CyberTherapy & Rehabilitation

Issue 4 / 2011

The Official Voice of iACToR

COVER STORY:

Medical Simulation: Empowering the Future of Healthcare

and much more...

ISSN 2031 - 278

INJURY CREATION SCIENCE

The Next Generation of Injury Simulation Today

Prosthetic tissue, wounds, and life saving skills training devices used in the training of medical professionals

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- Needle Decompression Skills Trainer
- Bleeding Wound Skills Trainer
- Amputation Skills Trainer
- Burn Wound Skills Trainer
- Odor Wound Skills Trainer

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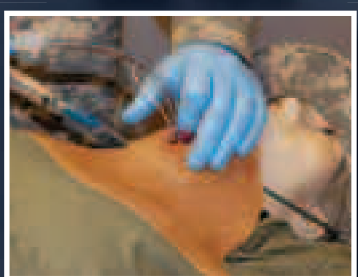
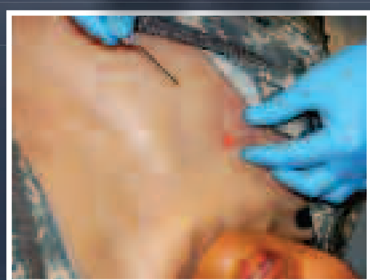
- Shock Prevention & Treatment

Cricothyrotomy Skills Trainer

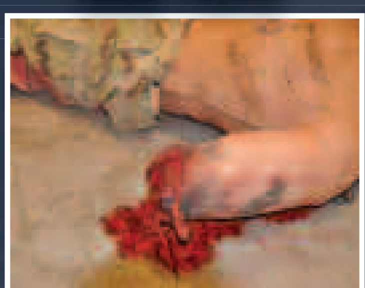


Needle Decompression Skills Trainer



Bleeding Wound Skills Trainer

Severe Amputation Skills Trainer



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Letter from the Secretary General and Editor-in-Chief

Professor Dr. Brenda K. Wiederhold

"'Virtual worlds, both immersive and Web-based, are at the frontier of innovation in medical education,' wrote an anesthesiologist in 2008. Now, a growing number of health professionals – physicians, nurses, dentists, EMTs, and others – have embraced Virtual Reality medical simulation as a cost-effective method of training."

Dear Reader,

"Virtual worlds, both immersive and Web-based, are at the frontier of innovation in medical education," wrote an anesthesiologist in 2008. As Richard Satava wrote 10 years ago, "The greatest power of Virtual Reality (VR) is the ability to try and fail without consequence to animal or patient. It is only through failure – and learning the cause of failure – that the true pathway to success lies."

Only recently, however, has the VR cost barrier been broken by the establishment of large, collaborative simulation centers, as these partnerships anticipate the influx of practitioners demanding VR training for certification. For example, the Israel Center for Medical Simulation is part of the licensing and accreditation process for various health professionals, including paramedics and anesthesiology residents. The Uniformed Services University National Capital Area Medical Simulation Center, which provides 346,000 hours of simulations per year, partners with the National Board of Medical Examiners, the American College of Surgeons (ACS), and the American Council of Obstetrics and Gynecology. The American Board of Internal Medicine adopted medical simulation (med sim) for use in its certification program for interventional cardiologists. Med sim reaches as far as Accra Ghana, West Africa, where a partnership with ACS created the Medical and Surgical Simulation Institute.

"Only recently has the VR cost barrier been broken by the establishment of large, collaborative simulation centers, as these partnerships anticipate the influx of practitioners demanding VR training for certification ... Today, there is a 20% malpractice insurance rate differential between anesthesiologists training with simulators and those not trained with simulators."

A growing number of health professionals – physicians, nurses, dentists, EMTs, and others – have embraced VR med sim because of its ability to:

• Reduce serendipity in education and training – VR can even out the variability in training should a particular situation not present itself during the surgical residency.

• Facilitate practice and rehearsal without patient consequence – The resident can practice on a 3-D, haptically-enhanced simulator that matches the patient's anatomy as many times as it takes to feel comfortable with the procedure.

• Reduce medical errors – Interdisciplinary teams can train to reduce errors caused by team member communication gaps or unfamiliarity with new equipment.

• Reduce reliance on animal models – Increasing pressure by PETA and scarcity of cadavers has accelerated the adoption of VR simulation.

• Reduce healthcare costs – Med sim offers the potential to decrease time spent and consequent costs.

Before the advent of mainstream VR med sim, anesthesiologists enjoyed 10% premium reductions beginning in 2001 based on malpractice claims data collected after anesthesiologist errors were reduced based on their work with mannequins. Today, there is a 20% malpractice insurance rate differential be-

Letter from the Secretary General
(continued from page 1)

tween anesthesiologists training with simulators and those not trained with simulators, and the members of this latter group are in steady decline.

In addition to anesthesiology, the use of VR med sim in endoscopic and laparoscopic surgery is producing promising results in terms of effectiveness and cost-effectiveness. One study of laparoscopic surgery found that trainees who studied on their own using a laparoscopic and endoscopic VR simulator achieved proficiency just as well as trainees who were proctored. The independent-study approach was less time consuming for trainees, and certainly minimized instructor time.

As Richard Satava wrote 10 years ago, "The greatest power of VR is the ability to try and fail without consequence to animal or patient. It is only through failure – and learning the cause of failure – that the true pathway to success lies."

There are significant benefits to simulation training, as one study focusing on endovascular procedures found. After nine residents trained for three days on the simulation, performance improved significantly from early on day one in three categories:

- Total procedure time decreased 54%
- Volume of contrast decreased 44%
- Fluoroscopy time decreased 48%

Endovascular simulation training is up to 16 times less expensive than similar training with animals, as found by researchers in another study. The economic analysis compared the rental of an animal laboratory to the purchase or rental of the simulator Procedicus VIST (Mentice). According to the researchers, consumption of stents for each procedure is the largest cost in the animal lab, as the stents cannot be retrieved from the animal.

Most recently, a meta-analysis of more than 600 studies involving technology-enhanced simulation training showed consistently large effect sizes for knowledge, skill, and behavior outcomes, and moderate effects for patient-related outcomes. The authors of this *JAMA* study are currently researching how to use simulation-based teaching most cost-effectively, and we look forward to reviewing the results of that research.

Create your own reality!
Brenda Wiederhold

INTERSTRESS

Interreality in the Management
and Treatment of Stress-Related Disorders

INTERSTRESS
Is a European-funded project

The INTERSTRESS project aims to design, develop and test an advanced ICT-based solution for the assessment and treatment of psychological stress.

Objectives:

- Quantitative and objective assessment of symptoms using biosensors and behavioral analysis
- Decision support for treatment planning through data fusion and detection algorithms
- Provision of warnings and motivating feedback to improve compliance and long-term outcome

To reach these goals, INTERSTRESS will use a new e-Health concept: Interreality. What is Interreality? It is the integration of assessment and treatment within a hybrid, closed-loop empowering experience, bridging physical and virtual worlds into one seamless reality.

- Behavior in the physical world will influence the virtual world experience
- Behavior in the virtual world will influence the real world experience

These goals will be achieved through:

- 3D Shared Virtual World role-playing experiences in which users interact with one another
  - Immersive in the healthcare centre
  - Non-immersive in the home setting
- Bio and Activity Sensors (from the Real to the Virtual World)
  - Tracking of emotional/health/activity status of the user and influencing the individual's experience in the virtual world (aspect, activity, and access)
- Mobile Internet Appliances (from the Virtual to the Real world)
  - Social and individual user activity in the virtual world has a direct link with user's life through a mobile phone/PDA

Clinical use of Interreality is based on a closed-loop concept that involves the use of technology for assessing, adjusting and/or modulating the emotional regulation of the patient, his/her coping skills and appraisal of the environment based upon a comparison of the individual patient's behavioural and physiological responses with a training or performance criterion. The project will provide a proof of concept of the proposed system with clinical validation.

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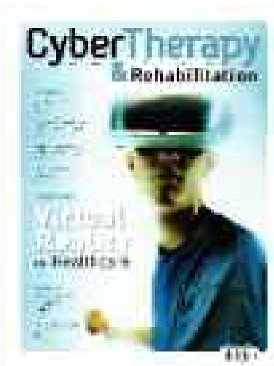

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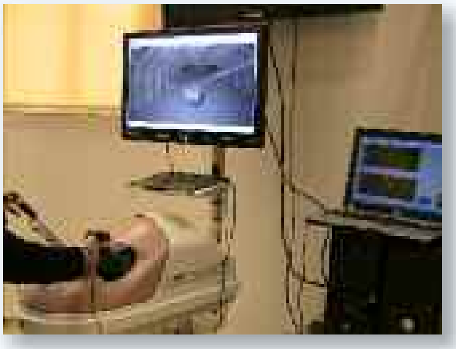
Virtual Training Systems for Rehabilitation

Rehabilitation, an often costly, lengthy and tedious process, is being improved using computerized training systems, such as the system pictured above, which encourages self-practice and independent engagement from users suffering from cerebral palsy or other disorders resulting in upper extremity disability. The software works with a pen-like haptic device to provide real-time feedback and easy visualization of movement on a computer screen.



Surgical Simulation Using Laparoscopic Simulators

A Virtual Reality laparoscopic simulator, like the one pictured above, can aid in surgical training by using sensors attached to the handles, which transmit kinematic data to a portable computer for processing and visualization. These types of trainers can drastically cut down on training costs, while ensuring patient safety and a large margin of error reduction.

International Association of CyberPsychology, Training & Rehabilitation (iACToR)

Conference Participation Report Fall/Winter 2011

European Health Forum Gastein

Bad Hofgastein, Austria / October 5-8, 2011

The 14th annual European Health Forum Gastein (EHFG) was held October 5-8, 2011, in Bad Hofgastein, Austria, with this year's theme of "Innovation and Wellbeing – European Health in 2020 and beyond." EU Health Commissioner John Dalli, EC Director Generals Paola Testori Coggi and Robert Madelin, and Zsuzsanna Jakab, Regional Director of World Health Organization Europe, were among some 600 experts who attended the conference.

The basis for Gastein's typically practical and open debate was Europe's aging, and ailing, population – described by one speaker as a "demographic time-bomb" – which is straining all European health budgets. Six parallel forum discussions took place on Health Technology Assessment, Towards Health in 2020, Non-communicable Diseases, European Innovation Partnership on Active and Healthy Ageing, and Harnessing Europe's Social Innovation Potential in Health. There was a particular emphasis on a topic dear to the heart of the Forum's Founder-President, Prof. Dr. Günther Leiner, who denounced a high level of unnecessary diagnostic and surgical procedures.

The forum also focused on dealing with the epidemic of non-communicable diseases. These types of diseases have become a growing problem even outside the wealthy West, the EHFG noted, and call for due attention. Commissioner Dalli backed a plea for more preventive medicine, with doctors actively discouraging smoking. Several experts called for a complete EU-wide tobacco ban. There was also lively debate about the effect of misinformation on the Internet on what experts called a growing "confidence gap" in vaccinations.

For more information on the conference, visit www.ehfg.org.

The 2nd Annual World Health Care Congress Middle East

Abu Dhabi, United Arab Emirates / December 11-13, 2011

The 2nd Annual World Health Care Congress Middle East (WHCC ME), co-sponsored by the Health Authority-Abu Dhabi (HAAD) and the Abu Dhabi Tourism Authority (ADTA), was a global event in which over 600 healthcare, government and corporate leaders from over 25 countries came together to define objectives and frame solutions to the challenges of healthcare reform, cost, quality and delivery.

The 2011 WHCC ME Congress featured the top innovative leaders and industry influencers including health ministers, leading government officials, hospital directors, health system and hospital providers, patient safety directors, disease management professionals and health and wellness experts, chief financial leaders, IT and mHealth innovators, decision makers from public and private insurance funds, investment and venture capital principals, pharmaceutical and biotech executives, and healthcare industry suppliers.

