and reconstructive surgery to demonstrate objective improvement in surgical knowledge as a result of simulator training, suggesting the potential effectiveness of simulators for a panopoly of breast reconstruction options.

Haptics

Hannes Bleuler

Haptic Handles for Robotic Surgery

Robotic surgery, i.e. master-slave telemanipulators for surgery, are rapidly developing. One of the key components for these systems is the surgeon's console, and, within the console, especially the "handle" (the "joystick") for manipulation control. We present here two very different haptic (force-feedback) handle designs developed and realized at the LSRO lab and we discuss practical experience, design considerations (ergonomics, usability) and relative merits of both systems, along with some thoughts on significance, incidence on patient safety and patient benefit and future trends in this field. We emphasize the link to cognitive neurosciences pursued in this research.

Liliane dos Santos Machado

An Experimental Study on CHVE's Performance Evaluation

Virtual Reality-based training simulators, with collaborative capabilities, are known to improve the way users interact with one another while learning or improving skills on a given medical procedure. A comprehensive set of interaction devices, like haptic devices, can be used aiming at achieving a higher level of realism and immersion in Collaborative Haptic Virtual Environments (CHVE). Performance evaluation of CHVEs allows us to understand how such systems can work in the Internet, as well as the requirements for multisensorial and real-time data. This work discloses new performance evaluation results for the collaborative module of the CyberMed VR framework.

Timothy Judkins

Development of the KineSys MedSim: A Novel Hands-Free Haptic Robot for Medical Simulation

Many existing force-feedback devices are limited because the user must be attached to the device at all times. There is a need for medical simulators that integrate the cutaneous sensations of direct interaction along with typical kinesthetic feedback in order to provide a complete haptic experience. Here, we present a novel cable-based haptic robot for hands-free simulation of surgical environments.

Robotics

Omid Motlagh

Evaluation of Robot Motion Control Algorithms for Service Robots

There are many control algorithms for reactive navigation of service robots. However, there is no means for evaluation of algorithms in various types of environments. This article presents a novel simulation technique for evaluation of navigation algorithms. A new application of fuzzy cognitive map (FCM) is introduced for imitating motion behaviors of mobile robots. After learning various way-finding behaviors from known trajectories, the trained model is used to anticipate the robot's trajectory in unfamiliar indoor environments. The robot's control algorithm is then evaluated based on its anticipated performance in virtual environments.

Omid Motlagh

A Navigation Algorithm for Service Robots in Cluttered Environments

Service robots have brought convenience to the disabled. Housekeeping robots, e.g., floor cleaners, must be able to handle obstacles while moving toward designated targets. In real life, yet robots face difficulty in maze-like and in very cluttered environment of crammed indoor spaces. This article introduces a new decision mechanism for path planning in indoors e.g., home, and office. A method is presented for implementing sub-goal network together with wall following. Various subroutines are used to direct the robot towards the target while each subroutine has its own sub-goal. Trajectory results are included to evaluate the performance of the algorithm.

Farzam Farahmand

Design of a 4 DOF Laparoscopic Surgery Robot for Manipulation of Large Organs

In this paper, a 4-DOF robotic for tool handling in laparoscopic surgery is introduced. The robot provides sufficient force to handle endoscopic tools used for large organ manipulation and is capable of measuring the tool-tissue forces. The RCM constraint is achieved using a spherical mechanism and roll and insertion motions are provided using time pulley and spindle-drive, respectively. The forward and inverse kinematics of the robot was solved and the dimensions of its links were determined, using particle swarm optimization method, so that the maximum kinematic and dynamic performance could be achieved.

Sergei Kurenov

A Simple Master-Slave Control Mapping Setup to Learn Robot-Assisted Surgery Manipulation

A simple, but yet effective application for learning and testing instrument manipulation of available (and future) master-slave control robot-assisted surgical systems has been created. As an example, the paper describes a simple mapping of da Vinci surgical system master-slave control with two haptic devices acts as the master control.

