CyberTherapy & Rehabilitation

Issue 1 / 2009

The Official Voice of I-ACToR

COVER STORY:

The Evolution of Wearables

FEATURES:

PRODUCT COMPARISON:

COUNTRY FOCUS:

ISSN 2031 - 278

CyberTherapy 14

Full-Day Pre-Conference Workshop

Virtual Reality Assisted Exposure Therapy in the Treatment of PTSD

Lago Maggiore, Verbania, Italy
June 21, 2009

James L. Spira, Ph.D., MPH, ABPP

Workshop Leader

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Letter from the Publisher

Professor Dr. Brenda K. Wiederhold

"We began our voyage of discovery by looking at currently available technologies and their benefits for health. Now we take a closer look at the applications of advanced technologies…"

Dear Reader,

Welcome to Issue 1 of the 2009 CyberTherapy and Rehabilitation Magazine (C&R), the official voice of the International Association of CyberPsychology, Training and Rehabilitation (I-ACToR). I-ACToR, formerly known as the International Association of CyberTherapy and Rehabilitation (IACR), is an international association dedicated to the promotion of virtual reality and advanced technologies as an adjunct to more traditional forms of healthcare. It also, in its new form, will deal with issues concerning how technology is changing behavior and society.

As you know, 2008 was C&R's inaugural year. In 2009, C&R will continue to work to bring you news of cutting-edge technologies, innovations and new research in this domain. I would like to take this opportunity to thank you, our readers, for your encouragement and support in the founding of C&R. Special thanks also go to the Editorial Board members for their dedication in bringing this idea into reality. I would like to as well thank the Management Board and Founding Members of I-ACToR. We are excited to announce that we have already formed affiliations with several other associations, conferences, publications and institutional partners to further strengthen the goals of the association and unite this heretofore-fragmented field. We plan to build upon the momentum begun in 2007 and 2008 through the hard work and determination of my colleagues.

In the inaugural issue of C&R, we began our voyage of discovery by looking at currently available technologies and their benefits for health. We introduced the concept of virtual reality in healthcare, and focused on head-mounted displays. In this, the second issue of C&R, we take a closer look at the applications of advanced technologies. Our lead article considers the evolution of wearables and their uses in the field of healthcare. The wearables theme is continued with articles on clothing which calls for the doctor and the "SpiderGlove". Our product comparison chart allows you to compare existing innovations in wearable technology – these range from garments that monitor health problems to a patch used for transdermal drug delivery. Other articles look at technological solutions to curb teen smoking and improve the cognitive functioning and increase the social participation of the elderly. A further study also looks at how human computer interaction can improve the social skills of children with Aspergers Syndrome. And finally, an open-source platform is discussed for virtual environments. I would like to thank the authors of these articles for the time and effort that they put into getting these thought-provoking articles ready for print.

Looking to the future, coming issues of C&R will discuss topics such as E-habilitation, video games for health, implantables and much more. There is a wealth of advanced technology for healthcare, and C&R will continue to dedicate itself to bringing you news of exciting developments in this field.

I hope you enjoy reading our publication and that it sparks your desire to increase your knowledge in this exciting new domain. We are always striving to meet (and surpass!) the needs and expectations of our readers, and so we very much welcome your input. Please contact me, or the C&R Managing Director, at office@vrphobia.eu, with your comments and suggestions. We would be delighted to hear from you. Indeed, your contributions are vital to our continued growth.

Create your own reality!

Brenda Wiederhold

GENERAL INFORMATION

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MANUSCRIPTS
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C&R Editorial Board

The Evolution of Wearables

Daniel Stevens documents the evolution of wearables in the lead article on p6. He takes us on a journey through time, from the origins of wearables - the invention of the pocket watch in the 1500s - to the high-tech wearables of today, which are now being used in healthcare. Take a look at this interesting article to learn more about the pros and cons of current wearable technology.

The SpiderGlove

The SpiderGlove is a new data glove, which has been developed to address the need for low-cost, easily adjustable and user-friendly data gloves. The SpiderGlove can not only be used for a variety of hand sizes, but it requires little or no recalibration when it is transferred between patients with different hand sizes. Find out more about this new data glove on p24.

Conference Participation Report Winter/Spring 2009

NextMed

Medicine Meets Virtual Reality (MMVR) 17

Long Beach, California, U.S.A. / January 19-22, 2009

Medicine Meets Virtual Reality (MMVR) is the premier conference on emerging data-centered technologies for medical care and education. It brings together an interdisciplinary, vanguard community of computer scientists and engineers, physicians and surgeons, medical educators and students, military medicine specialists, and biomedical futurists. The CyberTherapy and CyberPsychology conference has its origins in this annual conference.

MMVR presentations this year at Long Beach, California, offered a critical review of current progress: from initial vision and prototypes, through assessment and validation, to clinical and academic utilization and commercialization. Members of both the JCR and I-ACToR board were asked to take part in the Behavioral Health portion of the conference. Complimentary copies of JCR and C&R were given to all members in attendance.

e-Health 2009 Conference

eHealth for Individuals, Society and Economy

Prague, Czech Republic / February 18-20, 2009

The ministerial conference, *eHealth for Individuals, Society and Economy* took place in Prague this February, during the Czech presidency of the European Union. Members of I-ACToR were invited to attend, along with the editiorial boards of the Journal of CyberTherapy and Rehabilitation (JCR) and the CyberTherapy and Rehabilitation Magazine (C&R). The challenges and benefits of eHealth were discussed from an individual, societal and economic perspective. The conference ended with the adoption of the Prague eHealth Conference Declaration. This declaration summarizes the way in which ICT in healthcare is currently used in Europe, including its benefits for patients and for the economic efficiency of the health sector. It goes on to define future steps to be taken on both a national and a European level. Finally, it calls for a common European eHealth area to facilitate pan-European communication about eHealth strategies.

Science beyond Fiction

The European Future Technologies Conference (FET) 2009

Prague, Czech Republic / April 21-23 2009

The new *European Future Technologies Conference and Exhibition* is dedicated to frontier research in future and emerging information technologies. It was organized by the European Commission, in conjunction with the Academy of Sciences of the Czech Republic and the Czech Technical University in Prague. This multi-disciplinary conference attracted over 750 participants, who were able to listen to 6 keynote speeches, attend 29 scientific sessions and see over 80 posters and exhibits. It was an opportunity for scientists, policy makers, industry representatives and science journalists to see how cutting-edge technologies can be used in a wide variety of disciplines. Exhibits included gaze-contingent displays and gaze-based interaction, cognitive robot companions, rehabilitation gaming and activity monitoring systems, a wireless wearable EEG recording system and much more.

EUROPE 2009

5th Annual World Health Care Congress

Brussels, Belgium / May 13-14, 2009

This year, the *World Health Care Congress* brought together international healthcare providers, payers and suppliers with European policy-makers, health ministers and health officials in Brussels, the center of the European Union. The congress, which has been under the patronage of the European Commission since 2005, comprised two days of workshops and seminars on subjects ranging from financing and funding solutions for healthcare to innovations in healthcare technology. During the congress, over 90 international experts discussed telemedicine, new approaches to eHealth, computer games for health and the need to demystify technology. Speakers included Marina Geli, the Spanish Minister of Health and Social Security, Dr Francisca Garcia-Lizana, the Policy Officer, ICT for Health at the European Commission and Tove Sorensen, Head of the WHO Collaboration Centre for Telemedicine.

The Next Generation of Injury Simulation Today

INJURY CREATION SCIENCE

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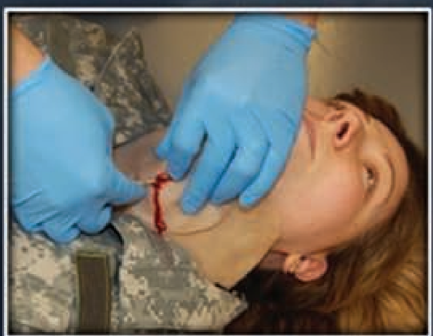

- Simulated Tracheas
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- Tracheal Skin Inserts
- Protective Neck Brace
- Adhesive
- Application Supplies
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- Carrying Case
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- User Manual
- 1 Day On-Site Training Course

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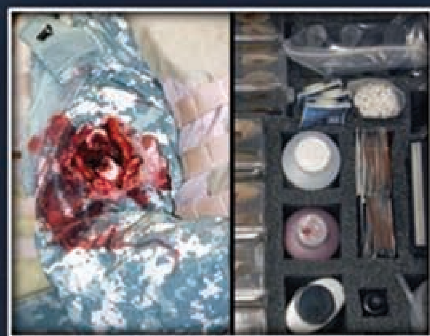
ICS Wound Kit



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The Evolution of Wearables

"The medical world has taken wearables to a new level: it has taken advantage of the possibilities of this technology to monitor human action and body temperature, and even administer medication…"

By Daniel Stevens

When the word "wearable" is mentioned, mixed notions of its meaning arise amongst the general population. It is fairly safe to say that the term wearable is not a commonly used expression outside of the CyberTherapy community. However, few understand that a very high percentage of the world's population use wearable technology everyday. In fact, wearables have been in use since the 1500s when a familiar and well-known device - the pocket watch - was invented. Since then, technology has expanded with the invention of the wristwatch, blood sugar monitors, intelligent textiles, health monitoring systems - and the list goes on. As technology has been revolutionized, wearables and their many uses have sprung up, reflecting improved ways of reinventing healthcare and well-being.

The term "wearables", in its most basic form, denotes a computer worn on the exterior of the body. However, the meaning of the term has broadened to technology worn on the body, which is generally focused on health and healthcare issues amongst the medical community. What was once just a matter of attaching a watch to a wrist has blossomed into a welcomed new application for the medical and technological worlds, and this modern innovation can be used in areas such as behavioral health, monitoring, media development, and other information technology. Also referred to as "wearable computing", researchers have made headway in areas of study such as augmented reality, pattern recognition, body temperature control, applications for disabilities, applications for the elderly, user interface design, electronic textiles, as well as even fashion design. With a constant interaction between the user and the computer, an "on/off" switch does not exist, allowing for continuous monitoring for research with little to no interruption of the user's everyday lifestyle.

A History

The first wearable was invented in the 1500s with the invention of the pocket watch. However, modern wearables have only come into existence in the last century, with vast improvements even in the last decade. Though some attempts to create wearable technology occurred in the 1960s, the most notable wearable computing began in the 1980s with all-purpose wearables. The First International Symposium on Wearable Computers: Digest of Papers, IEEE Society credits Steve Mann with the first general-purpose wearable technology – he invented the backpack-mounted CMOS 6502 microprocessor-based computer that controlled cameras and flash bulbs. Mann would later invent the Wearable Wireless Webcam in 1994, which greatly influenced wearables and wearable research.