The WHCC ME agenda featured debates, case studies and best practices from all industry sectors to identify innovative strategies to improve the overall delivery of healthcare. This unparalleled networking event puts together senior executives to meet and strategize on the crucial steps necessary to adapt their health systems to operate more efficiently to decrease the cost of care, enhance the delivery of service and improve the patient experience.

For more information, visit www.worldcongress.com/me.

Games for Health Europe

Amsterdam, Netherlands / October 24-25, 2011

The first annual Games for Health Europe conference, which took place in Amsterdam on October 24-25, was a great success. The conference brought together medical professionals, academics and industry leaders and featured 468 attendees, 72 speakers, 24 partner companies and 22 ground exhibitors. Nine keynote speakers from various fields presented their visions of the future for serious games for healthcare.

Presenters included diverse specialists such as Ben Sawyer, the founder of Games for Health in the U.S., Adam Gazzaley, a cognitive neuroscientist who presented some remarkable discoveries on the link between games and cognition, Jan-Willem Huisman, CEO of IJsfontein (a successful Dutch serious games company) and Bertalan Mesco, founder of Scienceroll blog, and successful practitioner of both medicine and new media.

The main theme of the conference was "How Games & Simulations Can Improve Health(care) and Make it Affordable" and topics discussed included rehabilitation games, exergaming, active gaming and fitness, and medical education, training, modeling and simulation.

The next Games for Health Europe will take place November 5-6, 2012 in Amsterdam.

For more information, visit www.gamesforhealtheurope.org.

Medical Simulation:

Empowering the Future of Healthcare

In the last few decades, medical simulation technologies have provided groundbreaking innovations that have revolutionized surgery, and improved teaching and training by creating realistic environments that are not only reusable, but can be personalized to test individual trainees' skills without putting patients' lives at risk. Simulation technology is rapidly gaining support from organizations around the world for its ability to reduce errors and improve patient safety, and its popularity is only picking up speed.

By Brenda K. Wiederhold & Mark D. Wiederhold

The advent of medical simulation technologies stemmed from a diverse array of fields, merging together to form a new way to not only practice medicine but teach, train and improve the lives of both patients and doctors. What once seemed like a far off fantasy has quickly emerged as a promising method of improving healthcare and is more a reality now than ever before, having been swiftly integrated into medicine and playing a much larger role in medical practice than predicted.

Early Mannequin Simulators

The creation of mannequins for medical purposes began in the early 1960s when a Norwegian plastic toy manufacturer, Asmund Laerdal, developed the Resusci Anne mannequin for CPR training. Life-size models of the body proved useful for practicing basic procedures like physical exams and mouth-to-mouth, allowing students to train on a realistic figure before an actual human. Not long after medical mannequins were developed, engineers and physicians began improving on the inanimate patients with computer technology. The first high-fidelity computer-controlled human patient simulator, the SimOne, developed by Laerdal, was a lifelike model of a human patient used for anesthesia training that measured physiological and pharmacological changes in real time. Although SimOne was not widely used, its creation marked a turning point in computer-controlled mannequin simulation, and technologies thereafter replicated the essence of the SimOne.

Development of Surgical Simulators and VR

Simulators utilizing Virtual Reality (VR) emerged in the 1980s when the National Aeronautics and Space Administration (NASA) at the Ames Research Center in Palo Alto, California developed the first head mounted display (HMD) for displaying the data collected during planetary explorations. At the same time, the DataGlove was developed, making interaction with 3-D virtual scenes possible. The possibility of being immersed in a virtual environment while also being able to interact with the scene was what inspired the idea of immersive technologies for surgery, and thus the birth of surgical simulators.

Laparoscopic, or "keyhole" surgery, is a type of minimally invasive surgery (MIS). This type of procedure was introduced into general surgery in the late '80s and employs the use of a camera, a fiber-optic light and joystick-like instruments that perform the operation through tiny incisions. This new technique saw the addition of a new member to the surgical team, the robot, controlled by surgeons through video game-like controllers while looking at a computerized depiction of the actions occurring inside the body. The first robot-assisted surgical device used on humans, the RoboDoc, was developed in the early 1990s for orthopedic surgery. Computer-controlled robotic arms perform actions with a high degree of accuracy and precision, reducing pain, errors, and unnecessary damage leading to shorter hospital stays and accelerated recovery. More complex surgical robotic systems soon surfaced that possessed multiple applications throughout general surgery. The da Vinci system, developed by Intuitive Surgical and considered one of the top surgical robotic devices, ranges extensively in its abilities, and is able to perform MISs in various fields such as urology, gynecology, colorectal and cardiothoracic medicine, as well as procedures on almost every part of the body.

While this novel approach proved to be extremely beneficial to patients due to its minimal invasiveness, the procedures put enormous pressure on surgeons due to the loss of visualization it required, as well as a degraded sense of touch and impaired dexterity the instruments caused. High quality visualizations were needed to accurately perform the surgery as well as realistic haptic feedback, not to mention practice using the new video game-like controllers. Being able to feel present in the surgery through high quality, virtual depictions in real time was important for surgeons performing laparoscopic surgery. Improving VR technologies allowed this sort of seamless immersion into surgery, and without such technology, laparoscopic surgery would not have thrived.

Studies have also been conducted assessing the benefits of practicing in VR for improving performance in surgery. Draycott et al. showed that training on a simulator reduced neonatal injury by 7%. Dr. James "Butch" Rosser from the Beth Israel Medical Center has even developed a video game, Top Gun, for warming up and improving surgical trainees' agility and accuracy before going into surgery. Hand-eye coordination has become increasingly important with the introduction of laparoscopic surgery, and its similarities to playing a video game, a joystick controller manipulating figures on-screen, has earned gaming a respectful place in today's world of surgical training.

"With companies readily incorporating simulation into their medical practices the laparoscopic device market has already become a multibillion dollar endeavor and according to iData Research, anticipated advancements project that by 2018 sales will reach approximately $7.5 billion, with major corporations like Ethicon and Allergan vying for control."

Training and Practice

Just like air flight simulators prove useful for training pilots, VR and mannequin simulators too have been shown to be extremely beneficial for training medical personnel. Combining mannequins and VR simulations for training allows for an extensive range of applications and different methods of training. While human actors, mannequins and videos have all been used in the past as teaching tools, full environment simulations (FESs) have recently grown in utility and popularity, along with simple screen-based computer simulations and partial task trainers for specific procedures. FESs include high-fidelity mannequin simulators that replicate medical conditions in an accurate and detailed way, placed within a realistic environment that creates contextual factors that might be present in real situations, for example, a difficult patient, family members, and distractions, to gain experience responding to unusual or crisis situations more accurately. These types of simulations enhance the reality of training while also assessing performance more extensively and encompassing more competency skills than a mere checklist of tasks; not only is the medical procedure being measured, but professionalism, communication skills, and teamwork as well. This type of training is widely used among anesthesiology students, laparoscopic training, cartaroid stenting training, and dentistry procedures, and is used by nursing students and emergency medical technicians (EMTs).

Training using simulation technologies has been shown to improve accuracy and overall performance, thus explaining its widespread adoption. A 1999 survey conducted by Morgan and Cleave-Hogg showed that 71% of anesthesia and medical students were taught using some kind of mannequin or simulator, and a survey by Okuda et al. showed that 91% of emergency medicine residencies use simulation during training, 85% of which are mannequin-based.

High-fidelity simulators are also optimal tools for assessing the performance of physicians and surgeons throughout their career, and are useful for practicing new techniques or procedures before performing on real patients. In addition, with improving VR and modeling technology, physicians are hoping that in the near future they will be able to download a patient's specific data and test solutions and different procedures on the virtual patient before the real person to ensure the best practice will be used.

MMVR and TATRC

While many organizations are promoting medical simulation research and development, Medicine Meets Virtual Reality (MMVR) and the Telemedicine and Advanced Technology Research Center (TATRC) have played large roles in improving medical simulation technologies and optimizing their applications in both the medical and military arenas. While both MMVR and TATRC separately support advancements in telemedicine, they have recently teamed up, holding dual events focused on improving clinical competency using medical simulation for training and practice, with an emphasis on maintaining the skills of anesthesiologists, surgeons, and other medical personnel. The events bring together leading researchers and doctors alike to assess current practices, areas in which programs are lacking, and to produce fresh ideas on how to improve and expand on these practices. These events and conferences encourage the creative development of new technologies to discover best practices and new uses, and it is because of organizations like these that medical simulation has been integrated on multiple platforms, such as crisis management training, improving clinical competency and patient safety, and medical trauma training for military troops performing in battle.

Adoption and Incorporation – Certification to Financial Benefits:

The themes of improving patient safety and clinical competency through the use of simulation technologies have increasingly become a priority for many prominent medical organizations as well. The American Surgical Association's Blue Ribbon Panel recommends that medical simulators be adopted into surgery as a tool for education, teaching and verifying competence, and The American Board of Internal Medicine has shown their support for incorporating medical simulation into board exams by giving grants to companies developing simulators. The promising results of medical simulation technologies have even inspired a bipartisan effort to further research, with Rep. Randy Forbes (R-VA) and Patrick Kennedy acting as instrumental leaders in the movement. HR 4321, the Enhancing SIMULATION (Safety in Medicine Utilizing Leading Advanced Simulation Technologies to Improve Outcomes Now) Act of 2007, is a bill supporting medical simulation research and training to reduce healthcare costs, improve safety and create more simulation centers.

Many organizations have already adopted medical simulation techniques into formal assessments of performance, certification programs, and board exams. The first organization to integrate computer-based case simulation into testing was The United States Medical Licensing Examination (USMLE). The American Board of Family Practice has also incorporated computer-based case simulations for each individual examinee into their family practice board certification exam. International organizations have also expanded their exams to include medical simulation. The Royal College of Physicians and Surgeons of Canada use video simulations during their internal medicine exam, and The Israeli Board of Anesthesiologists Examination Committee has adopted one of the most extensive simulation-based portions of their board exam, developing five standardized scenarios to assess competency in a range of practices from administration of anesthesia to trauma and operating room management. Continuing medical education (CME) programs have also found simulation techniques to be sufficient for ensuring physicians' skills remain fresh; simulator-based education is required by The American Board of Anesthesiology to fulfill the maintenance of certification requirements, and many other CME credits are now fulfilled using simulation programs.

"Continuing medical education (CME) programs have also found simulation techniques to be sufficient for ensuring physicians' skills remain fresh; simulator-based education is required by The American Board of Anesthesiology to fulfill the maintenance of certification requirements, and many other CME credits are now fulfilled using simulation programs."

Studies have been conducted showing that practicing and training with simulator technologies lowers the number of errors performed during procedures, thus reducing malpractice. According to a press release by Randy Forbes in 2007, the cost of medical errors in the U.S. can be as much as $79 billion dollars a year. However, hospitals funded by a trial program utilizing simulations and established by the U.S. DOD saw the rate of clinical errors decrease from 30.9% to 4.4%. In 2001, The Consolidated Risk Insurance Company (CRICO), a malpractice carrier for the Harvard community, started offering insurance premium incentives to anesthesiologists who were trained in crisis resource management at the Center for Medical Simulation, as well as grants to cover costs. Reduced malpractice due to incentive programs like CRICO's has led to other similar arrangements for other specialties, such as obstetrics and gynecology.

Resistance May Be Futile

Some physicians resist these new forms of teaching and training, saying that a virtual reenactment can never replace hands-on practice, and while it is undeniable that real-life experience will yield the best results, what simulation technologies offer is a chance to make early learning more effective and provide new ways of exploring techniques. In addition, with companies readily incorporating simulation into their medical practices the laparoscopic device market has already become a multibillion dollar endeavor and according to iData Research, anticipated advancements project that by 2018 sales will reach approximately $7.5 billion, with major corporations like Ethicon and Allergan vying for control. Clinical, as well as financial benefits, make a slow in growth unlikely, and for the time being medical simulation is here to stay.