Tamás Haidegger

Technology Supporting Hand Hygiene Control—Heritage of Semmelweis

Technology is supporting not only interventional medicine, but also patient care, health care management and home attendance. One of the most dynamically emerging areas is hand hygiene control, which spans across all these areas. Medical hand washing and hand rubbing have been shown to have crucial role in reducing Healthcare Associated Infections (HAI) that cause $4–5 B needless expenses every year in the USA and directly responsible for 90 000 deaths. The teaching of effective hand washing is crucial in modern medical education, and special attention should be paid to maintain the right protocol. We tackled the problem of objective evaluation of hand disinfection through digital imaging and image processing. We developed a compact, mobile device in which a picture is taken of the hands, and a software performs the segmentation and clustering automatically. We can derive a synthetic image, once the hand washing procedure had been performed with soap mixed with UV-reflective powder. Based on the image, the exact skin surface of improper treatment can be identified, and then fed back to the user in meaningful visual format. This intuitive solution leads to a higher compliance ratio and a practical way of education. Our group has joined the World Health Organization's (WHO) efforts to promote proper hand hygiene.

Intelligence Networking

José Mosso Vázquez

iPhone G3 for Telemedicine in Emergency Surgery — Report of 46 cases at the HGR No. 25 of the IMSS

We present our experience in Telemedicine using smart phones in 46 emergence surgeries on patients in critical care. All clinical data were send from a surgeon with an iPnohe G3 to anesthesiologists and scrub nurse to prepare on time an adequate endotracheal tube, their equipment for regional o general anesthesia and more over, scrub nurses prepared the room and surgical instruments. The project was developed at the emergence service and the department of Surgery. All surgeries were made on weekends at the Regional Hospital of the Instituto Mexicano del Seguro Social in Mexico City.

Cory Leeson

PleurAlert: An Augmented Chest Drainage System with Electronic Sensing, Automated Alerts and Internet Connectivity

We have enhanced a common medical device, the chest tube drainage container, with electronic sensing of fluid volume, automated detection of critical alarm conditions and the ability to automatically send alert text messages to a nurse's cell phone. The PleurAlert system can graphically display chest tube output over time and provides a simple touch-screen interface. Our design augments a device whose basic functions date back 50 years by adding modern technology to automate and optimize a monitoring process that can be time consuming and inconvenient for nurses. The system may also enhance detection of emergency conditions and speed response time.

University of Nebraska Research Projects (Group Two)

Mary Bernhagen

Using the Battlefield Telemedicine System (BTS) to Train Deployed Medical Personnel in Complicated Medical Tasks – A Proof of Concept

This work describes the use of Adobe Connect software along with algorithm software to provide the necessary audio visual communication platform for telementoring a complex medical procedure to novice providers located at a distant site.

Ben Boedeker

User Preference Comparing a Conventional Videolaryngoscope Blade vs. a Novel Suction Videolaryngoscope Blade in Simulated Hemorrhagic Airway Intubation

The hemorrhagic airway makes visualization during laryngoscopy and intubation difficult. A specially designed videolaryngoscope blade with integrated suction was developed and studied in a simulated hemorrhagic airway at the Omaha VA Medical Center. Results show that, if available, many users would choose to include this new suction device in their standard airway carts due to its "always there" design.

Gail Kuper

Utilization of a Civilian Academic Center as Force Multiplier in Support of NATO Special Operations Medicine – A Pilot Demonstration

This work describes a NATO-university telemedicine collaboration established to perform a teleneurosurgery consult to assist a deployed soldier with a spinal cord injury.

Nikola Miljkovic

Use of a Malleable Bougie and Curved Forceps with Videolaryngoscopy in Airway Management Training in a Cadaver Model– A Pilot Study

The wider angle of view of videolaryngoscopy versus standard direct laryngoscopy requires an assessment of the adjunctive devices used to facilitate intubation. In this study, subjects performed malleable bougie-assisted intubation and curved forceps removal of a glottic foreign body using videolaryngoscopy on a lightly embalmed cadaver and completed a post-procedure questionaire. All subjects valued access to the malleable bougie available at their hospitals and 82% valued access to the curved forceps. Malleable bougie and curved forceps seem well-suited to facilitate videolaryngoscopic airway management.

Jeffrey Morgan

Tele-Orthopaedics: United States Army European Regional Medical Command

Telemedicine is the provision of medical care over long distances by way of videoconferencing and other communication technologies. Staff at Vilseck U.S. Army Clinic set up a 3-month pilot real-time teleorthopaedic clinic to determine if it was feasible to extend Orthopaedic specialty care over long distances. A full time physician assistant was located at the patient site and an orthopaedic surgeon was located at the Landstuhl or Heidelberg site. Patients were initially evaluated by the PA. All consults were reviewed by the PA and Orthopaedic surgeon via telephone or VTC. Patients meeting possible indications for surgery were then scheduled for a VTC consult with a surgeon.