A head-mounted display by Private Eye instigated further research and improvements for head-mounted displays (HMDs) in 1989; however, universities such as MIT ("Tin Lizzy" wearable computer design), Columbia University (KARMA: Knowledge-based Augmented Reality for Maintenance Assistance), and the University of Toronto (the "wrist-computer") made drastic improvements and additions to the wearable world in the early 1990s. DARPA (Defense Advanced Research Projects Agency), a U.S. agency responsible for the development of military technology, began the Smart Modules Program to develop wearable technology for commercial use.

The first wearable, the pocket watch, was invented in the 1500s.

Today, the latest research and modern technology is being developed and showcased at international technology and healthcare conferences such as IEEE, SIGGRAPH, and CyberTherapy & CyberPsychology conferences. Commercial technology companies have realized the possibilities of these wearables and have attempted to commercialize different wearable computers for the masses. Though some attempts did not popularize, the wristwatch with a GPS system wearable, probably the most popular and commercialized wearable, has become mainstream for campers, runners, and travelers.

Wise Wearables

Current projects that have risen on the wearable community radar are focusing on reinventing different and innovative uses for wearable technology. These projects are among some of the most groundbreaking uses of wearables on the market today.

Fabrican has created a spray-on, non-woven garment to create unique clothing that attaches itself to the body or the garments beneath, creating a one-of-a-kind technology-based clothing that can be created to fit the user's mood and creativity. The company has also begun exploring medical possibilities with the "fabric's" potential as an adhesive for new types of patches, wound healing products, dressings, and slow release systems, among others. Dr. Manel Torres, who bases his operations out of Imperial College London, describes his products as "novel concepts [that] enlighten major worldwide manufacturers as to the huge potential which exists, through the successful branding of a product range." Fabrican states that their "underlying ethos is to produce concept products, which are market leaders, through scientific research and development for a futuristic market" (www.fabricanltd.com).

An MIT-based team of scientists has created "Graspables," which are built around the idea that technology and wearables should not be complicated or user-unfriendly. "Graspables" have achieved a technology that is considered smart enough to understand what the user expects "based on the many physical cues that people automatically give when they simply pick up a device" (Boston.com). The "wearable" can achieve this adaption by sensing the type of grasp of the device itself by the user. With a familiar "bar of soap" appearance, "Graspables" are able to predict the user's intent and automatically morph into predicted modes such as a cell phone, camera, or remote control. This product is able to react and even predict the user's actions and thus has an incredible potential for the commercial world. The technology reacts to the user's fingers and their grip on the surface of the product. Graspable technology is already finding its way into the sports and medicinal realms, considering its capability to enhance and mold itself to fit the user instead or vice versa.

The medical world has indeed taken wearables to a new level: instead of just using technology for creative or commercial purposes, it has taken advantage of the possibilities of this technology to monitor human action, body temperature, and even administer medication when needed. The U.S.-based IsisBiopolymer has created a "wearable" technology called the Isis Patch, that is a "personalized, single-use, flexible, ultra-thin, transdermal drug delivery ("TDD") patch…which will allow medical professionals, for the first time, to accurately control transdermal drug delivery" (isisbiopolymer.com). This product has the ability to ensure drug administration that is both reliable and effective over an extended period of time without a nurse or doctor having to physically be with the patient. The founders of the Isis Patch describe their break-through technology as expanding the possibilities for similar products (much like nicotine or hormone-based patches) to applications for pain management, cancer treatments, neurology, chronic and acute illnesses, as well as diabetic medications. Design News describes the technology as a "Band-Aid like" patch, which is .002 inches thick. Prominent researchers are convinced that the Isis Patch will revolutionize the way medicine is delivered.

The "Flip Side"

After researching and discovering the multitude of wearable computing innovations, one can't help but wonder if wearables can be completely positive, practical, beneficial, and hold the potential to revolutionize medicinal and technological applications. Despite these incredible applications, when in use, can they practically aid the user, whether it is medicinally or for general purposes, or will wearables become an added burden? Objectively, I've put together some key points, on the possible "downsides" of wearable to determine their practical uses for the general population.

Practicality and Affordability

Are wearables practical? Designers would argue that this is the purpose of having computer technology attached to the user, so that s/he will have access to the technology at any point at which the user decides. This argument is quite true and wearable technology serves its purpose well - but at what cost? How affordable can a mobile medication reminder or advanced multi-media watch be for the general public? Can smell-technology incorporated into garments become affordable?

Obviously, new technology will initially come at a high price. However, once perfected and commercialized, the product has the ability to become more affordable for the general public. GPS watches, which are probably one of the most commercialized modern wearables, are currently being sold for $250 - $400 per watch, which is expensive, but you can certainly spend more on a traditional top-of-the-line watch. It is a fact that with most new technologies, the price will remain higher than an average product due to their connection to other technologies. Take, for example, the same GPS watch as previously mentioned. In order for the technology to function, the wearable relies on a satellite circling the globe, tracking the system to inform the user of their location. The company who produces these watches must have satellite-launching capabilities or must partner with a company who has them. The same process coincides with medicinal wearables as well, as monitoring technology must rely on third-party technology to relay messages back and forth between the two users. Products that rely on third-party technology will consistently remain at a higher price than other technology-based products.

"Wear-Ability"

As the GPS watch example shows, some wearables can be used without effort, effectively appearing to be a part of clothing or even a simpler wearable. However, when certain technology becomes larger, odd-shaped, or even serving as an adhesive to the body, it may cause difficulty in the practicality of actually wearing the wearable. Fabrican's spray-on technology is incredibly inventive, but is it completely "wearable"? Would you feel comfortable spraying on your clothes while performing activities that might induce perspiration like jogging, cleaning your house, or helping a friend move? The sheer possibility that an object could easily rip would hinder my decision in a similar situation. Obviously, this spray-on technology is meant for a higher fashion realm and to be used with other traditional garments as well, but, for all intents and purposes, these are clothing substitutes and must be treated as such. On the other hand, Fabrican's technology holds a high probability of success in medicinal treatments for pain management, etc. as well as finding applications in the automotive, design, and hygiene fields of study.

Other technology such as the "No Contact Jacket" from No Contact, which uses a highly electric-stimulated material to shock an uninvited attacker to the point of losing muscle control, has been designed with a woman's protection in mind. The idea behind this particular wearable is to protect the user, yet such a jacket has the potential to do more harm than good. Indeed, this is effectively a wearable taser-gun that could just as easily injure an innocent bystander as it could an actual attacker. With such a design, the question of "wear-ability" arises as well as whether or not a wearable has a plausible possibility of success in an everyday environment.

Future Applications

Although there are a few downsides to wearable technology, in most cases, it seems to be a very relevant, practical, affordable, and "wearable" concept. Many wearables have been commercialized: they are quickly becoming more affordable and improvements are being made to original models. In the next decade, I predict that wearables will become a common and well-used household product amongst the general population, and this will only enhance our daily and medicinal lives.

So where would you go to find the newest wearables and wearable research studies? International conferences such as SIGGRAPH, IEEE, and the CyberTherapy & CyberPsychology conferences would be at the top of your list. Corporations and medical technology businesses are watching closely for the newest study to be unfolded at these conferences. This groundbreaking addition to the technological and medical field has already been able to enhance the user's life and will continue to support improved quality of life. Wearables have been introduced to us, providing a technology to better our lives, and time will tell the magnitude of the effect that this concept will have on the future of technology - a future that no doubt will be beyond our imaginations.

Photos courtesy of Matt Isgro
www.mattisgro.com

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The Eldergames Project

"Eldergames is an EU-funded international project that in three years completed the design, testing and production of an entertainment platform for elderly people to train memory, attention and reasoning."

By Luciano Gamberini et al

A longer life expectancy and decreasing birth rates in developed countries represent the main factors contributing to a rapid growth of the aging population. Even in the case of normal aging, elderly people risk a gradual exclusion from social life and a worsening of their general well-being because of a decrease in some cognitive functions (e.g. memory) and because of changes in their social roles (e.g. retirement). Joined solutions exploiting the advances in medicine, psychology and technology are sought in order to support a dignified continuation of life characterized by independence and by satisfactory social participation. Information and Communication Technologies (ICTs) allow the implementation of solutions to improve cognitive and social activity for the elderly as well as the monitoring of their general conditions. In the form of computerized exercise programs, ICTs can complement the intervention already provided by hospitals, health care centers and leisure centers, supporting psychological and neuropsychological treatment and rehabilitation through cognitive stimulation and training. In particular, videogames can be used to stimulate the cognitive abilities of both young and old users alike.

Eldergames ("Development of High Therapeutic Value IST-based Games for Monitoring and Improving the Quality of Life of Elderly People", ref. n. 034552) is an EU-funded international project that in three years completed the design, testing and production of an entertainment platform for elderly people to train memory, attention and reasoning. The game is divided into two main modules: Memogame and Minigame. Minigames are individual games randomly selected by the system to train a specific cognitive ability (memory, attention, reasoning and categorization). The Memogame is a social game requiring a player to pair his/her cards - representing images, sounds, or calculations - with the matching cards among those positioned in the central panel. Correct or incorrect pairing leads to receiving a bonus (extra time or extra turns) or to taking a Minigame, whose successful completion waives the assignment of a penalty respectively. Bonuses can be spent on a final multiplayer game offered at the end of the Memogame.

The scores of all players are shown during the game and are permanently stored in an archive along with several indices of the players' performance over time. Experts can access this archive to monitor the development or decrease in the users' abilities. In fact, a comparison between the performances of 59 elderly participants in the Minigames for memory, reasoning, selective attention, divided attention, and categorization, and the scores obtained on the WASI (Wechsler Abbreviated Scale of Intelligence) test was carried out. No significant differences were found between the scores, showing that Eldergames can be used as a monitoring tool for cognitive functions.

The specific needs of elderly users were taken into account both in the conception and in the development of the prototype. Regarding the concept, the risk that users could perceive the tool as too challenging and complex was considered. A mixed-reality tabletop solution was then chosen, in order to make the prototype appear as an elegant, ergonomic yet familiar object. The entire hardware system consists of five main elements: a customized table, a screen (a normal 47" LCD TV), 4 webcams, 4 pen-objects and a normal PC for running the software (Fig. 1). The users are comfortably sitting around the table, handling one pen each. By detecting the position of the pens with respect to the virtual objects appearing on the screen, the system allows the users to interact with the game. In this way, the elderly can take advantage of an advanced ICT without having to learn commands or to use unfamiliar input modalities. In the development of the interface, the starting point was the identification of a series of requirements that took into account specific usability needs connected to aging impairments in perception, memory and attention. From the first prototype to the last one, an extensive usability evaluation was carried out, where

The Eldergame consortium is composed of:

AIJU *(Spain)*

Trondheim Kommune *(Norway)*

Labhuman *(Spain)*

Kent Council County *(UK)*

Lappset *(Finland)*

Gaia *(Spain)*

Università di Padova *(Italy)*

Generalitat Valenciana *(Spain)*

Infowerk *(Austria)*

Brainstorm Multimedia *(Spain)*

These pictures show users gathering around the game table to play with Eldergames. This picture contains extra cameras for the purpose of videorecording of the session.

the fulfillment of the requirements was iteratively tested through methods such as checklists, cognitive walkthrough and video analysis.