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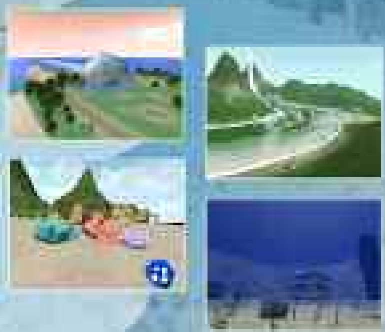

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- Instant Feedback

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- Reclaim Normalcy
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Methods and Tools for Surgical Assessment in the Simulation World

"As opposed to the traditional model, in simulation training 'permission to fail' can be built into the learning process without jeopardizing patient safety. Other major advantages include risk-free practice on complex and rare case scenarios, constructive feedback, individualized training, and objective assessment."

By Constantinos Loukas

Simulation-based education is a training and feedback method in which learners practice a task repeatedly on a simulated model until reaching a predefined competency level. Training is performed in a lifelike environment with feedback obtained either from external observers (experts), or the simulation system itself based on validated assessment metrics. In minimally invasive surgery, the instruments and training models with which the user interacts may be real (physical reality simulation) or virtual (Virtual Reality simulation). As opposed to the traditional model, in simulation training "permission to fail" can be built into the learning process without jeopardizing patient safety. Other major advantages include risk-free practice on complex and rare case scenarios, constructive feedback, individualized training, and objective assessment.

Despite the significant assets of reality simulation, a major issue is the assessment process where the traditional model requires careful review of the recorded video. This clearly leads to a lengthy process that is also prone to errors due to fatigue of the reviewer, provided that most tasks require several trials to master. Recently, there has been an influx of computational tools enabling automated performance analysis and assessment. Hand motion analysis systems constitute the majority of these tools, whereby specialized sensors are attached either on the surgeon's hand or instrument handle (see Fig. 1). A well-established assessment metric is the hand motion trajectory. This is usually obtained by means of a motion analysis system equipped with electromechanical or infrared sensors. The signal emitted (or reflected) by the sensors is acquired by a receiver placed at a fixed position nearby the system, thus providing kinematic measurements of the instru-

Figure 1: Surgical training with a laparoscopy VR simulator. Sensors attached to the instrument handles transmit kinematic data to a portable computer for additional processing and visualization.

> *"Visual tracking of objects of interest in the surgical simulation space provides a great range of opportunities for the development of hybrid training methods such as Augmented Reality Simulation, whereby physical and virtual objects are mixed, allowing users to interact with virtual models using real surgical instruments."*

ments in real-time. More advanced systems utilize multisensory information including force and torque signals, or specialized sensor-gloves that capture hand gestures during the performance of a laparoscopic task. The signal data obtained are modeled with advanced computational techniques, such as Hidden Markov and Multivariate Autoregressive Models, in order to generate an assessment index based on the data collected. These methods allow association with quantifiable parameters that correlate with surgical experience.

An alternative, yet more challenging, methodology for obtaining kinematic information is based purely on the visual information obtained from the endoscopic camera, implying a sensorless training environment that provides greater flexibility to the trainee. In the literature there are a small number of systems that attempt to detect and track the laparoscopic instruments. The instruments are first detected using, for example, edge or color information, sometimes with the aid of a color marker, and then tracked in subsequent frames. Visual tracking of objects of interest in the surgical simulation space provides a great range of opportunities for the development of hybrid training methods such as Augmented Reality Simulation, whereby physical and virtual objects are mixed, allowing users to interact with virtual models using real surgical instruments. Recent research has revealed the potential advantages behind this method such as realistic haptic feedback, objective assessment of performance, high quality visualizations and great flexibility in the development of training scenarios.

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A Virtual Training System for Children with Upper Extremity Disability:

Providing Real-time Interactive Feedback for Hand Rehabilitation

Practicing writing skills for children with cerebral palsy can be tedious and boring. However, "by taking advantage of Virtual Reality technology, the rehabilitation process can be performed in a more interactive and efficient manner." Here, a novel treatment method is discussed.

By Kup-Sze Choi

Hand dexterity is essential for many activities of daily living (ADL), e.g., buttoning or tying shoelaces. Among them, writing and drawing are of particular importance to children who may spend up to 60% of their school time on handwriting. Proper handwriting requires well-coordinated fine motor movements of the fingers. For children suffering from motor impairment, resulting from cerebral palsy, for example, it is difficult to control the small muscles of various fingers in order to appropriately adjust the pencil's position in their hand. Rubber pencil grips, pen tablets and other assistive gadgets have been used to help these children regain their handwriting ability. However, these devices do not provide active feedback in the training process, and a tutor is required to assess the children's performance, to demonstrate ways of writing, or to provide guidance by holding and maneuvering their hands. By taking advantage of Virtual Reality (VR) technology, the rehabilitation process can be performed in a more interactive and efficient manner.

VR-based Training System

A VR-based system has been developed to facilitate hand rehabilitation through computerized training. The objectives are to enable self-practice by providing interac-

Figure 1 (left): System set-up: the child is holding the haptic stylus to practice handwriting.

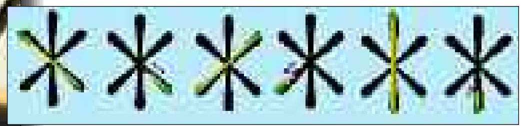

Figure 2 (above): Yellow guidelines are overlaid interactively to show the steps in drawing an asterisk. The red and green dots indicate the virtual pencil-tip and the starting point of a stroke.

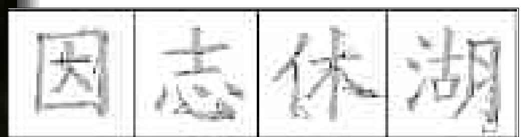

Figure 3 (above): Trajectories of the virtual pencil overlaid on the images of the characters.

tive visual and haptic cues as guidance, and by monitoring user performance automatically with quantifiable performance metrics. The hardware consists of a generic personal computer and the Phantom Omni haptic device made by SensAble Technologies, Inc. The software of the system is built using C/C++, OpenGL and OpenHaptics. The haptic device has a pen-like stylus, which can be grasped and maneuvered in a 3-D space. Using a piece of virtual paper laid horizontally, users practice handwriting with the stylus as if they were writing with a real pencil (see Figure 1). When the tip of the virtual pencil-tip contacts the paper, the strokes are displayed simultaneously on the screen, while feedback forces, i.e., contact forces and haptic cues, are generated to drive the haptic device.

Visual and Haptic Cues

Training begins by showing the image of the complete character or pattern in the background. The user is required to draw, stroke by stroke, by following the visual cues provided. The visual cues are displayed in the form of guidelines superimposed on top of the background image, as shown by the yellow lines in Figure 2. Users are guided to draw the strokes one by one sequentially.

The users are also guided by interactive forces when drawing along the guidelines. If the virtual pencil-tip deviates, leaving the writing surface or moving laterally away from a guideline, forces are generated to pull it back to the guideline. The forces are computed in real time in response to the user's movements. In the system, two kinds of forces are provided to: (i) move the pencil-tip from the starting point of a guideline towards its end, or (ii) to pull the pencil-tip back to the guideline if it is being moved away.

Quantitative Performance Assessment

User performance can be analyzed in detail using the quantitative metrics provided by the system. Timing data including the time taken to complete a drawing (completion time), the time taken to draw individual strokes (stroke-drawing time), and the time elapsed during transitions between consecutive strokes (transition time) are automatically recorded. Furthermore, undesirable maneuvers, such as in-air stroke drawing and on-paper transitions, are measured. Path length, deviation from the ideal path, forces applied by the user, and the trajectory of the virtual pencil tip (shown in Figure 3) can also be recorded by the system.

Evaluation and Future Work

The system has been implemented in a pilot study for children with cerebral palsy to practice writing Chinese characters, as shown in Figure 1. In a two-week study where practice was conducted two times a week during 20-minute sessions, the subjects showed improvements in handwriting speed and accuracy (average completion time and path length reduced by 50% and 30% respectively), especially for those diagnosed with a mild degree of deficiency. The legibility of real handwriting on paper was also improved, as evaluated by language teachers. Featuring interactive feedback and quantitative assessment, the system has the potential to facilitate self-practice with minimal supervision from therapists. In the next version, tablet devices will be adopted to offer a natural user interface where the drawings are displayed directly under the stylus end-point. Clinical trials with a larger sample size and longer study period will be conducted to further evaluate the effectiveness of the system.

The author would like to acknowledge the support of the Hong Kong Red Cross Princess Alexandra School and its OT team in the project.

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Simulation-Based Training: Beyond the Bells and Whistles!

"Simulations have unique benefits as they accelerate expertise by allowing trainees to practice infrequent or dangerous procedures in a safe and controlled setting ... We know that simulation itself does not cause learning. Rather, it is the instructional features embedded into it that produce learning outcomes. In order to be effective, a simulation-based training system needs to follow the science of learning."

By Eduardo Salas & Megan E. Gregory

The use of simulation-based training (SBT) is becoming more and more prolific in healthcare. Simulations can include anything from role-playing standardized patients (SPs) to high-fidelity, full-functioning advanced mannequins. Simulations have unique benefits as they accelerate expertise by allowing trainees to practice infrequent or dangerous procedures in a safe and controlled setting. But what makes simulation work? What features facilitate learning? What do we know from the science of learning? How do we go "beyond the bells and whistles"?

We know that simulation itself does not cause learning. Rather, it is the instructional features embedded into it that produce learning outcomes. In order to be effective, an SBT system needs to follow the science of learning. There are seven key components (see Figure 1) that maximize the effectiveness of an SBT system.

First, an effective simulation system involves defining the task requirements and the learning objectives of the training. Previous performance history (if available) and skills currently possessed by trainees are determined in order to shape the training. The next step involves deciding what tasks and competencies – the knowledge, skills, and attitudes (KSAs) needed to perform the task – the SBT system will address. This helps determine the learning objectives for training.

The scenarios are then designed using the competency information and learn-

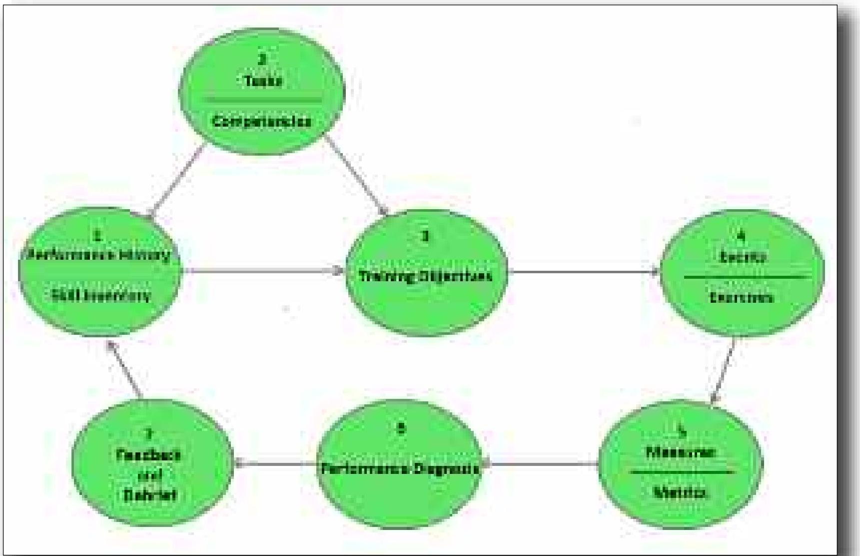

Figure 1: Seven interrelated and critical stages make simulation-based training work. Adapted from Oser R.L., et al.: Enhancing human performance in technology-rich environments: Guidelines for scenario-based training. In: Salas E. (ed.): *Human/Technology Interaction in Complex Systems*, vol. 9. Greenwich, CT: JAI Press, 1999, pp. 175–202.

ing objectives as guides. Effective scenarios contain "trigger" events that lead to an opportunity for trainees to perform the desired competencies and tasks. For example, in order to train an intern on the recognition of hypertension, an abnormal vital sign showing high blood pressure (the "trigger") could be embedded into the scenario. Alternatively, the SP could complain of headache, dizziness, blurry vision and nausea. Effective scenarios are always realistic.