Thomas Nicholas

Nasotracheal Intubation in a Difficult Airway using the Storz C-MAC Videolaryngoscope, the Boedeker Bougie Endotracheal Introducer, and the Boedeker Curved Forceps

Airway management has multiple indications for nasotracheal intubation. In this study, we focus on its indication in difficult airways. This work describes a modified procedure of nasotracheal intubation using the new Storz CMAC® Videolaryngoscope, the malleable Boedeker Bougie and the curved Boedeker Forceps in the intubation of a difficult airway manikin.

Saturday's Presentation Summaries

SATURDAY Morning, February 11
TRACK A

Simulation Validation

Allen Andrade

Using Anthropomorphic Avatars Resembling Sedentary Older Individuals as Models to Enhance Self-Efficacy and Adherence to Physical Activity: Psychophysiological Correlates

The prevalence of obesity and associated health complications are currently at unprecedented levels. Exercise in this population can improve patient outcomes. Virtual reality (VR) self-modeling may improve self-efficacy and adherence to exercise. We conducted a comparative study of 30 participants randomized to 3 versions of a 3D avatar-based VR intervention about exercise: virtual representation of the person exercising condition; virtual representation of other person exercising and control condition. We did not find any improvements of physical activity levels and self-efficacy in sedentary, overweight or obese individuals as a result of the intervention enhanced by avatars resembling the participant or others.

Stefan Marks

Design and Evaluation of a Medical Teamwork Training Simulator using Consumer-Level Equipment

Virtual environments (VE) are increasingly used for teamwork training purposes, e.g., for medical teams. One shortcoming is lack of support for nonverbal communication channels, essential for teamwork. We address this issue by using an inexpensive webcam to track the user's head and using that data for controlling avatar head movement, thereby conveying head gestures and adding a nonverbal communication channel. In addition, navigation and orientation within the virtual environment is simplified. We present the design and evaluation of a simulation framework based on a game engine and consumer-level hardware and the results of two user studies showing, among other results, an improvement in the usability of the VE and in the perceived quality of realism and communication within the VE by using head tracking avatar and view control.

Sandrine de Ribaupierre

Evaluation of Neuroanatomical Training Using a 3D Visual Reality Model

As one of the most difficult components of the curriculum, neuroanatomy poses many challenges to students -- not only because of the numerous discreet structures, but also due to the intricate spatial relations between them, which must be learned. Traditional anatomical education uses 2D images with a focus on dissection, and this approach tends to underestimate the cognitive leaps between textbook, lecture, and dissection. With reduced anatomical teaching time worldwide, and varying student spatial abilities, new techniques are needed for training. The goal of this study is to assess the improvement of trainee understanding of 3D brain anatomy, orientation, visualization, and navigation through the use of digital training regimes in comparison to the current methods. Two subsets of health science and medical students were tested individually after being given a group lecture and either pre- or post-dissection lab. Results suggest that exposure to a 3D digital lab may improve knowledge acquisition and understanding of students, particularly for first time learners.

Li Felländer-Tsai

Training Diagnosis and Treatment of Cervical Spine Trauma Using a New Educational Program for Visualization through Imaging and Simulation (VIS): A First Evaluation by Medical Students

We investigated if medical students' perceived self-efficacy changed by training in a new program for visualization through imaging and simulation, and how they evaluated the user interface (UI) of the program, and the whole practice session. Before and immediately after training 43 students answered a questionnaire on their perceived self-efficacy, and questionnaires on the training session and UI. Self-efficacy increased significantly by training ($P<0.001$). Pearson correlation tests revealed that the increase in students´ self-efficacy was significantly associated with: how the session was compared to expected ($r=0.66$; $p<0.0001$), how realistic it was ($p=0.38$; $p<0.01$), and their overall judgment of the practice ($r=0.49$; $p<0.01$). Hence, students' belief in their ability to manage a clinical case was related to positive experiences of the program. Assessment of perceived self-efficacy should become a vital part in usability evaluations of educational programs.