Emphasizing the social dimension of the game is important to keep the players involved and is a goal in itself given the risk of isolation for the elderly population. Up to four players can be involved in the Memogame at the same time, including players connected from different countries via the Internet. A communication system implemented in the platform makes interaction possible between speakers of different languages.

The project involves engineers and usability experts from the academy, leading European toy manufacturers and testers, and elderly care centers. Being a game, fulfilling several usability requirements tailored to the elderly population and involving the participation of several players at the same time, the project consortium aimed at creating a tool to sustain the users' motivation to engage in continuous cognitive training. The level of acceptance of the prototype, measured through specific questionnaires administered to 128 elderly people and experts in three different countries (Spain, Norway and the UK), showed that the platform was received very favorably. The hands-on experience gained at the various trial sites around Europe confirms that Eldergames provides users with an enticing ICT solution, that while appearing like an ordinary piece of furniture within a recreation center, contains all the tools necessary to connect, train and monitor the users.

This project is supported by the European Commission under the 6th FWP (Sixth Framework Programme), Project Reference n° 034552; Start Date: 2006-09-01 - End Date: 2009-02-28.

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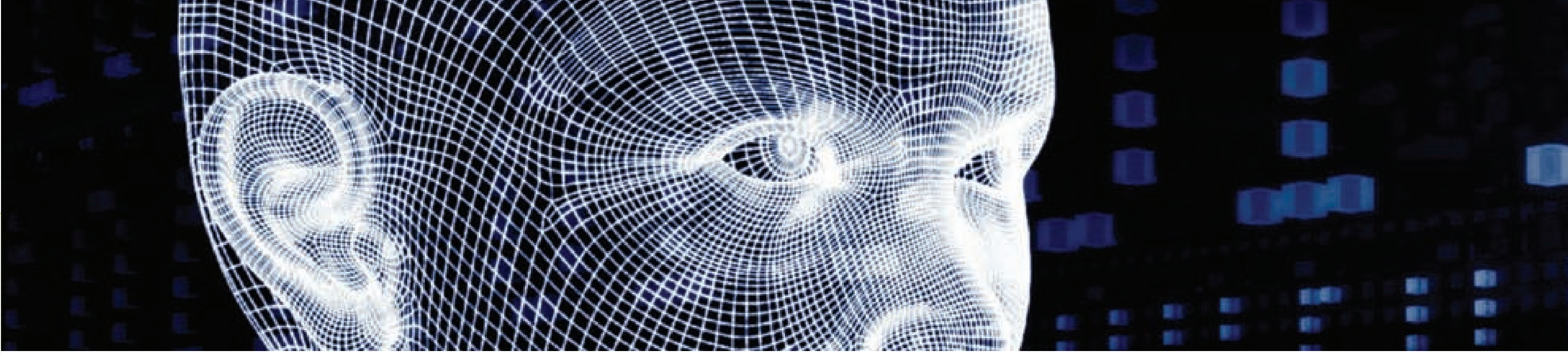

Join the International Association of CyberPsychology, Training & Rehabilitation (I-ACToR)

Mission

Our mission is to bring together top researchers, policy makers, funders, decision-makers and clinicians, pooling collective knowledge to improve the quality, affordability, and availability of existing healthcare.

Ultimately, through international collaboration with the most eminent experts in the field, we are working to overcome obstacles and increase access to top-quality healthcare for all citizens. By enhancing public awareness of the possibilities that technology offers, we move toward changing and improving healthcare as it currently exists.

I-ACToR is the official voice and resource for the international community using advanced technologies in therapy, training, education, prevention, and rehabilitation.

Membership

As the only international association dedicated to CyberPychology, Training and Rehabilitation, I-ACToR offers its members unique opportunities to:

- Network with other experts and industry leaders in CyberPsychology, Training and Rehabilitation
- Be the first to know about important events, funding opportunities and other news
- Share knowledge with industry peers
- Learn industry best practices and standards
- Attend the international CyberTherapy & CyberPsychology Conference and other special events at a discount
- Subscribe to the Journal of CyberTherapy & Rehabilitation (JCR) at a special subscription price
- Subscribe to the CyberTherapy & Rehabilitation Magazine (C&R) at a special subscription price

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Yes, I would like to apply for membership in the International Association of CyberPsychology, Training & Rehabilitation (I-ACToR) as:

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Transforming VR into a Reality for Behavioral Health Care: The NeuroVR Project

The Italian FIRB research project IVT2010 is developing NeuroVR, a cost-free virtual reality platform based on open-source software, that allows non-expert users to easily modify a virtual environment (VE) and to visualize it using either an immersive or non-immersive system.

By Giuseppe Riva et al

Although frequent papers show that Virtual Reality (VR) has come of age for clinical and research applications, the majority of projects are still in the laboratory or investigation stage. In fact, according to the data that will be presented by Prof. Giuseppe Riva, Ph.D., Istituto Auxologico Italiano, Milan, Italy at the forthcoming CyberTherapy 2009 conference in Verbania, Italy – http://www.e-therapy.info - the real impact of VR in European behavioral health is still low:

- The penetration of VR in behavioral health care/research centers is minimal: around 0.5/1%
- The penetration of VR between behavioral health professionals is even lower: less than 0.001%

Why is VR more virtual than real for many health care practitioners? From the experience of the current researchers involved in this area it is possible to identify four major issues that are limiting the use of VR in psychotherapy and behavioral neuroscience:

- the lack of standardization in VR hardware and software, and the limited possibility of tailoring the virtual environments (VEs) to the specific requirements of the clinical or the experimental setting;
- the low availability of standardized protocols that can be shared by the community of researchers;
- the high costs (up to 100.000 €) required for designing and testing a clinical VR application;
- most VEs in use today are not user-friendly; expensive technical support or continual maintenance are often required.

To address these challenges, the Italian FIRB research project IVT2010 is developing NeuroVR (http://www.neurovr.org), a cost-free virtual reality platform based on open-source software, that allows non-expert users to easily modify a virtual environment (VE) and to visualize it using either an immersive or non-immersive system. Now at its version 1.5, the original NeuroVR 1.0 received the 2007 Laval Virtual Science Award (http://www.laval-virtual.org/) for the best Virtual Reality science application worldwide.

The majority of existing VEs for health care are proprietary and have closed source, meaning they cannot be tailored from the ground up to fit the specific needs of different clinical applications. NeuroVR addresses these issues by providing the clinical professional with a cost-free VE editor, which allows non-expert users to easily modify a virtual

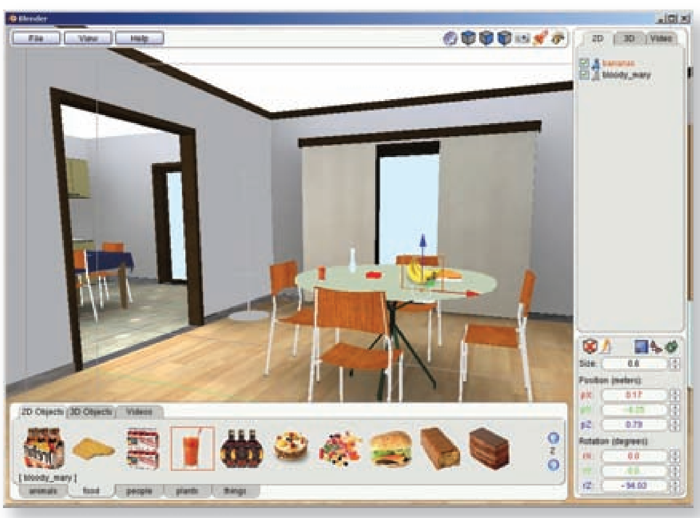

Figure 1: A screenshot of the NeuroVR Editor

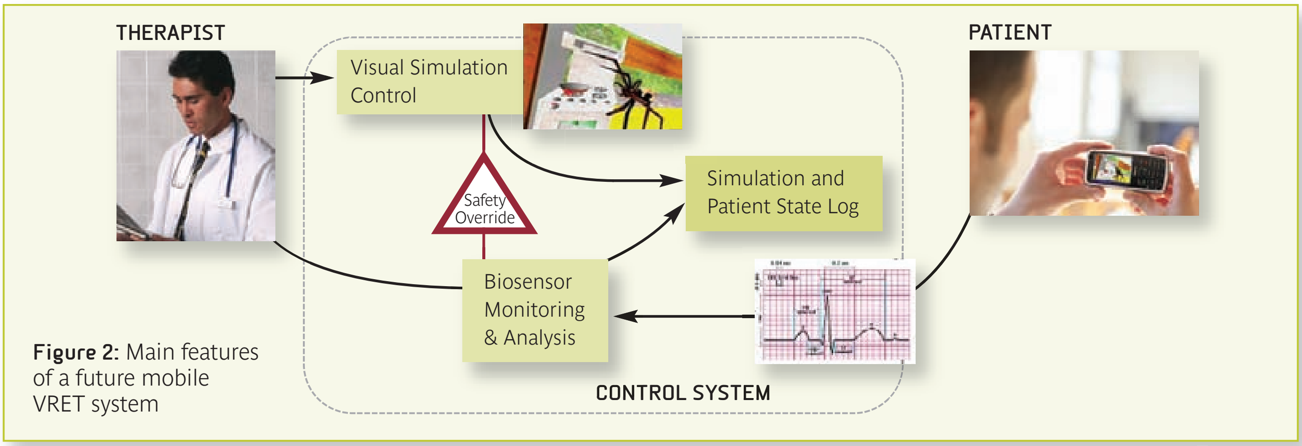

Figure 2: Main features of a future mobile VRET system

scene, to best suit the needs of the clinical setting.

Using the NeuroVR Editor (see Figure 1), the psychological stimuli/stressors appropriate for any given scenario can be chosen from a rich database of 2D and 3D objects, and easily placed into the pre-designed virtual scenario by using an icon-based interface (no programming skills are required). In addition to static objects, the NeuroVR Editor allows an overlay on the 3D scene of video composited with a transparent alpha channel. The editing of the scene is performed in real time, and effects of changes can be checked from different views (frontal, lateral and top).