The next component is to determine how to measure the events. Without measurement, there is no learning. Measures and metrics are needed to evaluate both outcomes (e.g., successful completion of an intubation) and processes (e.g., choosing the correct procedure to perform on the patient), at the individual and team levels. Considerations are given to both task (e.g., applying sutures) and team (e.g., mutual support) outcomes and processes. Observational protocols are developed. In an effective simulation, measures are always developed with training objectives in mind.

The next step of an effective SBT system involves actually measuring the simulation, observing and diagnosing performance. The measures created earlier are put to use. The information collected in this step allows for determining the impact of the training. Additionally, this step serves to govern what feedback will be given to trainees. Lastly, diagnostic feedback is given, and given in a timely manner. In an effective SBT system, trainees are debriefed after each simulation.

Simulation can be beneficial in many areas of healthcare. One example of where its use should be considered is to supplement medical team training. For instance, an operating room team may undergo a simulated operation scenario in order to practice team skills and processes that are vital to performing a successful surgery, such as coordination, back-up behavior, and strategy formulation. While this one example is used to illustrate the use of SBT in healthcare, simulation can be adapted to almost any aspect of healthcare training and team training.

SBT creates learning only if the system is designed, planned, and implemented properly. By following the components mentioned previously, you will help ensure that the training is impactful, and that you have gone "beyond the bells and whistles."

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A Medical VR Simulator in Laparoscopic Rectum Surgery

"Recently, with the rapid growth of computer technology and power, Virtual Reality simulators have become a viable alternative to traditional surgical training methods, allowing the trainees to hone their skills by operating on a virtual patient."

By Jun J. Pan et al.

The last two decades have seen some of the most exciting developments in medicine with the advent of minimally invasive surgery (MIS) including both laparoscopic and endoscopic techniques. MIS reduces the surgical trauma to the patient, thereby dampening the surgical stress response. This results in better outcomes with less postoperative pain, a shorter hospital stay and a quicker return to normality.

Colorectal cancer is the third most common cancer in the UK, with approximately 40,000 new cases diagnosed annually. Surgery remains the mainstay of treatment and is the primary intervention in 80% of cases. Although it is estimated that 90% of cases are suitable for a laparoscopic approach, there has been a relative lack of surgeons trained to perform such a demanding surgery. This is particularly true for rectal cancer surgery which is the most complex and technically challenging for the laparoscopic colorectal surgeon. The learning curve of a laparoscopic surgeon can be influenced in a number of ways. Laparoscopic training boxes provide the junior surgeon with training on inanimate objects, but offer only mundane tasks and lack the feel of handling human tissue. Animal tissue can be used but differs in anatomy to humans, and although cadaveric courses are available they are expensive and do not allow repetitive practice. In addition, the tradition of training in animal tissue is particularly criticized and can pose ethical dilemmas. In reality, trainees in many countries, including the UK, develop their laparoscopic skills by operating directly on patients under the supervision of senior surgeons. Recently, with the rapid growth of computer technology and power, Virtual Reality (VR) simulators have become a viable alternative, allowing the trainees to hone their skills by operating on a virtual patient. Compared with traditional surgical training on patients, VR-based methods have the following advantages:

• Repetitive tasks: A VR-based system can be reused many times without risk to patients.

• Variable complexity: Different scenarios can be simulated including extreme situations, allowing the response to be rehearsed.

• Surgeon responses can be recorded: Skills and training progress can be objectively recorded, measured and evaluated.

Our researchers have developed a VR simulation system for laparoscopic surgery on the rectum, perhaps the most challenging surgery encountered by the laparoscopic surgeon. The hardware of our system includes a computer, a display screen and two haptic devices (Phantom Omni). These devices can be used as grasping tools, as well as dissecting instruments or energy sources depending on the function selected, and are interchangeable between the two haptic devices (Figure 1).

Figure 1: VR simulator in laparoscopic rectum surgery.

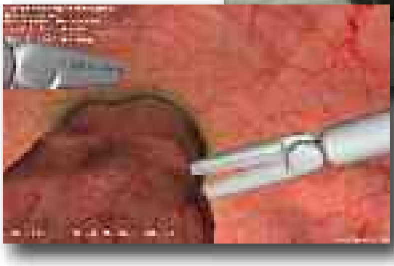

Figure 2: Interface of VR simulator in laparoscopic rectum surgery.

The haptic device provides 6-DOF navigating parameters (pitch, yaw, insertion) and force feedback when there is a collision detected. The user interface (Figure 2) also permits the user to use the haptic device as a navigation camera. We created the surface mesh model of a rectum and its surrounding tissue using data from a Magnetic Resonance Image (MRI) of the rectum and by referencing real surgery videos, as it is simple and efficient in deformation computation. Run-time operations include soft tissue deformation, collision detection, cutting, rendering and communication with the haptic devices. Some novel techniques are applied in this system. A haptic force filter based on the radial basis functions can adjust the force adaptively according to the mesh density of the contact surface. A Cosserat rod model has been introduced to cope with frequent collision detection and substantial soft tissue deformation. It parameterizes the centerline of the intestine with material coordinates. Rigid spheres are attached to the Cosserat rod, approximating the 3-D shape as bounding volumes of the intestine model. This approach meets the system requirement of real-time graphic performance and high deformation accuracy.

Two consultant surgeons, from hospitals in Bournemouth and Poole, have been closely involved in the development of the system from the outset. They both provide regular input, advising our researchers about the medical aspects of the VR model and help to evaluate the results. The tactile feedback model has been refined a number of times as a result and has been developed using their experience of operating on patients to provide a realistic feel. Our aim with this haptic rendering is to provide trainee surgeons with a VR tool with which they can familiarize themselves with the anatomy and steps of a procedure, at the same time giving them a realistic tactile feeling and real-time visual outputs. The ultimate aim is to shorten the surgeon's learning curve in an era where the length of surgical training is being reduced.

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Medical Simulations for a Patient-specific Clinical Practice

"Patient-specific modeling has been used to develop new applications in the rapidly growing field of interventional cardiology, namely supporting the development of minimally invasive procedures for the treatment of valvular pathologies ... the outcomes of these simulations can provide clinicians with further evidence on the feasibility of implants, as well as advise engineers about the risk of structural issues."

By Claudio Capelli

The safety and performance of medical devices prior to their use in clinical practice is currently demonstrated by the use of models. Computer models can contribute to creating a virtual environment for testing the efficacy of novel designs. Realistic simulations require information on the anatomy where the device will be employed, and on the physiologic conditions which will affect its mechanical behavior. Recent developments of modern 3-D imaging techniques, especially magnetic resonance (MR) and computed tomography (CT) imaging, make these aspects describable in so-called patient-specific models.

Patient-specific modeling has been used to develop new applications in the rapidly growing field of interventional cardiology, namely supporting the development of minimally invasive procedures for the treatment of valvular pathologies. In 2000, Professor Bonhoeffer demonstrated the feasibility of replacing a heart valve without resorting to an open-heart surgical operation: a biological valve, sewn into a stent, was crimped onto a catheter, inserted into a vein in the leg and guided to the heart. The device, Melody® Transcatheter Pulmonary Valve (Medtronic Inc.), offered children and adults suffering from a failing pulmonary valve a revolutionary option for treatment without being forced to undergo high-risk surgery. Additionally, in 2002, a transcatheter procedure was successfully performed in the aortic position (TAVI) as an alternative for dealing with the most common valve pathology in Europe and the U.S. Since then, this approach has seen groundbreaking success with more than 40,000 patients treated to date. However, the number of patients who could potentially avoid surgery is still limited by the number of devices which are rarely implantable in a patient population that varies in terms of morphology and dynamics.

"Computer models can contribute to creating a virtual environment for testing the efficacy of novel designs ... Recent developments of modern 3-D imaging techniques, especially magnetic resonance and computed tomography imaging, make these aspects describable in so-called patient-specific models."

Hence, the pre-implantation assessment has become crucial. Next to well-established imaging techniques, we have developed patient-specific models in which we simulate the device implantation phase. MR and CT images are acquired and post-processed to create a 3-D model of the patient's anatomy (Figure 1). One or more models of devices are then virtually implanted by finite element simulations. The final configurations are

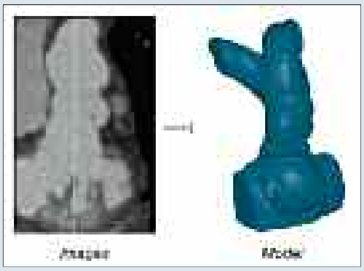

Figure 1 (above): Patient-specific model: from MR images (left) to 3-D model (right).

Figure 2 (upper right): Simulations of implant of percutaneous valve devices in pulmonary artery of highly different patients' morphologies.

Figure 3 (right): Validation process of device implantation into a patient-specific model: comparison between experimental (left) and computational (right) outcomes.

explored to assess the success of the procedure in a large population of patients (Figure 2). The best placement strategy and the distribution of stress were assessed. Results from the computational model are validated by bench experiments (Figure 3) and clinical results, supporting the reliability of the computational findings.

In general, the outcomes of these simulations can provide clinicians with further evidence on the feasibility of implants, as well as advise engineers about the risk of structural issues. At the University College London's Institute of Cardiovascular Science and the Great Ormond Street Hospital for Children (London, UK), this technique has fostered a better understanding of episodes of device fractures, supported the first implant of a novel device for percutaneous pulmonary issues in a human, and explored the potential of minimally invasive alternatives for patients suffering from a failing bioprosthetic aortic valve.

In the future, our aspiration is a more extensive implementation of medical simulations in clinical practice. A multidisciplinary approach of this kind can open the doors to safer and more effective procedures tailored to the characteristics of every patient.

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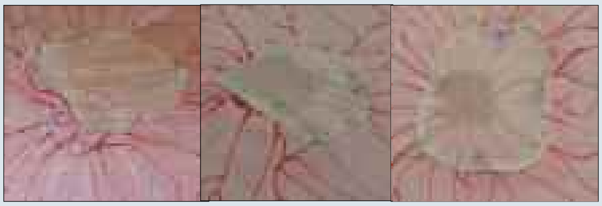
Higher Order Performance Assessments Using Error Enabled Simulations: A New Approach

▸ By Carla M. Pugh & Janis Cannon-Bowers

"Surgical procedure simulators that allow for error prevention, error recognition and error rescue offer training opportunities that may exceed those possible in the live setting as error avoidance and patient safety trump trainee independence."

In the operating room environment, mastery of surgical skills requires both technical excellence and excellence in operative decision making. Recognizing and correcting errors for both of these skills is a vital component of surgical training. When the goal of training is achievement of expertise, deliberate practice should be strategically incorporated as part of the learn-



Figures 1-3: Three hernia repairs with different types of errors.

Figures 4: Error enabled box trainer style simulator in simulated operating room.

Figures 5: Participant and assistant performing a hernia repair.

ing process. Many characteristics once believed to reflect innate talent are now believed to be the result of intense practice extended over many years. Proper implementation of deliberate practice requires strategically designed performance assessments and high quality, structured feedback. Performance-based assessments have been defined as behavior-related measurements in settings designed to emulate real-life contexts or conditions in which specific knowledge or skills are actually applied. In essence, performance-based assessments require evaluation during the performance of tasks that are valued in their own right. In contrast, pencil-and-paper tests derive their value primarily as indicators or correlates of other valued performances.