Allen Andrade

Medical Students' Attitudes toward Obese Patient Avatars of Different Skin Color

Physicians' biases for skin color and obesity may negatively affect health-care outcomes. Identification of these biases is the first step to address the problem. We randomized 128 U.S medical students into one of four animated videos of avatar physician–patient counseling sessions, varying the weight and skin color of an elderly patient avatar: white-thin, black-thin, white-obese and black-obese. Medical students viewed white obese avatars as unattractive, ugly, noncompliant, lazy, and sloppy. Medical students' comments suggested a paternalistic attitude toward avatar patients. Avatar-mediated experiences can elicit medical students' bias potentially enabling medical educators to implement bias reduction interventions.

Surgical Metrics

Camille Williams

The Benefits of Fundamentals of Laparoscopic Surgery (FLS) Training on Simulated Arthroscopy Performance

Current theories of skill learning suggest that novices learn optimally in a simplified environment. This information can be incorporated in simulator designs. Our purpose was to assess whether basic visuospatial training is beneficial for the performance on an arthroscopy simulator. One group of trainees practiced three visuomotor tasks, the other group was not given this opportunity. Both groups then performed three different tasks on a simulated arthroscopy model. Practice with the visuomotor tasks enhanced performance on two of the tasks on the arthroscopy model. The basic navigation skills learned through practice transferred to the performance of arthroscopic surgery and these skills should be included in the design of an arthroscopy simulator.

Daniel Bailey

Concurrent and Face Validity of a Capsulorhexis Simulation with Respect to Human Patients

Abstract. A prototype version of the ImmersiveTouch® virtual reality simulator was applied to capsulorhexis, the creation of circular tear or "rhexis" in the lens capsule of the eye during cataract surgery. Virtual and live surgery scores by residents were compared. The same three metrics are used in each mode: circularity of the rhexis, duration of surgery (sec), and number of forceps grabs of the capsule per completed rhexis (fewer is better). The average simulator circularity score correlated closely with the average live score (P = 0.0002; N = 4), establishing "concurrent validity" for this metric. Individuals performed similarly to each other in both modes, as shown by the low standard deviations for average circularity (virtual 0.92 ± 0.04; live 0.88 ± 0.04). By contrast, the standard deviations are high for the other two metrics, capsulorhexis duration (virtual 96.91 ± 44.23 sec; live 94.42 ± 65.74 sec, N = 8) and number of forceps grabs (virtual 10.66 ± 4.81; live 10.31 ± 5.23, N = 8). Nevertheless, the simulator was able to demonstrate that the surgeons with wide variations in total duration and number of capsular grabs in 2 to 4 trials of simulated surgery also had similar variations in live surgery, so that the simulator retains some realism or "face validity."

Gregory Wiet

Translating Surgical Metrics into Automated Assessments

In the effort to promote more continuous and quantitative assessment of surgical proficiency, there is an increased need to define and establish common surgical metrics. Furthermore, as various pressures such as limited duty hours and access to educational resources, including materials and expertise, place increased demands on training, the value of quantitative automated assessment becomes increasingly apparent. We present our methods to establish common surgical metrics within the otology and neurotology community and our initial efforts in the subsequent transfer of these metrics into objective automated assessments provided via a simulation environment.

Surgical Simulator Validation

Kristen Pitzul

Validation of Three Virtual Reality Fundamentals of Laparoscopic Surgery (FLS) Modules

The Fundamentals of Laparoscopic Surgery (FLS) box trainer is the gold standard for development of laparoscopic technical skills but contains a complex scoring metric that does not allow for immediate feedback. The Lap Mentor virtual-reality (LMVR) FLS tasks, with automated scoring metrics and haptic feedback, may be a suitable alternative. We determined the construct and concurrent validity of LMVR-FLS. Participants with a range of laparoscopic experience performed 3 FLS tasks on both simulators. The LMVR-FLS demonstrated moderate concurrent validity and a trend towards robust construct validity. The LMVR FLS modules are a valid educational tool for teaching laparoscopic skills.

Marie-Eve LeBel

Force Sensing-Based Simulator for Arthroscopic Skills Assessment in Orthopaedic Knee Surgery

The complexity of knee arthroscopy makes it difficult to teach and assess during real surgery. Simulator-based training is ideal for this complex procedure. To address the limitations of existing systems, a physical simulator, capable of providing skills assessment and feedback has been developed. The simulator measures the forces applied on the femur and acting on the tools. An experimental evaluation was conducted to assess the differences in task completion time and applied forces for fourteen tasks performed by trainees and expert surgeons. Initial results show that the simulator, together with well-chosen tasks, can be used to assess user performance.

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