Currently, the NeuroVR library includes different pre-designed virtual scenes, representing typical real-life situations, i.e., the supermarket, the apartment, the park. These VEs have been designed, developed and assessed in the past ten years by a multidisciplinary research team in several clinical trials, which have involved over 400 patients. On the basis of this experience, only the most effective VEs have been selected for inclusion in the NeuroVR library.

An interesting feature of the NeuroVR Editor is the possibility of adding new objects to the database. This feature allows the therapist to enhance the patient's feeling of familiarity and intimacy with the virtual scene, i.e., by using photos of objects/people that are part of the patient's daily life, thereby improving the efficacy of the exposure.

The second main component of NeuroVR is the Player, which allows the user to navigate and interact with the VEs created using the NeuroVR Editor. The player offers a set of standard features that contribute to increasing the realism of the simulated scene. These include collision detection to control movements in the environment, realistic walk-style motion, advanced lighting techniques for enhanced image quality, and streaming of video textures using an alpha channel for transparency.

The player can be configured for two basic visualization modalities: immersive and non-immersive. The immersive modality allows the scene to be visualized using a head-mounted display, either in stereoscopic or in mono-mode; compatibility with a head-tracking sensor is also provided. In the non-immersive modality, the virtual environment can be displayed using a desktop monitor or a wall projector. The user can interact with the virtual environment using either keyboard commands, a mouse or a joypad, depending on the hardware configuration chosen. A future goal of the developers is also to provide software compatibility with instruments that allow collection and analysis of behavioral data, such as eye-tracking devices and sensors for psychophysiological monitoring.

The current NeuroVR library includes a limited number of VEs addressing specific phobias (i.e. fear of public speaking, agoraphobia) and eating disorders. However, new pre-designed environments will be developed in the coming years: it is envisioned that the 250,000 people in the worldwide Blender user community will contribute to extend the NeuroVR library, developing new VEs which can be tailored by clinical professionals for a range of clinical and experimental needs.

A final critical issue related to the use of VR in health care is the lack of availability of a VR system in the real life context of the patient: both the cost and the setting of the system limit its use to the health care center/hospital/therapist's office. To overcome this issue, a VRML/X3D exporter for experiencing the environments on the Web and a player for PDAs and smartphones are planned features. The final goal is the development of a phone-based VR system able (see Figure 2):

- To present and structure emotionally relevant contents in a home setting;
- To verify the compliance of the patient and eventually alert the patient/therapist;
- To track in real-time the emotional level of the patient and record this for later assessment by the therapist;
- To provide feedback to the patient to enable him to cope with the environment's contents;
- To automatically contact the therapist if the emotional level of the patient is higher than a preset cut-off value defined by the therapist.

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Teens Help Researchers Create Internet Environment To Curb Teen Smoking

Given the poor record of previous tactics to curb teen smoking, and the failure of the tobacco industry to provide effective teen smoking counter-measures, a new approach is clearly needed. This article reports on the Internet-based VR environment developed and tested by VRMC to help teens quit smoking.

By Nancy Ahmann

Smoking kills 440,000 Americans each year. Despite this grim statistic, 2,000 teens start smoking every day. It is estimated that at least 4.5 million adolescents in the U.S. are still cigarette smokers, despite anti-smoking advertising.

Figure 1. The Virtual Reality Medical Center's Internet-based environment to curb teen smoking.

Among the many serious concerns about teen smoking is this statistic cited by the American Lung Association: "of adolescents who have smoked at least 100 cigarettes in their lifetime, most report that they would like to quit, but are not able to do so." In other words, it takes only five packs before these kids' smoking "choices" begin turning into an addiction.

In 1998, the tobacco industry agreed to launch its own anti-smoking campaigns, including magazine and television ads. However, these campaigns appear to be doing more harm than good. Philip Morris International, one of the world's largest tobacco companies, request that vendors place an anti-underage-smoking sign ("Help stop underage smoking – don't buy cigarettes for kids") in point of sale locations. What message, though, will teens take away from this sign? They have just been called "kids," and it has been implied to them that smoking is okay as long as they're grown-up enough. The message is getting across, but it is not the message supposedly intended.

Given the poor record of previous tactics to curb teen smoking and the failure of the tobacco industry to provide effective teen smoking countermeasures,

Figure 2. Software designers at The Virtual Reality Medical Center in San Diego, California get feedback from local high school students on the development of a Website to curb teen smoking. Input from teen participants was an important part of this NIDA-funded study.

a new approach is clearly needed. It is widely recognized that the initial act of smoking has much to do with a manufactured image of what smoking means and the psychological state of the teenager (see Table 1). In a study launched in 2006, The Virtual Reality Medical Center (VRMC) set out to shatter the media-manufactured image aimed at teens. VRMC theorized that a more effective way to curb teen smoking would be to allow the teen audience to draw its own conclusions about tobacco. To this end, VRMC researchers solicited teens to participate in creating a new message. With funding from the National Institute on Drug Abuse (NIDA) and with the input of teen volunteers, VRMC developed and tested an Internet-based VR environment to curb teen smoking.

The Internet site is made up of two parts: 1) an introductory page that displays deceptive media messages to make the point without being explicit or condescending and 2) a link to a game that teaches young smokers how to recognize and overcome smoking cues. The inclusion of media messages is an important aspect of this approach. Other groups, such as Campaign for Tobacco Free Kids (www.tobaccofreekids.org/) post tobacco advertisements on their Website with information about how much the industry spends on advertising. They also solicit users of the Website to send ads to them. Acknowledging the ability of young people to think for themselves demonstrates respect for their common sense and makes for a more effective communication strategy.

The overall goal of VRMC's Internet anti-smoking environment is to help teens quit smoking for good. VRMC worked with a group of students from a local California high school to help design an effective anti-smoking message. The high school

Table 1. Smoking as Viewed by Adolescents

Smoking is good because:	Smoking is bad because:
Controls your weight / makes you thinner	Parents get angry if you are caught
Improves mood, distracts from depression	Shortens your life
Makes you look older / "cool"	Makes hair and clothes smell bad
Relaxes you when stressed	Gives you ashtray breath
Makes you resemble cultural icons (Britney Spears)	Annoys friends who don't smoke

Figure 3. The environment is based on the daily routine of a typical teenager and contains common smoking cues.

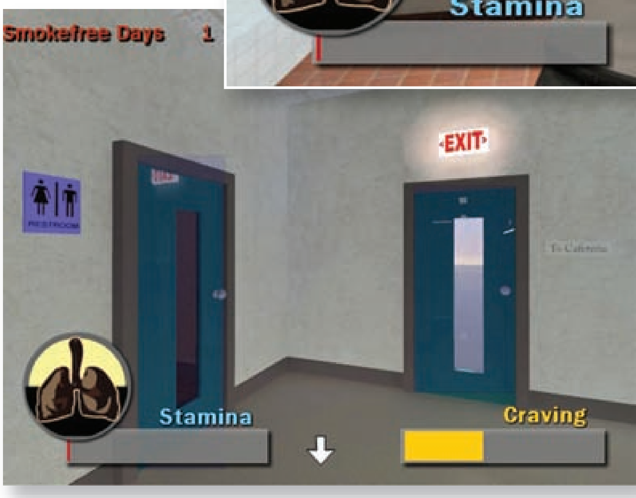

Figure 4. Icons on the lower screen indicate decision to smoke/not smoke (lungs), number of activities performed (stamina) and presence of smoking cues (craving).

Figure 5. Icons on the upper screen indicate time of day and number of smoke-free days, which helps teens monitor their cravings and provides motivation.

students helped create images and text for the Website. They also assisted with beta testing and review. When the initial version of the Website was tested on another group of teens, results showed that the Website dramatically increased their knowledge of the effects of smoking and techniques for smoking cessation.

Virtual reality (VR) has been used successfully by VRMC in a variety of therapeutic and training applications. Because VR is a heightened experience of computer gaming, it is particularly well-suited to deliver education to the teenage demographic. Speaking to teens through VR gets their attention due to the novel and interactive qualities of the medium. VR also uses mechanisms with which teens have familiarity, skill, and interest through their experiences in computer gaming. With its online capability, the program is easily accessed almost anywhere in the world with minimum system requirements. In its latest development, the application has been imported onto a cell phone platform, which is very desirable among mobile-savvy and participatory teenagers.

VRMC has conducted several previous investigations in collaboration with Korea's Hanyang and Chung-Ang Universities using VR to study smoking cues. In a study for nicotine craving, virtual environments (VE) were set up for smokers to virtually navigate. The rooms contained different smoking cues, such as an ashtray and an open pack of cigarettes on a bar. Overall, the study was determined to have helped reduce cravings in those who are nicotine dependent. Dr. Brenda Wiederhold was also involved in a study using functional magnetic resonance imaging (fMRI) to study smoking cravings in VEs. This study tested whether smokers could experience cue-induced smoking craving inside an MRI scanner by using the VR system, and, if so, whether the magnitude of the craving differed between the classical device (2D pictures) and the VE scenario. The study concluded that smoking cues in the 3D virtual world were stronger than in the 2D world.

Researchers at VRMC hope that by using the distinctive attributes of VR, they can create effective counter messages to the tobacco industry's media campaign, which has been ongoing for more than 50 years. VRMC's expertise in combining VR with therapeutic applications provides a unique understanding of how VR can be an effective response to the tobacco industry's construction of the meaning of smoking. Several Ministries of Health in Europe have expressed interest in VRMC's Internet-based program originally developed in the U.S. to curb teen smoking. Sensitivity and attention to cross-cultural cues will be important in successful acceptance and implementation of the anti-smoking message. For more information, visit The Virtual Reality Medical Center Website at www.vrphobia.com.

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Intelligent Clothing Calls for the Doctor

Wearable Computing Assistants will allow people with chronic diseases to have a safe and secure life in their own home.

By Michael Lawo

Among the initiatives aiming to improve health status monitoring technologies, the European Commission promotes CHRONIOUS, a 42-month project, started in February 2008 and involving 19 partners from several countries. The project (www.chronious.eu) works on an innovative, open and adaptive platform that includes overall a mobile and wearable system with intelligent sensors and decision support system for patients and healthcare professionals in the area of chronic diseases. It is a system to monitor patients' vital body parameters, context, environmental variables, patient motion and other activities such as drug intake and dietary habits. Furthermore it is designed to detect patient's abnormal health status, generating possible alerting information for the management of emergency situations critical for patients and health professionals. The system will assist health care experts and patients by providing tools for health status monitoring and decision support. The project aims to evaluate the platform on two specific chronic diseases: Chronic Obstructive Pulmonary Diseases (COPD) and Kidney Diseases. This paper describes the goal of the project and its background, the system architecture and a first prototype with preliminary results and the expected impact. The focus will be on the evaluation of the system prototype by user tests.