Overall, performance-based assessments are well positioned to measure complex skills including communication and disciplinary knowledge which are considered important competencies in medical and surgical training. Surgical procedure simulators that allow for error prevention, error recognition and error rescue offer training opportunities that may exceed those possible in the live setting as error avoidance and patient safety trump trainee independence. Figures 1-3 show images of ventral hernia repairs completed by three different surgical residents during a performance-based assessment grounded in an error framework. All of the participants were senior level residents (fourth or fifth year) from different training programs. In Figure 1, a number of errors can be seen: a) there are no anchoring stitches, b) the mesh does not completely cover the hernia defect, and c) the mesh is not completely flat or flush to the abdominal wall. In Figure 2: a) the anchoring stitches are not well positioned for the mesh size and b) the mesh does not completely cover the hernia defect. In Figure 3: a) the mesh is too large for the defect, b) the mesh is off-centered, and c) some of the mesh tacks are too far away from the mesh edge. This surgical procedure simulator allows for independent operative decision making which allows for error prevention, recognition and rescue. Figures 4-5 show the complete system.

"Recognizing and correcting errors is a vital component in the process of achieving mastery both for individuals and high functioning specialized teams."

Error-enabled simulations allow for higher order training and assessment. Moreover, in the process of recognizing and correcting errors and near misses, the possibility exists that the newly developed, behavioral adjustment may still result in an error or worsening of an already recognized error. The theoretical basis for this was described by Wirstad. In essence, as knowledge-based behaviors are employed when a situation is novel or unexpected, the resulting behavior represents a more advanced level of reasoning. Moreover, in these situations, the cognitive workload is typically greater than that noted for basic skill- or rule-based behaviors and may increase the likelihood of making errors. Recognizing and correcting errors is a vital component in the process of achieving mastery both for individuals and high functioning specialized teams.

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Mixed Virtual Learning Environments for the Simulation of Head and Neck Injuries

"New immersive and authentic learning environments are needed to enhance the interactive visualization and understanding of injury mechanisms in a contextualized accident history. The Visualization through Imaging and Simulation educational model is namely a mixed simulation-based virtual learning environment that aims to improve the clinical diagnosis and treatment of head and neck injuries for medical education, in particular, for specialist training in orthopedics."

By Olivier Courteille, Hans von Holst & Li Felländer-Tsai

The quality of clinical decision making in the treatment of trauma patients could be significantly improved by promoting the history of the accident as an important supplement to generally accepted diagnostic tools like computerized tomography (CT) or magnetic resonance (MRI). However, this kind of investigation is complex and involves a biomechanical perspective in the diagnosis, a knowledge that is not part of the curriculum for physicians, physiotherapists, occupational therapists or nurses today.

This is particularly the case of injuries in the head and neck region which are often acute and multi-faceted, involving hard and soft tissues. Thus, to be able to handle these cases and decide on proper investigation and treatment procedures, medical students and residents need to be trained with more dedicated learning tools to learn the underlying anatomical and physiological, as well as biomechanical, properties of such injuries.

Educational Computer Simulation Model

New immersive and authentic learning environments are thus needed to enhance the interactive visualization and understanding of injury mechanisms in a contextualized accident history. Embracing the increasing trend advocating for integrated simulations, joined efforts led by the Royal Institute of Technology (KTH) and the Karolinska Institute (KI) in Sweden gave birth to the VIS-Ed (Visualization through Imaging and Simulation) educational model. VIS-Ed is namely a mixed simulation-based virtual learning environment that aims to improve the clinical diagnosis and treatment of head and neck injuries for medical education, in particular, for specialist training in orthopedics and neurosurgery.

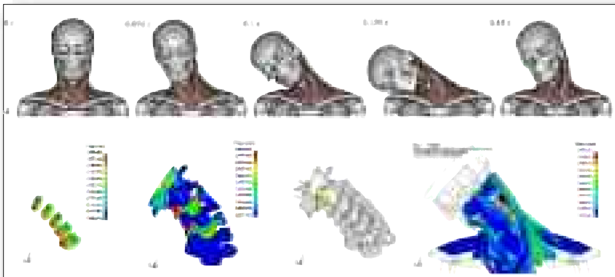

Figure 1: Visualizations of injury risk due to a lateral impact to the torso (red areas showing high risk for injury, © KTH head and neck model).

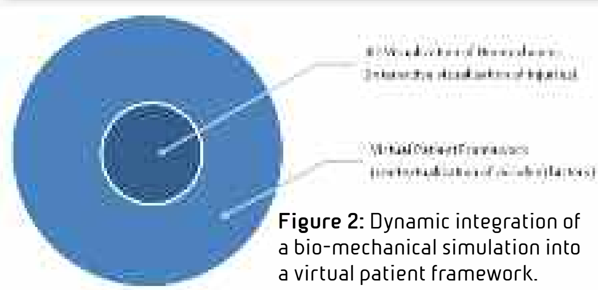

Figure 2: Dynamic integration of a bio-mechanical simulation into a virtual patient framework.

VIS-Ed enables a dynamic integration of a biomechanical simulation, featuring the interactive visualization of injuries, into a virtual patient (VP) framework, providing the conceptualization of accident history.

Figure 3a: Screenshot of the Virtual Patient's Medical History.

Figure 3b: Screenshot of the Virtual Patient's lab section displaying a 3-D reconstruction of a cervical spine CT.

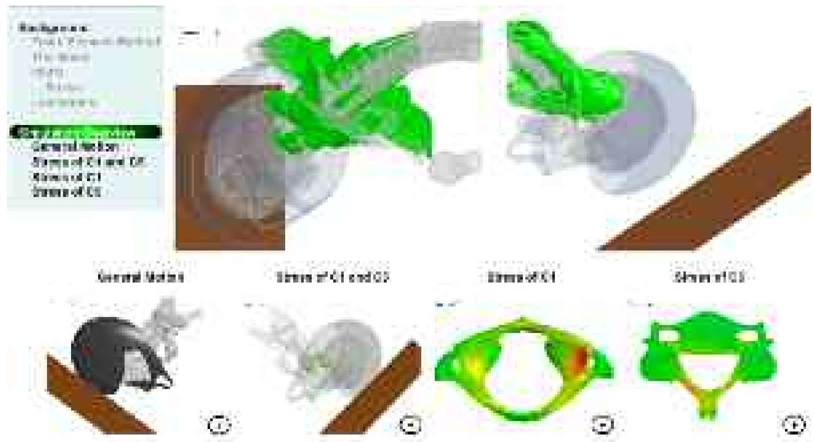

Figure 4: Screenshot of 3-D simulations showing the impact of an accident on cervical vertebrae.

Through the VP-based contextualization of the accident history, this educational model favors experiential learning, which is beneficial for knowledge acquisition, retention and skill transfer. Moreover, the interactive biomechanical simulation of the injury makes it possible to easily visualize therapy and rehabilitation outcomes, and consequently, better understand their impact over time on patient condition.

Virtual Patient

The patient cases are portrayed using Virtual Patients, where trainees can investigate the clinical case, make decisions and explore the consequences of their actions. This includes taking the patient's medical history, examining the patient, and ordering lab/imaging tests.

Interactive Visualization of Traumabiomechanical Events

The 3-D interactive visualization of biomechanical events related to the accident is based on the Finite Element Method (FEM), where the user can easily explore the forces the skull, neck and soft tissues have been exposed to. The animated biomechanical simulation can display, in detail, the impact on the cervical vertebrae and muscles.

Ongoing Work

A preliminary study with a motorcycle accident case was recently undertaken involving nine participants (five medical students and four residents). We investigated how trainees can take advantage of these integrated visualization techniques to better understand how head and neck injuries should be handled clinically. Data collection included:

• The perceived usefulness of the model

• Participants' appraisals about the educational potential of this mixed learning tool

• Suggestions for technical and educational improvements

The preliminary results were very promising. Participants were very positive about VIS-Ed and overwhelmingly favored this kind of (mixed) learning method to the traditional one. They also perceived that this computer-mediated activity would help them to better understand and visualize biomechanical injuries and the effectiveness of suggested therapy. Finally, they believed they would be better prepared to assess and treat similar head and neck injuries if such models were to be implemented in the medical curriculum.

Levels of acceptability and satisfaction were high and valuable recommendations for further improvements of the VIS-Ed model and its learning components were also provided.

A new control study is currently investigating if VIS-Ed can significantly improve the clinical diagnosis and treatment in head and neck trauma situations for undergraduate student education and specialist training in orthopedics.

Future Directions

• More targeted interactive and immersive educational models are needed on head and neck injuries and their prevention.

• The range of use of VIS-Ed like Mixed Virtual Learning Environments extends beyond undergraduate student education and specialist training for physicians and also includes physiotherapists, occupational therapists and nurses.

• Safety promotion and injury promotion have also been identified as natural areas for VIS-Ed (like consequences of violence in schools, childcare clinics and young parents, drivers' license education, life guard training, etc.).

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Product Comparison Chart: Medical Simulation

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PRODUCT	DESCRIPTION OF PRODUCT	MANUFACTURER
BabySIM	simulator baby features realistic touch and feel with features such as palpable pulse, urine output, bowel sounds, blinking eyes and pupil dilation; facilitates learning of critical care interventions including infant CPR, airway management, drug administration and defibrillation	METI
Abdominal Opening & Closure Trainer	pad featuring a refined abdominal wall used for surgical access to the abdomen including procedures such as incisions: linear, ellipse, flaps, shaped; subcuticular undermining; interrupted suturing techniques; suturing, stapling and use of adhesive strips	Limbs & Things Ltd.
Spinal Injection Simulator	spinal simulator that allows for realistic demonstration and practice of all spinal injections such as spinal anesthesia, spinal tap, epidural analgesia, caudal analgesia, sacral nerve block, and lumbar sympathetic block	3-DMed
Physician and Surgeon Training	interactive experience using 3-D technology to simulate instrumentation, anatomy, complex processes, procedures and surgical techniques; includes Tutorial and Perform Modes, and haptics strategy	mySmartSimulations
Colonoscope Training Model	colonoscope simulator made of soft, flexible, airtight material allows for realistic insertion and withdrawal training, insufflation, suction and difficult maneuver techniques	Kyoto Kagaku Co., LTD
SMART STAT	full-body, adult mannequin which can be used for EMS, nursing, and trauma skills and helps users gain experience in cardiac and medical disease care	WorldPoint
Keystones Certificate	an immersive, multi-course healthcare simulation experience including developing a simulation scenario for piloting, submitting reflection papers, and participating in rounds	Sim-One
MetiMan	mannequin-based simulator with built-in, wireless system and can be used for basic assessment and practicing chest tube insertion, general ongoing care, pre and postoperative care, experience with complications including deep vein thrombosis, suctioning and trachea care with hypoxia, etc.	CAE Health Care
Combat Medic System	virtual training simulator for field medics; simulates patient care in a highly volatile battlezone, built-in performance evaluation system to provide real-time feedback with data stored for future reference	Virtual Reality Medical Center
Ultrasound Heart Phantom	simulator heart consisting of a completely anthropomorphic external and internal anatomy, useful for teaching and developing ultrasound examination skills and techniques as well as demonstrating 3-D ultrasound capabilities	CIRS
Host Site Instructor Training: Simulation as a Teaching Tool	four-day course designed for educators who wish to create high-quality healthcare simulation programs; clinical, behavioral, and cognitive skills through simulation are taught to the participants with the daily schedule including simulation scenarios, lectures, small and large group discussions, and practical exercises with feedback	Center for Medical Simulation

Wounds of War IV: Pain Syndromes: From Recruitment to Returning Troops

EDITED BY:
Professor Dr. Brenda K. Wiederhold, Ph.D., MBA, BCIA

WOUNDS OF WAR IV: PAIN SYNDROMES – FROM RECRUITMENT TO RETURNING TROOPS

On September 30-October 2, 2011 the NATO Advanced Research "Wounds of War IV: Pain Syndromes – From Recruitment to Returning Troops" drew over 25 eminent experts from 11 countries to discuss the topic of increased pain syndromes in our service men and women.

Held in Südkärnten, Austria at the Hotel Amerika-Holzer, discussion topics included increased pain syndromes as a result of missions, as well as how pain syndromes may be prevented. Research has shown that those who have served in both combat missions and peacekeeping operations are at an increased risk for pain syndromes. The ultimate aim of the workshop will be critical assessment of existing knowledge and identification of directions for future actions. The co-organizers of the workshop alongside Professor Brenda K. Wiederhold included Professor Kresimir Cosic, Professor Mark D. Wiederhold and Colonel Carl Castro.