CHRONIOUS suggests the implementation of generic system architecture to be easily adapted to any chronic disease management program. For testing purposes, it focuses on two major chronic conditions, but the aim is to create an

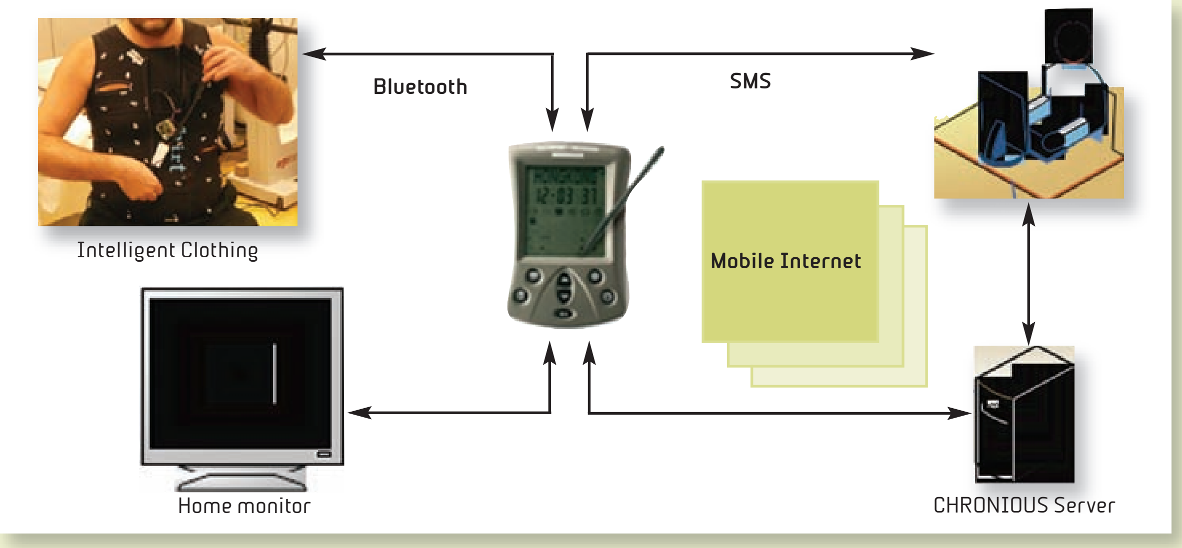

Figure 1. CHRONIOUS platform monitors patients with chronic diseases for a longer and saver stay at home. It provides continuous supervision by virtual and real caretakers and physicians.

easily adapted system for other chronic diseases requirements.

With such an approach, quality of life can be improved and highly qualified and efficient healthcare services for citizens can be provided (e.g. through disease prevention, ubiquitous and seamless to the user monitoring, adaptive interaction based on user characteristics and context of activity, reduction of unnecessary visits to hospitals and complexity of selfcare especially for patients with chronic diseases). Advanced disease prediction and diagnosis tools, and the exploitation of the vast pool of monitored parameters are provided (e.g. vital signs are recorded for various users groups under diverse contexts and conditions) for the production of new diagnostic models and protocols. Thus the formal care burdens are reduced, and formal care improved (e.g. through the reduction of patient visits for routine examinations, the prevention, diagnosis and in some cases prognosis of diseases, and immediate intervention in emergency or time-critical situations).

The approach mainly addresses two categories of users:
(1) patients, the real final users, who have to wear and interact with the system
(2) care providers, who have to use the system to remotely monitor the health conditions of the patients.

Therefore it is important to understand and collect data about what these different subjects are expecting from the system, and the most suitable way to comply with their expectations: a successful system and products must begin with an understanding of the needs and requirements of users and must also satisfy compliance with ethical principles.

With regard to local health institutions, professionals and hospitals, expected developments are the reduction of acute events and related hospitalization costs by up to 20-30%, by emergency cases alert, rationalization of medical prescriptions for diagnostic routine examinations, decision and education support services for professionals involved, stronger integration with home care service providers both in terms of shared clinical pathways and technological interoperability, quick and efficient medical information's access through a logical, structured and certified pathway similar to human logic, sensible growth in cooperation and multiactor approach to chronic diseases and an enhancement in ICT investments.

The expected impact on patients' lives is high because wearable monitoring will be non-invasive, allow them to reduce routine visits to hospitals for diagnostic purposes, provide them with more tranquillity because of a reduction of time of intervention when occurring in time-critical situations, integrate a reminding and alerting service linked to particular behaviors such as drug intake, eating and activities performed, require an active participation of patients both in monitoring and in decision-making, and need availability of adequate ICT equipment at home and a friendly approach to new technologies by patients and their families.

CHRONIOUS is multidisciplinary research project. In the ubiquitous health and lifestyle-monitoring domain it investigates and experiments with future visions and emerging technologies. The framework's architecture and structure is generic and thus enables expansion to the support of the management of further chronic diseases. CHRONIOUS, in its very final form, will be a universal solution to healthcare facilities and professionals for managing all various types of chronic diseases, increasing the quality of patients' lives and reducing health assistance costs.

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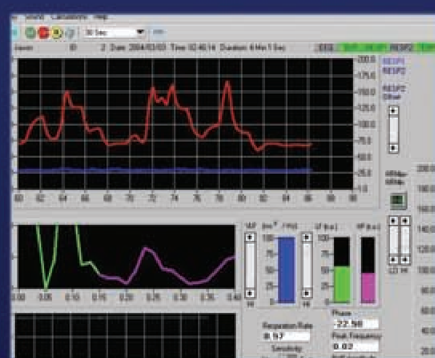


Product Comparison Chart: Wearables

Wearable technology is one of the foremost fusions of science and technology with every-day life. With a combination of fashion and technology, those in the medical field as well as common non-medical technology companies are discovering the possibilities of this unique blend. "Wearables" as they are commonly called, can fulfill a range of functions. They can monitor the health of the wearer, change color or shape to reflect the environment surrounding the garment, react to the user's body temperature and mood, or even have telecommunication and music systems installed within their material. Up and coming innovations in wearable technologies are being unveiled at technology conferences, such as IEEE, SIGGRAPH, and the CyberTherapy & CyberPsychology (CT14) conferences. For more information concerning wearable technologies and how to get involved, contact *office@vrphobia.eu.*

CREATOR	WEARABLE	FUNCTION	LOCATION	YEAR
AlphaMicron	Liquid crystal technology	Film laminated into a plastic curve	Alphamicron.com	2009
Fabrican	Spray-on garment	Instant, sprayable, non-woven fabric	Fabricanltd.com	2000
CenTex Bel	Intelligent Textile	Para-medical devices	Centexbel.be	2009
ASU Center for Applied NanoBioScience	Sensory chameleon bodysuit	Garment that responds to wearer's environmental and vital signs	biodesign.asu.edu	2004
OfSeth	Textile for healthcare monitoring	Optical fiber sensors embedded into textiles for healthcare monitoring	ofseth.org	2007
No-Contact	No-contact jacket	Exo-electric preventative armor	No-contact.com	2006
LifeWear	Wearable Computing MIT Media Lab Human dynamics	Body-worn computation, sensing, and networking in a clothing-integrated design	Media.mit.edu	2005
Fluid Interfaces Group	Invisible Media	Garments with the ability to respond to people's needs and actions	Ambient.media.mit.edu	2009
Columbia CGUI Lab	MARS	Mobile, augmented reality systems	Graphics.cs.columbia.edu	1996
ePI Lab	WearCam	Personal Imaging	eyetap.org	1997
Department of Computer Science University of Ioannina	Intelligent Information Systems	A Wearable platform for the monitoring of health conditions and sport performance and the real-time prevention of sport injuries	Medlab.cs.uoi.gr	2005
CLUTCH	Medulla-Intimata	Sensors that monitor the wearer's emotions to guide real-time video-generation that evokes a sense of seeing beneath the surface of the skin	Tinagonsalves.com	2004
Charmed Technology, Inc.	Badge-electronic	Badges that record the contact information of other CharmBadge users as they come into range	Charmed.com	2001
Science Fashion Lab	Smart Second skin	Implanting smell technology into multi-sensorial clothing	smartsecondskin.com	2005
The Banff New Media Institute	"Health Watch", "Company Keeper"	Responsive communicative health data analysis technology	banffcentre.ca	1998
Eurotech Ltd.	Zypad	Advanced multimedia tourist guide application wrist watch software	Eurotech-ltd.co.uk	2009
Angel Chang	Glow-in-the-Dark Bob Ross Dress	Glow-in-the-dark fabric infused with music	angelchang.com	2008
Triage Wireless	Rapid Response Monitor, ViSi	Wireless vital sign monitoring	triagewireless.com	2009
Isis Biopolymer	Isis Biopolymer Patch	Transdermal drug delivery	isisbiopolymer.com	2007
Salpavaara et al.	Capacitive insole sensor for hip surgery rehabilitation	Sensor that guides a hip surgery patient to train the operated leg with a suitable force	Pervasive Health 2008	2008
Pill Phone	The Pill Phone	Mobile medication reminder	pillphone.com	2009
AnthroTronix & ICT, SMARTlab	Scent Collar	Augmentation of emotional connections in immersive environments	SIGGRAPH 2004	2004
Siemens	A Wearable EMG augmentation system for robust behavioral understanding	Recognizes the emotional state of its users in real time	IST Project	2008
Cyberwearz	iDoublet	Fusion of music technology and fashion	cyberwearz.com	2008
CuteCircuit	Skirteleon	Photo & thermochromatic ink/UV thread	Cutecircuit.com	2009
Vehaert, Mamagoose	Space Pajamas	Infant clothing designed to detect signs of SIDS	verhaert.com	2008

Visualizing Voice

This article explores how human computer interaction can be used for voice recognition and to show audio patterns. The "Conversation Clock" creates a graphical language for visualizing communication.

By Karrie Karahalios

In the area of Human Computer Interaction (HCI), research in audio is minimal compared to textual and graphical domains. For example, there are many textual and image search engines, yet very few voice browsers for public use. One reason is that a voice or audio browser relies heavily on speech recognition and audio classification that is not very accurate in general use scenarios. Given different speakers and different speaking environments, the problem becomes increasingly difficult. Another reason is that audio is ephemeral; it is difficult to "see", and, hence, to compare as one would two photographs.

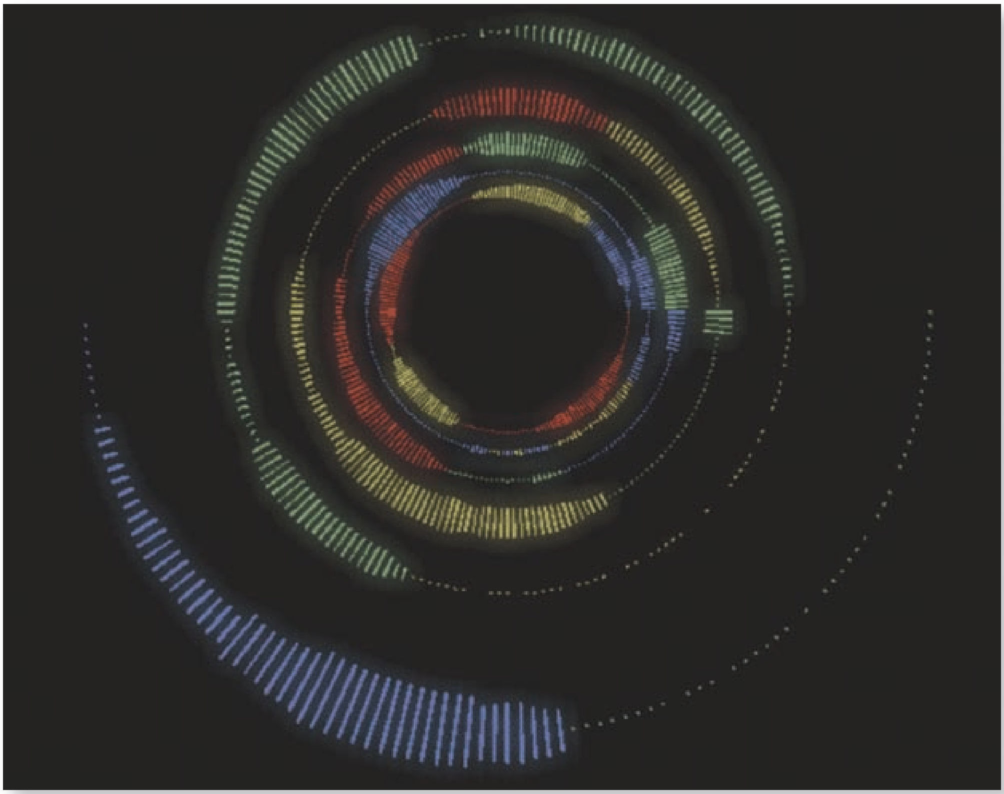
We have decided to take a step back and look at voice from a simpler perspective. Perfect speech recognition is currently out of technical reach. Yet there is still so much that can be learned by looking back at some of the basic parameters: volume, pitch, rate of speech, pause points, and history. Our approach is to computationally visualize voice to provide social cues and feedback that may not be easily perceived in traditional face-to-face interaction. For example, we can see mimicry - the state of mirroring another's volume and tone to signal allegiance, turn taking, status roles such as leaders and followers in group interaction, etc.

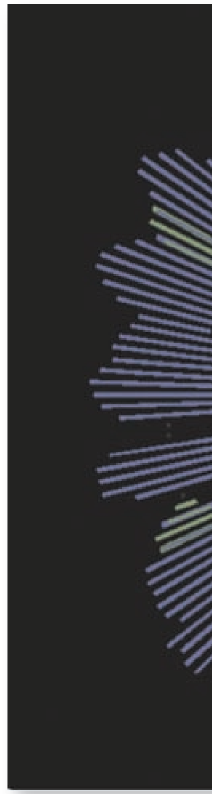
By starting from the beginning and looking at simple vocal features augmented with simple graphics, we create the building blocks for a new visualization tool. This first graphical language resembles musical notation in the sense that it characterizes pitch, volume, and prosody. In our early experiments, we have found that combining these simple parameters has created more intuitive and powerful visualization tools for reflecting on one's audio than existing state of the art tools that cater to the research elite. As time progresses and users adapt to the existing vocabulary, the building blocks will become more complex.

The goal is to combine the ease of voice with the visual feedback of graphics to create a new communication medium. In a sense we are creating a graphical language for visualizing communication. Below, I describe one example of this approach with the project Conversation Clock.

The Conversation Clock visualizes aural participation of up to four people around a circular table. The participants at the table wear lapel microphones. Their respective audio is captured by the microphones, transformed into an abstract form, and rendered onto the table via an overhead projector. A snapshot of a Conversation Clock rendering can be seen in Figure 1.

Each person in this visualization is represented by a different color. As a person speaks, his or her audio is visualized as a series of rectangular bars along the periphery of the tabletop. The length of the rectangular bar is proportional to the participant's spoken volume. That is, the longer the rectangular bar, the louder the audio. If no one is speaking, dots are rendered along the circumference of the ring to indicate that the table is active and capturing audio from the microphones. The most recent conversation is rendered





▲ **Figure 1.** The Conversation Clock visualization. Each participant in the conversation is rendered in a different color. The length of each rectangle is proportional to the volume captured at that point in time. Dots about the circumference of each ring imply the table is active, but no one is speaking. Each ring represents one minute of conversation.

on the outermost ring. Each ring represents one minute of time. As each graphical ring is completed, it animates toward the center of the table and a new ring begins at the outermost edge.

Our initial studies show that the Conversation Clock visualization encouraged balanced participation between the participants. In this study, the participants were graduate students. Specifically, when participants were divided into two categories, above-average speakers and below-average speakers, we found that although above-average speakers took approximately the same number of turns speaking with and without the Conversation Clock visualization, the turns taken using the Conversation Clock were noticeably shorter in length. Below-average speakers took more turns using the Conversation Clock with no noticeable difference in turn-length.

We are not arguing that balanced conversation is ideal conversation. In fact, that is probably not the ideal scenario. We are arguing that "social mirrors" such as the Conversation Clock have an intrinsic power to influence group behavior. This suggests that they should be carefully designed to produce a desired situation.

We are currently running a new series of studies using the Conversation Clock in a social skills club for teenagers diagnosed with Asperger's Syndrome.

Children with Asperger's Syndrome (AS), High-Functioning Autism (HFA), non-verbal learning disorder (NVLD), or Pervasive Developmental Delay – Not Otherwise Specified (PDD-NOS) have difficulty with the conversational aspects of social interaction, including turn-taking, interrupting, conversational dominance, length of turn and use of vocal volume for emphasis. Conventional speech and language therapy intervention has focused on remediation by teaching rules for conversational skills, practicing the skills and observing the use of these skills.

Interventions that occur during the conversation allowing for the child to modify a behavior are few. Using the Conversation Clock, children who struggle with social interaction receive real-time feedback and can make immediate adjustments during the conversation.

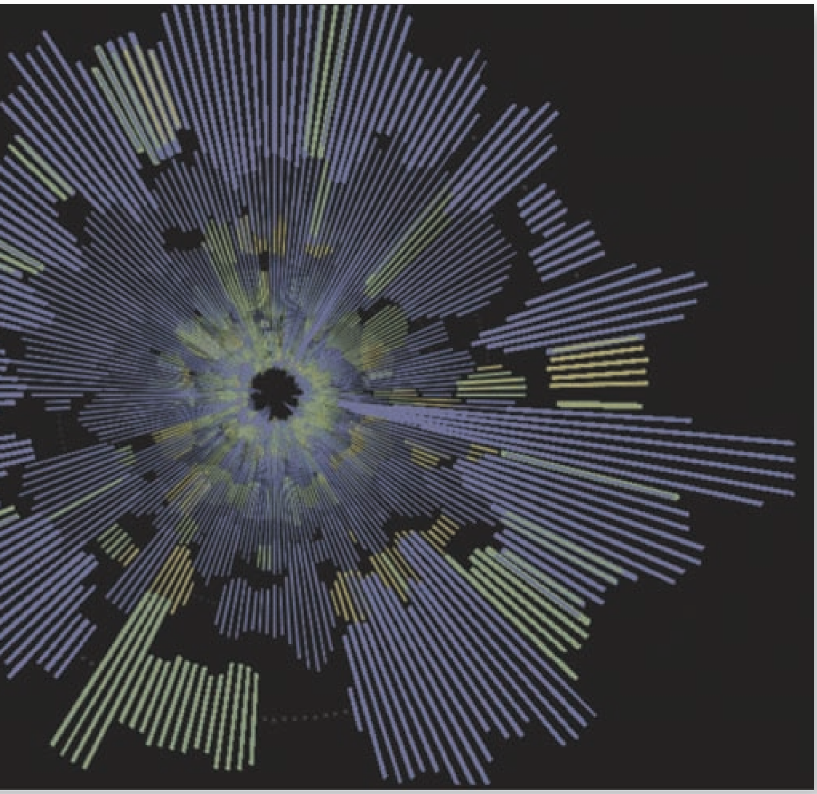


Figure 2. Snapshot of Conversation Clock depicting conversational dominance.

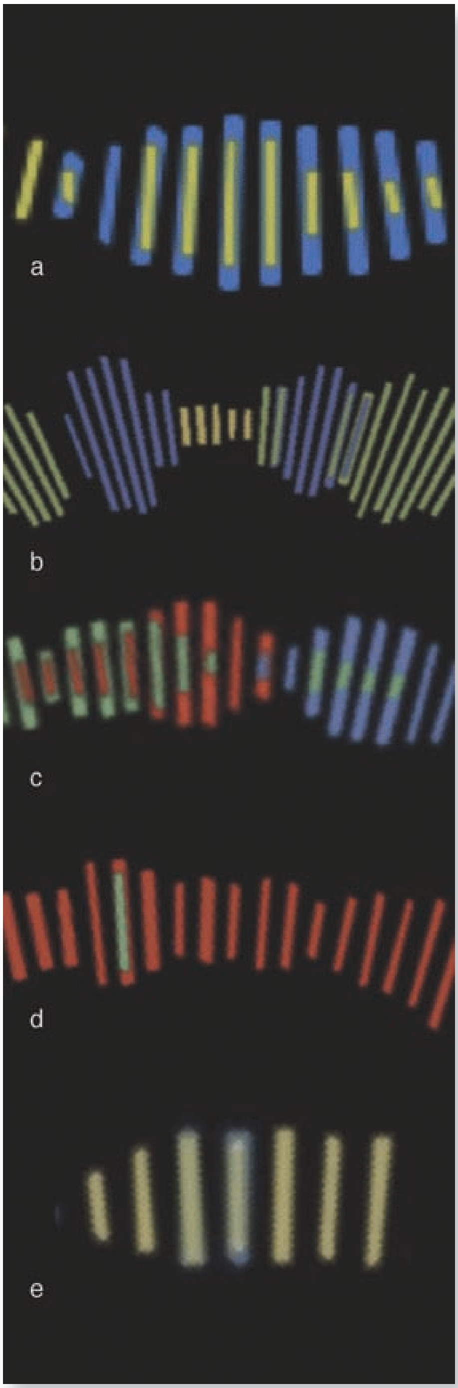


Figure 3. Common Conversation Clock patters: (a) concurrent speaking; (b) delayed turn-taking; (c) traditional turn-taking; (d) agreement; (e) agreement.