Full papers will be published with IOS Press
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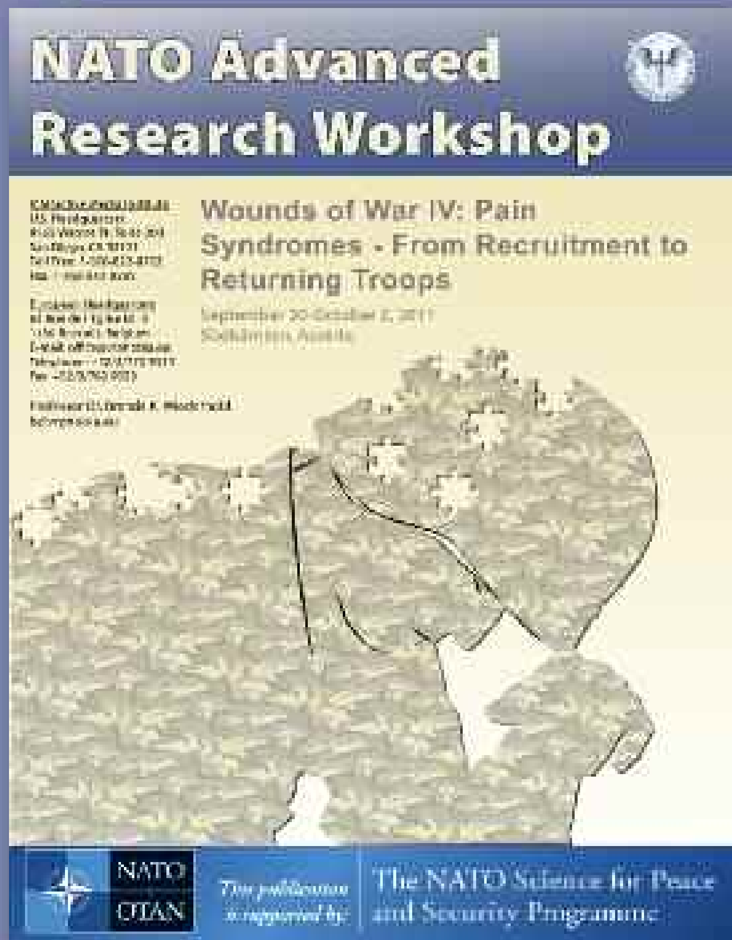

The post-conference book will reflect the key topics discussed in the four sections at the workshop:

First Session
Vulnerability to Pain Syndromes
Second Session
Diagnosis and Assessment of Pain Syndromes
Third Session
Treatment of Pain Syndromes
Fourth Session
Clinical Updates on Pain Syndromes

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A Whole New World of Medical Education

"Based on adult learning theory, STRATUS is founded upon 'learning by doing.' In addition to the hands-on clinical opportunities which ignite many insightful discussions related to clinical diagnosis and management, STRATUS [Simulation, Training, Research and Technology Utilization System Center] at Brigham and Women's Hospital also emphasizes the importance of teamwork and communication in the healthcare environment."

By Nicole Kissane & Charles Pozner

Medical education has entered a virtual world. The Neil and Elise Wallace Simulation, Training, Research and Technology Utilization System Center at Brigham and Women's Hospital, known as STRATUS, has taken the lead in teaching students and training clinicians through simulation. On the campus of the Brigham and Women's Hospital in Boston, Massachusetts, STRATUS is home to high-tech mannequins that talk, breathe, have a palpable pulse, and can go into cardiac arrest. In addition to these human simulators, STRATUS also uniquely has a high-tech micro-simulation center for computer-based simulation and education, as well as a partial task simulation center for hybrid simulation and hands-on procedures. The full-scale operating room is complete with authentic anesthesia equipment, high definition laparoscopic monitors and surgical booms, real instruments, and scrub sinks.

Figure 1: Using the endovascular trainer, this clinician is successfully placing a stent in the mannequin's clogged coronary vessel.

This operating room also doubles as a birthing suite with a sophisticated mannequin that can deliver a baby and simulate postpartum hemorrhage events. Upon delivery, again with hybrid simulation, the suite can transform into a Neonatal Intensive Care Unit, with focus transitioned from delivery to neonatal care. STRATUS also has an "arcade" which contains laparoscopic surgical trainers, endoscopic simulators, ultrasound trainers, and Virtual Reality surgical simulators. The arcade is also the home to an endovascular suite that enables cardiologists, interventional radiologists, and endovascular surgeons to master sophisticated vascular catheterizations in a simulated environment.

Using the experience of simulation as a catalyst for learning, STRATUS recognizes the primary importance of debriefing participants after each scenario. Based on adult learning theory, STRATUS is found-

Figure 2 (top): Trauma team members work together to save a life ... in simulation.
Figure 3: Students interested in medical careers participate in emergency code training, practicing basic and advanced life support skills.

ed upon "learning by doing." In addition to the hands-on clinical opportunities which ignite many insightful discussions related to clinical diagnosis and management, STRATUS also emphasizes the importance of teamwork and communication in the healthcare environment. Courses specifically designed for team training have shown to improve outcomes and provide learners with experience in high acuity, yet infrequent, scenarios. Code Team Training, Trauma Team Training, and Obstetrical Team Training are all examples of curricula designed specifically for maximizing teamwork. The curricula for these programs are created around a specialty-specific scenario, however, the focus of the debriefing is the same: communication, leadership, teamwork, safety, and outcomes.

"The curricula for these programs are created around a specialty-specific scenario, however, the focus of the debriefing is the same: communication, leadership, teamwork, safety, and outcomes."

STRATUS is available to every department throughout the hospital and provides each specialty with specific simulation-based training and educational opportunities. The learning community at STRATUS includes doctors, nurses, therapists, paramedics, and technicians. The future of STRATUS is focused around its learners by providing clinicians with the unique opportunity to improve performance – at the clinic, by the bedside, in the operating room, and during an emergency – where it matters most, and where patient safety is top priority.

Nicole Kissane, M.D.
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Annual Review of Cybertherapy and Telemedicine 2011
Advanced Technologies in the Behavioral, Social and Neurosciences
Editors: B. K. Wiederhold, S. Bouchard, and G. Riva

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Cybertherapy – the provision of healthcare services using advanced technologies – can help improve the lives of many of us, both patients and health professionals, while tackling the challenges to healthcare systems.

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Virtual Healers
Brenda K. Wiederhold, Ph.D., MBA, BCIA

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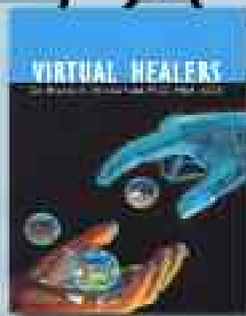
Virtual Reality in the Mental Health arena is barely over a decade old. Because VR is still such a young and focused field, the members of its community have come together as a tight-knit family. In Virtual Healers, Dr. Brenda K. Wiederhold, herself a pioneer of VR, sits down in casual one-on-one interviews with more than a dozen of the top researchers of this select group.



Virtual Healing
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Along with aliens and time travel, virtual reality (VR) is often thought of as a science fiction dream. Though it was developed nearly five decades ago, the use of VR in the private sector, particularly in the field of patient care, has become a possibility only in the past decade. As programmers are creating more detailed and interactive environments, the rapid advancement of technology combined with decreasing costs has turned VR into a promising alternative to traditional therapies.

Virtual Reality Resources
By Brenda K. Wiederhold, PhD, MBA, BCIA

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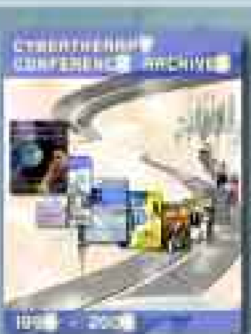
We, at the Interactive Media Institute, realized early on that it was relatively difficult for professionals wanting to break into the Virtual Reality (VR) field to locate relevant information. While the material was out there, there was no clear organizational structure or database to link it. To solve this problem, we have put together Virtual Reality Resources, a relevant compilation for researchers and clinicians alike.



CyberTherapy Conference Archives 1996-2005
A Collection of all abstracts from the past 10 years of CyberTherapy
By Brenda K. Wiederhold, PhD, MBA, BCIA

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A decade ago, CyberTherapy, then still in its infancy, only existed as a specialized Virtual Reality and Behavioral Healthcare Symposium at the Medicine Meets Virtual Reality (MMVR) Conference. It is now clear that in 1996, we had only begun to realize what promise might lie ahead for both VR technology and the CyberTherapy Conference.

iACToR Resources

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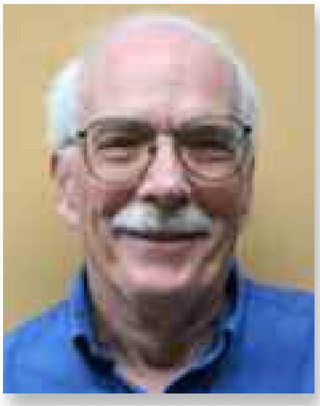
Ask the Expert: Q&A

Barr Taylor

Director of the Laboratory for the Study of Behavioral Medicine, Stanford Medical School

"Our programs could be improved by integrating games and other activities ... the importance of tailored interventions that are cost-effective, easily-disseminated, and engaging to youth must be balanced with the goal of promoting increased activity."



Brenda K. Wiederhold: What is your current position?

Barr Taylor: I am a Professor of Psychiatry at Stanford Medical School and Director of the Laboratory for the Study of Behavioral Medicine.

BKW: What is your main line of current research?

BT: I am interested in primary and secondary prevention using Internet-based programs and other new technologies to reach defined populations. We have two large projects underway. In one, we provide a universal and targeted/selective prevention program to all 9th grade students at a local high school. Students are assigned to one of two "tracks" based on baseline weight. If they are "normal" weight they get a healthy weight regulation program that focuses on good nutrition, exercise and body image. If they are overweight or obese they get a program that helps with weight maintenance or weight loss. The program lasts 10 weeks and is delivered in the computer lab, during the physical activity class. There is a huge need for such programs in schools, particularly online programs combined with other activities. I believe schools can (need to) play a pivotal role in promoting healthy weight regulation and emotional health among youth. We have another program designed to foster positive body image in college students. This program combines environmental activities with online screening so that college students are provided programs based on risk: no/low risk (StayingFit), risk of eating disorder (StudentBodies) and/or referral for clinical services.

"There is a huge need for such programs in schools, particularly online programs combined with other activities. I believe schools can (need to) play a pivotal role in promoting healthy weight regulation and emotional health among youth."

I have also been interested in combining teletherapy with online and Internet-based interventions. We have a project right now in Australia that uses telephone-based psychotherapy to promote lifestyle change (weight regulation and exercise) and improve mood in patients with heart disease and depression. In published studies we have shown the benefit of home-based nurse case management for multifactorial risk reduction in patients with heart disease and depression. I think the telephone is the most under-utilized tool in medicine!

BKW: In one of your papers you write: "Given its potential to reach large populations it would seem ideal to provide obesity prevention programs over the Internet ..." Can you tell me how you see technology impacting (positively or negatively) obesity, and more generally, metabolic disorders?

BT: Our work has recently focused on reaching all members of a defined population, for instance, all 9th grade students in a school. In many schools half or more of 9th grade students are overweight or obese and many are at risk of developing diabetes. A preventive intervention needs to address the unique needs of the students who are overweight and obese and a more universal curriculum must be provided to healthy weight students. Furthermore, the curriculum should avoid stigmatizing students while simultaneously reducing weight and shape concerns, the latter being a risk factor for eating disorders. We have designed programs to achieve these aims that can be delivered to all 9th grade students in a class.