Social skills such as turn-taking are subtle social negotiations. Traditional turn-taking as rendered on the Conversation Clock can be seen in Figure 2c. One speaker ramps down his or her volume to allow entry for another speaker. In our longitudinal studies, we are comparing social skills such as turn-taking, interruption, and volume modulation using the Conversation Clock visualization and using traditional social skills therapy. The approach using Conversation Clock and some of our other "social mirrors" for encouraging syllable production and word production in lower functioning children so far appear promising. Parents are enthusiastic about the tools and the children find them engaging. Our future work includes migrating the interfaces to iPhones and toy-like devices so that they can be used in everyday settings.

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The SpiderGlove:

Patient-Optimized Modular Data Gloves for Pediatric and Adult Rehabilitation

Data gloves are currently used as part of a variety of virtual reality systems. This article introduces the SpiderGlove, which will soon be available for use in research and other applications. This data glove addresses the need for low-cost, easily adjustable and user-friendly gloves.

By Pawel Pyk et al

Data gloves are a part of many virtual reality systems for both healthy users and patients. Currently available data gloves suffer from two major disadvantages: their limited adjustability for different hand sizes and their unsuitability for use with patients suffering from hand paralysis or spasticity. For a clinic, the inability to adjust data gloves increases costs as it requires multiple sets to be kept on hand even if not all are in continuous use. If the clinic deals with hand motor rehabilitation, e.g. after cerebral or spinal cord injury, normal gloves can be difficult or impossible for patients to put on or remove due to swollen or cramped hands, even with assistance from therapists.

We have developed the SpiderGlove (Figure 1) to address the need for low-cost, highly adjustable gloves that are easy to handle for patients and therapists. Its modular design separates the most costly part of the device – the electronics – from the underlying fabric. To put on the SpiderGlove, the user (patient or therapist) first selects one of the fabric units. These are

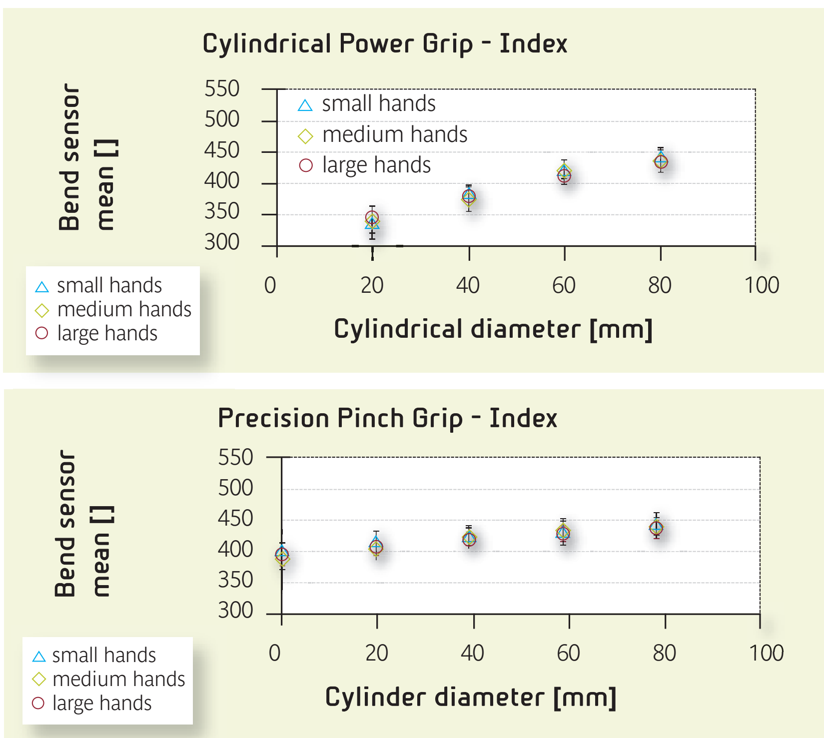

Figure 2. SpiderGlove index finger bend sensor readings, averaged across three groups of subjects with small, medium and large hands (5 subjects per group) and three trials per subject and object size. Top: power grip. Bottom: precision pinch grip.

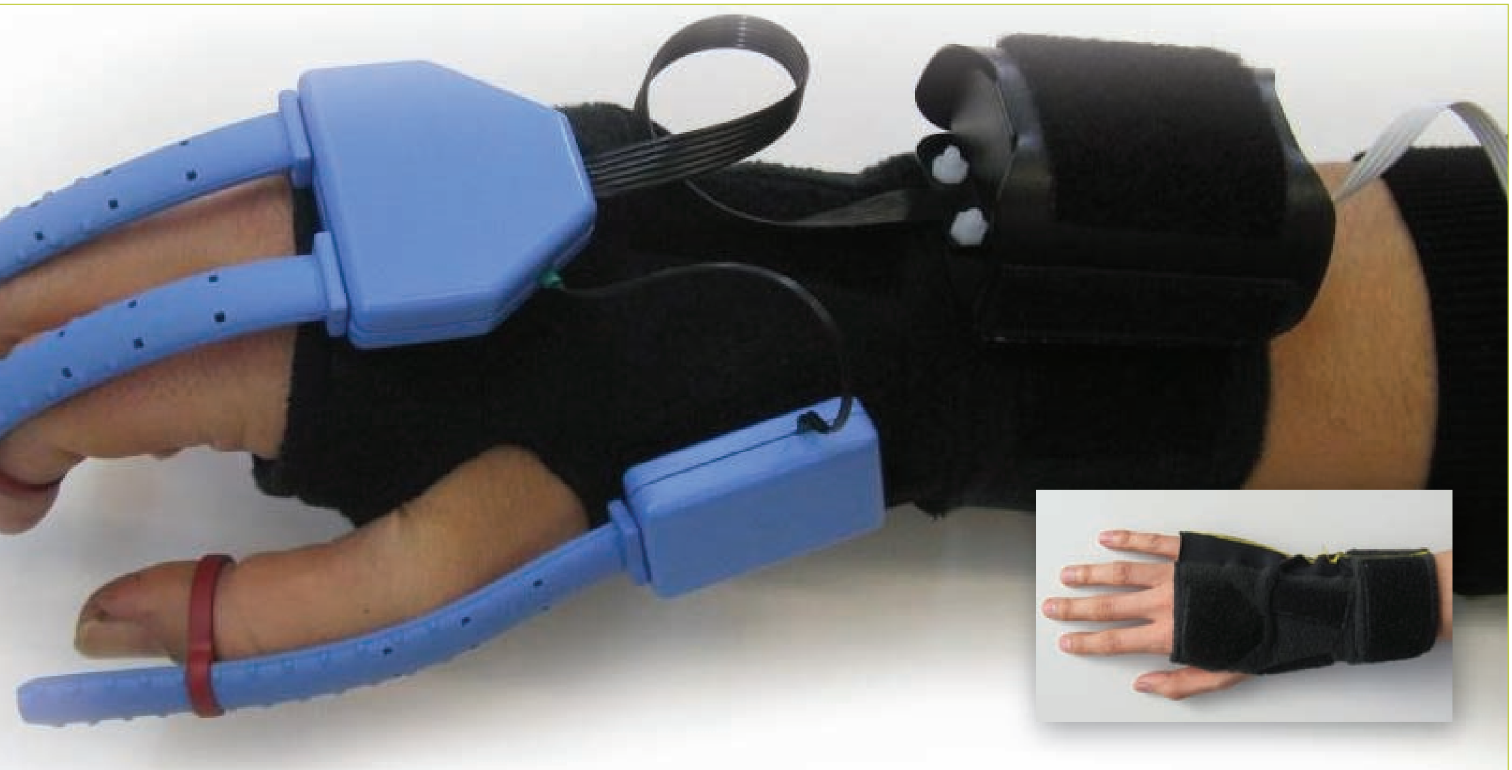

Figure 1. Overview of the SpiderGlove. Bottom right: fabric unit. Main: Electronics attached with velcro and finger rings.

made of a mix of fleece and Lycra, combining flexibility and comfort with a firm hold. They are available in four different sizes, covering the range from children of about 8 years to large male adults. The machine-washable fabric unit is designed as an elastic tube through which the user inserts his/her hand, with a single hole for the thumb. There are no separate finger holes, allowing the tube to be put on quickly and easily. The electronics, consisting of bend sensors and a wrist unit with accelerometers and digital compass, are then attached to the fabric units. One bend sensor each is used for the thumb, index and middle fingers. Only three digits are used to balance cost and usability against fidelity of finger tracking – approximately 70% of human grasping function is achieved using these fingers alone. Velcro is used to attach the electronics, allowing for precise adjustment for each patient. Finally, finger rings (available in three sizes) are attached to each bend sensor. The wrist unit on each hand is attached via a flexible cable to a small base unit which is connected to the host PC via a USB cable providing both data and power. In addition, vibration feedback is available in the box connecting the bend sensors between the index and middle fingers.

With its high adjustability, the question of glove sensor calibration arises for SpiderGlove users with different hand sizes. We conducted an experiment with fifteen healthy volunteers, with hand sizes ranging from children (8 years old) to large adults. Each subject grasped a series of objects of different sizes and the bend sensor values were recorded. Surprisingly, the recorded sensor values were virtually the same independent of hand size (Figure 2). The resolution achieved was approximately 1.5 bend sensor units per mm of diameter for a cylindrical power grip and 0.6 units/mm for a precision pinch grip. These results mean that not only can the SpiderGlove be physically fitted to a wide range of hand sizes, but that little or no recalibration should be necessary when transferring between users with different hand sizes.

We have tested the SpiderGlove on over thirty acute and chronic stroke patients, ten children and dozens more healthy volunteers of all ages and sizes. In all cases the gloves have been easily fitted in less than one minute. Individual patients have worked with the gloves continuously for an hour at a time over a month, performing over 300 reach-and grasp actions during each session with no-discomfort issues.

The SpiderGlove will shortly be made available for use in research and other applications. Future work will focus on obtaining more detailed hand pose information and automated decoding of grip type.

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IT@NETWORKING

WINNING PROJECT GETS EXTENSIVE PRESS COVERAGE AND €5,000 CASH

The IT @ Networking Awards 2009 will select outstanding European healthcare IT solutions in hospitals and healthcare facilities and bring them to the pan-European stage.