Preliminary data from several recent studies suggests that use of the program was associated with increased consumption of healthy foods and a decreased consumption of unhealthy foods, and with weight loss in the 40% of kids who were overweight/obese. Our programs could be improved by integrating games and other activities. It can seem counterintuitive to promote computer-based interventions while encouraging students to reduce sedentary activity. However, the importance of tailored interventions that are cost-effective, easily-disseminated, and engaging to youth must be balanced with the goal of promoting increased activity. However, these programs can and should be combined with classroom and other activities.

BKW: How does obesity prevention impact body image?

BT: This is a hugely important question. We have found, as have others, that obesity prevention, when done properly, can reduce weight and shape concerns. I believe it is a myth – and a dangerous one – that weighing kids in school is bad, because, for instance, it may increase the risk of eating disorders. When done with respect to the student's privacy and with proper feedback there is no evidence that weighing students in school is harmful; rather, it creates a database that permits us to deal with this epidemic in our society.

BKW: What first interested you in obesity and metabolic disorders?

BT: In the 1970s I was education director of an amazing study, in which whole communities were randomized to mass media plus community organization efforts to reduce cardiovascular risk. The study had a positive effect on improving risk. I also served as Associate Director of the Stanford Cardiac Rehabilitation Program and saw the sometimes devastating effects of these disorders first hand. I eventually decided to focus on adolescent and college students to address risk factors at an early age.

BKW: What do you think we should do to move this research forward?

BT: A. We need a national focus and center that provides free, healthy lifestyle programs to schools! Some countries are moving in this direction. These programs need to be developed using innovative methods that are likely to make them more effective, such as the use of adaptive designs, smart trials and continuous quality improvement. The programs should be linked to measured outcomes in schools.

B. We need to figure out how to combine Internet-based programs with school, community, and home-based activities and to take advantage of social networks.

C. We researchers need to make more interesting and engaging programs using apps, games, Virtual Reality programs, monitoring devices, etc.

D. Once we have a core program for schools, we can discover and add enhancements – such as games.

E. We need to have a way to fund school-based prevention programs. The schools are broke and the teachers overworked. I think Internet programs need to be easy to deliver within protected/private school networks. I think it will be necessary to seek local commercial sponsorship.

"I have also been interested in combining teletherapy with online and Internet-based interventions ... In published studies we have shown the benefit of home-based nurse case management for multifactorial risk reduction in patients with heart disease and depression. I think the telephone is the most under-utilized tool in medicine!"

BKW: What are you most proud of in your career?

BT: First, my students. Second, probably, is helping to establish the scientific basis that led the Joint Commission on Accreditation of Healthcare Organizations to require inpatient tobacco cessation programs for individuals who were smoking before admission and want to quit.

BKW: What do you predict as the new trends for technology and healthcare for the next decade?

BT: The next big trend will be finding ways to manage weight loss/maintenance via linking "consumption" (e.g., food purchases in restaurants and markets) and other lifestyle activities to weight changes/goals via phones, and other electronic devices.

BKW: What drives you?

BT: Flyfishing and getting StayingFit (our school-based healthy weight regulation program) to 50,000 students next year!

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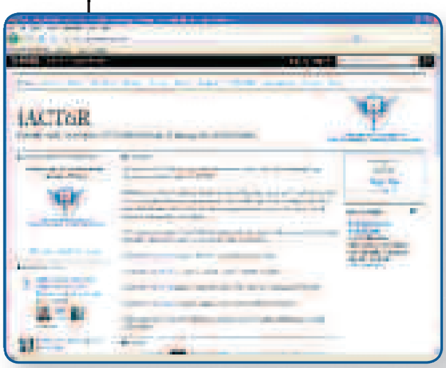

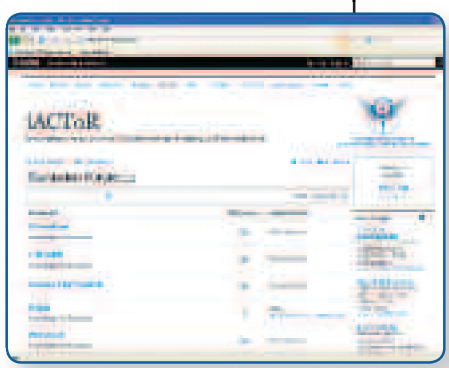

FROM WHERE WE SIT:
The Two Faces of Virtual Reality: Medical Simulation and Experiential Interface

By Giuseppe Riva

Within the emerging cybertherapy field, a central role is played by Virtual Reality (VR). If we check the two leading clinical databases – MEDLINE and PSYCINFO – using "Virtual Reality" as keywords we can find 3,336 papers listed in MEDLINE and 730 in PSYCINFO (all fields query, accessed 11 November 2011).

The first VR healthcare applications started in the early '90s to address medical staff's need to visualize complex medical data, particularly during surgery and for surgery planning. Actually, surgery-related applications of VR fall mainly into three classes: surgery training, surgery planning and augmented reality for surgery sessions in open surgery, endoscopy, and radiosurgery. A couple of years later, the scope of VR applications in medicine has broadened to include neuropsychological assessment and rehabilitation. In general, VR in healthcare has two faces.

For physicians and surgeons, the ultimate goal of VR is the presentation of virtual objects to all of the human senses in a way that is identical to their natural counterpart. As noted by Professor Richard Satava, as more and more of the medical technologies become information-based, it will be possible to represent a patient with higher fidelity to a point that the image may become a surrogate for the patient – the medical avatar. In this sense, an effective VR system, as discussed widely in this issue, should provide realistic body parts or avatars that interact with external devices, such as

"As noted by Professor Richard Satava, as more and more of the medical technologies become information-based, it will be possible to represent a patient with higher fidelity to a point that the image may become a surrogate for the patient – the medical avatar."

continued on page 37

FURTHER AFIELD:
Integrating High-Fidelity Simulation in Nursing and Medical Training for Seamless Care

By Lingjun Kong

For decades, simulation in nursing education and medical training has been incorporated into the teaching and learning process in the form of static mannequins, role playing, scenario settings, case studies and other techniques. However, the use of high-fidelity simulations to prepare students in critical thinking, self-reflection and complex clinical environments has recently become a progressively popular educational tool. The ability of high-fidelity simulations to simulate realistic clinical situations without risk to patients opens up new avenues in the development of medical and clinical competence for nursing students.

In healthcare, simulations provide a natural framework for the integration of basic and clinical mechanisms, allowing nurses to learn how to accurately and safely care for patients in less threatened environments.

Furthermore, high-fidelity simulations can mimic the environments in disaster situations, especially those that involve outside professionals such as paramedics, policemen, or firemen. SimMan, made by Laerdal, is an example of a high-fidelity simulator. SimMan is a computerized, interactive, life-sized mannequin driven by pre-defined software to provide realistic patient responses and outcomes for care training. Utilizing this innovative technology decreases the need for diverse clinical sites, equipping nursing schools with a cost-effective tool they have needed. The National Council of State Boards of Nursing an-

ticipates that high-fidelity simulation will continue to grow in presence as an evaluation and teaching strategy tool in the future of clinical and nursing education.

The use of high-fidelity patient simulation effectively facilitates learning under the right conditions, according to a systematic review by B. Issenberg et al. In addition to its use in offering clinical variations and diverse situations, high-fidelity simulation provides a range of difficulty levels for tasks and innovative learning strategies, as well as controlled and safe practice environments allowing for repetitive practice. Furthermore, simulations let nurses capture clinical variations and conduct individualized and outcome-based learning experiences to fulfill the unique needs of each user. New graduates are prepared for critical thinking and reflective skills, and real-time nursing practice correlated with the quality of patient care.

In Asia, Singapore was the first country to integrate advanced simulation facilities for nursing education. Funded by the Lee Foundation, the Critical Care Nursing Simulation Laboratory of the National University Hospital (NUH) opened in 2007. The $250,000, 100-square foot laboratory is used to conduct practical training in its High Dependency and Intensive Care Unit rooms.

The most integral component of the laboratory is a high-fidelity simulation mannequin, which can simulate almost all critical medical conditions when coupled with their state-of-the-art computer and audio-visual system. The mannequin can replicate critical medical conditions with vital statistics, ECG waves, and even physical responses. Nurses at NUH are able to safely practice their clinical skills prior to interacting with real patients, thus greatly improving the quality of care that they provide. In addition to allowing students to gain experience in critical skills such as airway management, immobilization, and basic and advanced life support, the integration of the Critical Care Nursing Simulation Laboratory has offered the systematic training of doctors and nurses alongside one another. When tailored for a specific situation, the high-fidelity simulation allows both doctors and nurses to practice their skills to provide cooperative care for patients. NUH is continuing to expand their program to offer the course to a larger percentage of their staff. Hospitals in neighboring countries, such as Indonesia, Thailand, and Malaysia, have also expressed interest in using the laboratory to train their own nurses.

The second high-fidelity simulation laboratory in Asia was The Virtual Integrated Nursing Education Simulation Laboratory (VINES) at The Far Eastern University Institute of Nursing in the Philippines. VINES integrates hospital-like qualities into their laboratory, as well as high-fidelity mannequins for safe and controlled environments for its student nurses.

According to results from the Philippine Nurse Licensure Examination, as well as employment statistics, The Far Eastern University Institute of Nursing is consistently one of the top nursing schools in the country. Since the incorporation of VINES, the school can provide repetitive and customized nursing lessons in a non-threatening arena, further expanding the avenues of education provided at the Institute.

Despite the many benefits of simulation education in nursing schools, a large gap exists between academic simulations and clinical reality.

"The use of high-fidelity patient simulation ... provides a range of difficulty levels for tasks and innovative learning strategies, as well as controlled and safe practice environments allowing for repetitive practice. Furthermore, simulations let nurses capture clinical variation, and conduct individualized, outcome-based learning experi-

It is still a recently adopted technology that raises many questions in nursing education: How can it be used effectively in its role of the clinical development of students? How can it be seamlessly integrated to be a key part of education curriculum? Factors that need to be considered include variations in faculty skill sets and how these changes can be addressed; changes in teaching evolving into student-centered approaches; high technology practices being integrated into clinical settings; and the need for high quality training devices, and high expectations of students. With further development, the integration of high-fidelity simulations holds the promise of bridging the gap between nursing education and clinical practice.

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surgical instruments, as closely as possible to their real models.

However, there is another way of using VR in healthcare. Clinical psychologists and rehabilitation specialists use VR to provide a new human-computer interaction paradigm in which users are no longer simply external observers of images on a computer screen but are active participants within a computer-generated 3-D virtual world. Within the virtual experience the patient has the possibility of learning to manage a problematic situation related to his/her disturbance. The key characteristics of virtual environments for these professionals are both the high level of control of the interaction with the tool without the constraints usually found in computer systems, and the enriched experience provided to the patient.

"The first VR healthcare applications started in the early '90s to address medical staff's need to visualize complex medical data."

For both sides, a critical advantage is that virtual environments are highly flexible and programmable. They enable the therapist to present a wide variety of controlled stimuli, and to measure and monitor a wide variety of responses made by the user. This flexibility can also be used to provide systematic experiential training to optimize the degree of transfer of training or generalization of learning to the person's real world environment.