WHERE AND WHEN

Brussels, the centre of European decision-making, will be the location for the IT @ Networking Awards 2009 *(IT @ 2009)*. It will be held from 29 - 30 October 2009 during the European Summit in October at Square-Brussels, ensuring international attention.

WHO

The event will be organised by the *European Association of Healthcare IT Managers* (HITM) and the *European Association of Hospital Managers* (EAHM), the worlds' largest interest represenation of its kind.

The attendee roster will include hospital CEOs, CIOs, CMIOs, hospital and healthcare IT managers, physicians with an interest in IT, members from European and national institutions whose mandates cover healthcare IT and members from the pan-European Press.

WHY

Behind its fragmented façade, European healthcare IT includes a number of world-class jewels: cutting edge IT solutions that meet real-world challenges, efficiently and cost-effectively, and not rarely, in an elegant fashion. Unfortunately, many such jewels remain unknown to the outside world – not just to the general public, but ironically, to the healthcare IT community as well.

So too do their designers and architects, unsung heroes who have often invested their creative talents, and dedicated months and years of hard work – to create and build something good, something better, all the way through to the very best. But many such efforts extend beyond job definitions, stretch far above the call of duty.

These pioneers need recognition! Their stories will inspire others. The lessons they have learned can help both avoid mistakes and transform healthcare IT challenges into opportunities, into "Made-in-Europe" success stories. This is the goal of *IT @ 2009*.

HOW

HITM and EAHM believe that peers will make the wisest decisions in respect to their own needs. As far as healthcare IT is concerned, the Associations consider it to be self-evident that senior healthcare professionals will know what is the best solution for them and their challenges they face.

To use familiar terminology for IT professionals, *IT @ 2009* is built on the principles of best-of-breed and peer-to-peer networking.

An on-the-spot, one-person = one-vote electronic system will be used to enable attending CEOs, CMIOs, CIOs, hospital and healthcare IT managers as well as department heads to make their choices. Only they are eligible to vote.

ORGANISERS:

European Association of HEALTHCARE IT MANAGERS

MEDIA PARTNERS:

HEALTHCARE IT MANAGEMENT

Hospital

G AWARDS 2009

ROLLOUT: FROM MINDBYTE TO WORKBENCH

FIRST DAY: MINDBYTE

All successful submissions for the *IT @ 2009* will be allocated 10 minutes for a Mindbyte (a short presentation) on what differentiates their solution and makes it special.

VOTING

Voting will immediately follow a synopsis of all presentations, and the finalists will be announced by the Chair of the Organising Committee.

SECOND DAY: WORKBENCH

Finalists of the *IT @ 2009* will be given 45 minutes to provide an in-depth presentation, followed by a 1/4 hour Q&A session with the audience.

FINAL VOTING

Final voting will commence immediately after the last presentation followed by the awards ceremony.

THE IT @ Networking Awards 2009 CEREMONY

Out of the finalists, the 3 top rated IT solutions will be awarded a prize.

The winning project will:

- receive the IT @ Networking Awards 2009 Trophy;
- have a detailed presentation of their solution in Europe's leading healthcare management media, and
- be awarded a cash prize of Euro 5,000.

WHO SHOULD PARTICIPATE

Developers of imaginative, innovative healthcare IT solutions. Solutions can be built on both COTS as well as bespoke designs. However, all entries have to demonstrate a considerable degree of customisation and show ingenuity.
All entries must be already implemented in at least one site.

SUBMISSION DEADLINE

Submissions must be received by **25 September 2009** and must be entered through **www.conftool.com/itawards2009/**

For further information on IT @ of for your project submission please visit our website ***www.hitm.eu****, contact our General Secretariat via email* ***awards@hitm.eu*** *or call* ***+32 / 2 / 286 8501****.*

CyberTherapy in Italy

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Italy - the nation that birthed Michelangelo, Julius Cesar, Leonardo da Vinci, the Latin language, world-renowned cuisine, incredible art, and the European Renaissance – has become one of the foremost countries at the pinnacle of cybertherapy research and advanced technology-based rehabilitation.

With nearly 60 million inhabitants, close to 70 percent of its population living in urban environments, and home to one of the highest levels of psychological distress in Europe, Italy has the need for improved mental health treatments. Italian institutes, private companies, and universities, with the aid of the Italian Ministry of Health, have seen the possibilities that cybertherapy possesses and have joined in efforts to promote the use of advanced technologies in the treatment and rehabilitation of Italy's mental well-being.

The Birth of CyberTherapy in Italy

The use of advanced technologies for psychological treatment and rehabilitation was brought to the scene in the mid-1990s and has since continued to vastly grow in the last decade. The Applied Technology for Neuro-Pschology Lab, held at the Istituto Auxologico Italiano, began in 1996, pioneering many of the applications that enabled the diffusion of virtual reality and Internet in the field of healthcare often referred to as "cybertherapy". At this time, its main focus was integrating innovative research ranging from clinical psychology and cognition, to mobile devices and simulation apparatus. As described by the ISI Web of Science, this lab is currently within the top three laboratories worldwide in numbers of publications available on Virtual Reality and Ambient Intelligence.

In recent decades, the Human Technology Laboratory (HTLab), among others, has been at the forefront of the investigation in human-computer interaction, particularly in cognitive, communicative, social, and cultural aspects of the human relationship with new and emerging technologies. Located at the University of Padova, this lab is devoted to virtual environments, the use of videogames for healthcare (known often as "serious games") and simulators for safety training.

Many other technology-based healthcare labs exist in Italy, including wearable technology companies, virtual reality-based treatment clinics, and the topmost cybertherapy research facilities on the continent. Despite Italy's small stature, its healthcare research has kept Italy as a leader in technology-based mental healthcare. Companies such as FIAT, Telecom Italia, ST Microelectronics, and Motorola have joined with research facilities and the Italian Ministry of Health, focusing on prevention, treatment, and rehabilitation to further improve its citizens' mental wellbeing.

International Collaborations

As a founding member of the European Union and a country with a passion for traveling, Italy has a multitude of research links to all corners of the globe. Limited research funds have pushed many researchers to move abroad, creating permanent partnerships with at least 15 research centers in Asia, Europe, Australia, and North America.

The European Union has a strong connection with Italy's laboratories and universi-

	Value	Year
Population (Million)	58,1	2009
Mental Disorders, prevalence in % per 100.000		
SDR, suicide and self-inflicted injury, 0-64	4,47	2006
SDR, suicide and self-inflicted injury, all ages	5,51	2006
Number of mental patients staying in hospitals 365+ days	34,21	1994
Pure alcohol consumption, litres per capita	7,61	2003
SDR, homicide and intentional injury, 0-64	0,88	2006
First admissions to drug treatment centers	59,34	2003
Mental disorders incidence	57,54	1995
Alcoholic psychosis incidence	0,74	1995
Psychiatric hospital beds	13,02	2006
SDR, mental disorder & disease of nervous system & sense organ, all ages	24,03	2006

ties. The EU supports political, cultural, and economic research in Health and Future Emerging Technologies (FET), granting the possibility for Italy and other EU countries to research top-level projects by way of an unbiased evaluation. Acting as a guarantee of quality, the EU funds the "best of the best," often awarding Italian researchers the necessary funding to supplement the lack of domestic funding opportunities. The use of outside funding has aided many laboratories to continue research as well as to provide a dissemination process for the laboratories. The unique possibility to collaborate with international scientists and research groups in the FP7 (EU research framework program), FP6, and FP5 has offered concrete support for future advancement in scientific investigation into technology and many varied conditions.

EU-Funded Projects in Italy

Some of the top Italian projects have been funded by the European Union. Two of the top current Italian-based projects sponsored by the EU are the INTREPID and ELDERGAMES research projects. INTREPID is a project commissioned to design a biofeedback enhanced Virtual Reality treatment for generalized anxiety disorder (GAD). GAD is a psychiatric disorder characterized by a constant and nonspecific anxiety that interferes with daily-life activities. INTREPID uses its biofeedback bio-monitoring system to teach the patient to control his or her physiological parameters, using the feedback provided by the virtual environment to evaluate his or her success.

ELDERGAMES has developed a tabletop solution for mixed reality environments. Users are offered the possibility to play with real and virtual objects and to engage in a series of more than 40 videogames specifically designed to test and monitor elderly cognitive conditions without mandatory and frequent periodic psychological check-ups. With the ELDERGAMES project, the elderly can socialize with old and new friends, challenge other players online, try to improve their personal cognitive performance, and provide data that enables the ability to evaluate and monitor cognitive conditions – all while the subjects feel they are playing a game.

The Future of CyberTherapy in Italy

As cybertherapy in Italy continues to grow at a rapid rate, the future will undoubtedly remain bright for this pioneering country. Future areas of research appear to be in the concept of "presence," an experience elicited by technology, as well as in new forms of Human-Computer Confluence (HCC) and ICT studies as shown by trends in research and by future EU calls for proposals.

Presence is a concept that was described in a journal by Sheridan and Furness, early researchers in cybertherapy, as the effect felt when controlling real world objects remotely as well as the effect felt when individuals interact with and immerse themselves in virtual environments. Despite the above definition, many researchers have argued about varying classifications for the term. Future and emerging research has indicated a clar-

ification of the definition of "presence," which has a simple, but critical role in everyday experiences, defining the control of agency and social interaction through the unconscious separation of both "internal" and "external" and "self" and "other."

HCC signifies a priority on the EU research agenda for the most advanced forms of theorization and empirical investigation on neural, psycho-physiological, and behavioral correlates of human relations with technology, specifically with new interfaces. This, along with the fast-growing phenomena of new emerging forms of ICT based on interpersonal and social networked activities, has been an interest of the EU. The EU has shown trends to pursue projects and quickly introduce these phenomena into mass communication, the economy, culture, and education.

Il Futuro è Qui

Italy will be the host of the 14th annual CyberTherapy & CyberPsychology conference this June, located at the beautiful Lago Maggiore in Verbania-Intra. This conference will explore emerging applications, design, and effects of new media, featuring a multitude of top international researchers from around the globe. Many Italian researchers will be in attendance, capitalizing on the international conference's magnitude and reputation as a frontrunner of cybertherapy and advanced technology-based rehabilitation as well as a key forum for dissemination.

Italy has proven to be a notable leader in cybertherapy and, this June, will host one of the world's foremost leading forums for advanced technologies for healthcare. Italy will continue to hold its place amongst influential researchers in this field and will surely flourish in the years to come. As Solera once said, "You may have the universe if I may have Italy".

Sources:

World Health Organization, European Commission, and personal communication with Prof. Giuseppe Riva and Prof. Luciano Gamberini

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