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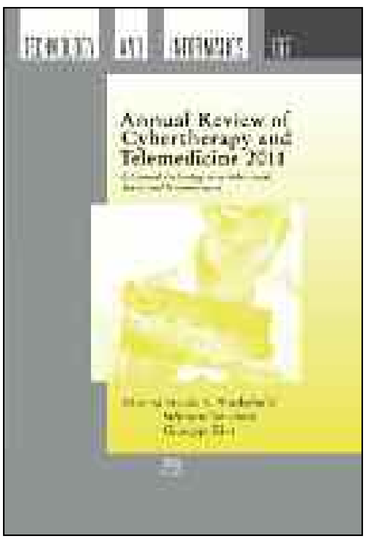

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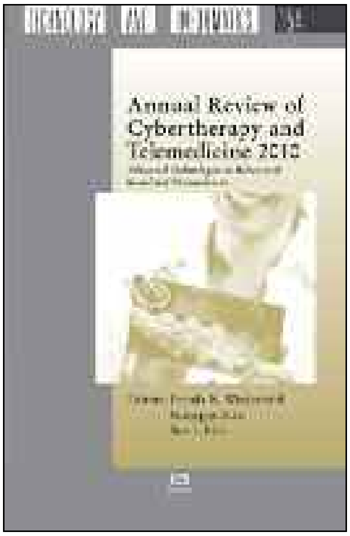

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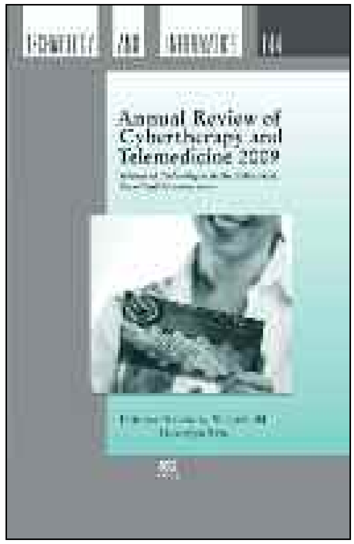

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With the aid of the provincial governments, the Canadian federal government addressed shortcomings in the field of mental healthcare after realizing that this segment had been neglected. Using the engagement and feedback from people of all sectors, it helped to lay the groundwork for a deliberate and thoughtful plan which is now leading to the steady development of a new mental healthcare strategy for the country.

The growth of psychology as a separate field was not considered in Canada until the last half of the 19th century. The first psychology course was taught by Thomas Mucculloch at Dalhousie University in eastern Canada in 1838. Ten years after the establishment of the first psychology laboratory in Germany in 1879 by Wilhelm Wundt, James Mark Baldwin, one of Wundt's students, founded the first psychology laboratory in Canada. Although individual psychology departments began expanding in the 1920s, it was not until the 1940s that psychology was truly separated from philosophy.

Overcoming Roadblocks: Constitutional and Personal Attitudes

According to the Canadian constitution, individual provinces are responsible for the sector of mental healthcare, meaning the country does not have a supreme mental health strategy.

Researchers have estimated that almost one in every five Canadian adults will experience some type of mental illness in a year. However, many do not get proper treatment or have access to care. The quality and quantity of services available to those affected is insufficient to meet their need. Additionally, fear of stigma keeps many from seeking help, while others are unable to afford treatment.

The Canadian Senate Committee on Social Affairs, Science and Technology came to the conclusion that Canada was in critical need of a "profound transformation of the mental healthcare system … a genuine system that puts people living with mental illness at its center, with a clear focus on their ability to recover."

A Step Forward for Mental Healthcare

The federal government, with the collaboration of provisional and territorial governments, announced the creation of the Mental Health Commission of Canada (MHCC) in 2007. Its mission was to hasten the development of a mental health strategy for Canada, acknowledging that all the jurisdictions had neglected mental health needs and were faced with the same challenges.

The MHCC developed a framework for a Mental Health Strategy between June 2007 and September 2009, aiming to increase awareness of mental health and structure an official strategy for the country to follow to properly address the issue as a unified nation.

The Structure and Process

The Commission felt it was important to engage a wide range of people in order to develop the framework, including those suffering from mental health issues, their families and caregivers, advocates, mental health service providers, researchers and policy experts. A phased approach was adopted by the Commission to reach its goal, primarily focusing on *what* a trans-

Population (Million)	34
Life Expectancy (Years)	81.4
Fertility Rate	1.58
Population Median Age (Years)	41
Population Density (Persons Per Sq Km)	9.27
Percentage of Urban Population	80
Annual Population Growth Rate	0.794%
Unemployment Rate	7.1%
Hospital Beds (Per 100,000)	34
Percentage of the Population (15 and Above) Satisfied with Current Healthcare System	85.2
Lifetime Prevalence of Panic Disorder (Percentage of General Population)	3.7
Lifetime Prevalence of Mood Disorders (Percentage of General Population)	8
Total Expenditure on Health (as Percentage of GDP)	10.9

formed mental health system might look like (Phase 1 – completed), and secondly, on *how* to achieve this vision (Phase 2 – in progress).

The main goal of Phase 1 was the development and refinement of a framework document, aiming towards "Recovery and Well-Being," and using a broad public and stakeholder engagement process including:

1) Engagement of the extended Commission: Eight permanent Advisory Committees in the Commission representing both a broad range of perspectives and Canada's demographic and cultural diversity provided advice to the board and assisted the Commission in engaging with the broader stakeholder community. Most of the advisory committee members were individuals who were asked to contribute their personal perspectives based on their experience of mental health issues or illnesses. Additionally, there was a consumer council, comprised exclusively of people living with mental health issues.

2) Online participation Web site – public and stakeholders: A customized participation Web site was designed to collect input and opinions from the general public and stakeholder groups using open-ended and close-ended questions, as well as a free form option where the audiences could give qualitative comments. The site increased engagement due to its accessibility and privacy, and allowed the Commission to reach out to the youth, younger adults and other hard to reach groups whose voices are often unheard.

3) 12 Regional Dialogues: From February to April 2009, regional dialogues were held which brought together a cross-section of 30-40 participants, demonstrating a mix of individuals who had experienced mental health problems or illnesses, and their family members, caregivers, and policy-makers, among others. Participants received the opportunity to learn about the proposed framework and provide feedback, and their full participation was encouraged.

4) Focused Dialogues: These dialogues aimed at obtaining a deeper understanding of specific needs and concerns of Canada's aboriginal people, and of health and social services professionals to ensure they were correctly reflected in the final framework document.

5) Consultations with Federal/Provincial/Territorial Governments: The Commission integrated various meetings regarding the complexity and lasting effect of jurisdictional issues in the field of healthcare, and the need for a collaborative approach to address mental health issues. Additionally, the Commission held facilitated dialogues with members of the Canadian Public Health Network's Mental Issue Group and a session that brought together representatives of over 10 federal departments (justice, health, etc.) to participate in dialogue on the draft framework.

A Lasting Impact

This initiative led to a complete redrafting of the framework document to reflect pub-

lic and stakeholder input, including the addition of a vision statement, reframing of the goal statements and rewording of key concepts. It also signified the starting point of a new dialogue on mental health in Canada. Project evaluation results showed that the majority of the respondents and participants appreciated the opportunity to contribute to the creation of a mental health strategy and planned to stay linked with the Commission's work to develop a strategy based on their online experience.

The Commission's goal of moving towards a comprehensive national mental health strategy is a high-level, long-term policy objective that requires major changes in how mental health legislation, policies, programs and practices are developed and delivered by Canadian provinces and territories. The Commission will continue to involve different demographics, perspectives and regions to help raise awareness, build capacity and support advocacy to the levels necessary for sustaining a national dialogue on this critical issue, and lead decision makers to recognize and support mental health issues as a priority.

The Evolution of Therapy

Canada's first Computer Assisted Rehabilitation Environment (CAREN) systems have been implemented in Ottawa and Edmonton to utilize Virtual Reality (VR) medical treatment systems for the care of both military and civilian patients. CAREN systems will create a secure, controlled, therapeutic learning environment for soldiers requiring physical and mental rehabilitation. It will allow participants to become part of their simulated environment and interact with it, while aiming to foster hope, provide opportunity and nurture independence for people who have faced challenges due to certain illnesses or injury.

Dr. Edward Lemaire of the Ottawa Hospital Rehabilitation Center is directly involved with the development of the system and points to ways in which the rehabilitation will affect activities of daily living. "Downtown Ottawa is now programmed into CAREN to allow people to move in their virtual community during therapy," he says. The lab's collaborative research is fostered by close contact with other CAREN system labs in Israel, the Netherlands and the U.S.

Canadian universities, as well, are employing VR in their labs to address healthcare concerns. Dr. Stephane Bouchard, a professor and researcher at the Université du Québec en Outaouais, focuses on the impact of cognitive behavorial therapy on anxiety disorders, and the ways in which telepsychotherapy can be delivered through video conferencing. Bouchard uses VR to study and treat a range of afflictions, from specific phobias to more complex anxiety disorders, including panic disorder and social anxiety. The work can be used for a broad range of applications and Bouchard says, "Most of the environments we develop in the lab could be used for prevention or treatment [of mental disorders]."

The Advancement of Telemedicine

Canada is leading the way for the use of telemedicine and the Ontario Telemedicine network is one of the biggest telehealth networks in the world. In 2010, the satisfaction rate of Canadian patients using telemedicine was almost 95%. Internationally, their telehealth organizations enjoy a high profile with companies operating in Latin America, Africa, Europe and the Middle East. Over 85% of Canadian telehealth companies export their products. Moreover, tele-guided surgical operations involving doctors in Canada and Japan, and Canada and France, have proved successful.

Other forms of computing technology will enhance all aspects of physical rehabilitation, Lemaire says. "This includes VR applications in the clinic, home and workplace," he states, "wearable systems for diagnostic analysis and biofeedback; intelligent assistive devices (including smart prosthetics, exoskeletons, etc.); more intelligent wheelchair controls; and smarter outcome reporting systems to assist with clinical decision making, among others."

While the Canadian healthcare system may be undergoing major structural changes, a bright future lies ahead for the development of health information highways and innovative telehealth applications. The research and development and export capacity of the Canadian telehealth industry shows the field is ready to offer a large range of products and services on the international market. An aging and demanding consumer will undoubtedly provide more momentum for the development of home telecare systems and more accessible health and wellness information on the Internet, in addition to diverse types of new technologies to support healthcare issues. The government's commitment to providing its population with acceptable mental healthcare options and treatment, based on their ongoing support and input, speaks to its capacity to embrace change and the coming years will assuredly see novel, exciting developments in the field.

Sources:

Personal communication with Stephane Bouchard, Ph.D. and Edward Lemaire, Ph.D., and the World Health Organization.


Therapist Monitoring Station

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True North Logistics (TNL) is a small business providing complete warehouse management services either in one of our existing warehouses or in the warehouses of our clients. We are positioned to acquire an existing warehouse or build a new facility to meet our client's specific needs. Types of services we offer our clients include warehouse operations and kitting; inventory management and tracking; inventory optimization; and warehouse management system (WMS) implementation and support.

While TNL is a new company, in name only, individuals on the TNL team have over 100 years of industry experience in distribution management and commercial real estate development.

• *Tom Glisson* – Lieutenant General (Ret.) US Army. Former Director of the Defense Logistics Agency, and independent consultant.
• *Dennis Gilhooley* – Former Associate Partner at IBM Consulting and Logistics Director at Zenith Electronics.
• *Steve Kozarits* – Commercial Real Estate Investment/Development Executive with a focus on industrial properties.

Our parent company, True North Investments, is a Chicago area based real estate acquisition and development company. The principal's of the company have been partners for over twenty-six years. Together they have acquired over 18,000,000 square feet of commercial product valued in excess of $800,000,000.

To get more information on TNL please visit www.truenorthlogistics.com or
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TNL is an active member of International Warehouse Logistics Association (IWLA).

The Official Conference of the International Association of CyberPsychology, Training & Rehabilitation (iACToR)

CYBER^{17} will bring together researchers, clinicians, funders and policymakers to share and discuss trends in healthcare and technology. CYBER^{17} continues to seek input from a wider segment of the scientific community, and is interested in attracting experts in clinical therapy and rehabilitation, cognitive sciences, social sciences, and computer sciences dedicated to *shaping the future of health & well-being.*

Key focus areas will include:

1. The Impact of Technologies as Tools: technology's use in training, therapy, rehabilitation, and education to improve the quality and availability of healthcare.

2. The Influence of New Technologies: technology's influence on behavior and society (e.g., positive technology for well-being, healthy ageing, and inclusion).

3. The Imprint of Social Networking: the exploration of social networking tools on individual behavior and societal relations.

4. New Technologies/New Terms: studying the psychological aspects of new areas influenced by technology (e.g., cyberfashion, cyberadvertising, cyberstalking).

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