IMSC News

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Musically Gifted Engineer Elaine Chew Wins 2004 Presidential Early Career Award

Elaine Chew, assistant professor of industrial and systems engineering in the USC Viterbi School of Engineering, holder of the Viterbi Early Career chair and a research area director in the university's Integrated Media Systems Center (IMSC), has won a 2004 Presidential Early Career Award for Scientists and Engineers (PECASE).

Chew, a well-known concert pianist, was recognized for her innovative work at the intersection of computational mathematics and musical perception and cognition. Her research, which is highly integrative, combines aspects of the performing arts with computer science, modeling, human cognition and development of the Internet. The research promises to make music more visual, understandable and accessible to people.

The awards, presented June 13th in a ceremony at the White House, are given annually to approximately 60 of the finest junior researchers in science and engineering across the country. According to the President's Office of Science and Technology Policy, which administers the awards, recipients possess "talents and potential that are expected to make them leaders in 21st century science and technology."

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What's Ahead at IMSC?

New Center Director Adam Powell Takes A Look At Phase Three

"A creative technologist, outstanding leader, and the ideal person to take IMSC through its next phase."

That's how outgoing Engineering Dean C. L. Max Nikias described Adam C. Powell III when he took the helm of the Integrated Media Systems Center in January.

Powell, a champion of new media who helped start and then ran Internet and technology programs for the Freedom Forum (formerly the Gannett Foundation), was chosen to lead IMSC into Phase Three of an ambitious agenda of research, education and industry collaboration.

Powell's appointment coincided with a number of key changes in the center's management team.

During its first phase, IMSC organized and began to build ambitious research, education, and industry collaboration programs around a far-reaching vision. In its second phase, the center focused on transforming this vision into real technologies.

The third phase is just getting under way, and Powell is clear on what lies ahead.

"We are going to be moving technologies into society more rapidly through partnerships with key industries, arts institutions, and K-12 schools, with an emphasis on connecting with underserved communities," he said. "At the same time, we will continue to move the research program forward and pursue more cross-disciplinary collaborations with other USC units and with entities outside of USC. We will also be increasing our focus on video game technologies to take advantage of our location in the hub of that industry."

As Powell sees it, these goals are related to USC's new strategic plan.

"The strategic plan talks about meeting societal needs, expanding our global presence, and promoting learner-centered education," he explained. "The National Science Foundation started the Engineering Research Center program with societal needs in mind. A major goal of ERCs is to rapidly develop technologies deemed critical to the nation and to arm the workforce with the skills needed to compete globally in these critical areas. So I believe that IMSC has been meeting societal needs and promoting learner-centered education since it began."

Powell points to the strong ties IMSC shares with other units at USC.

"We've had longstanding collaborations with Annenberg Center for Communication

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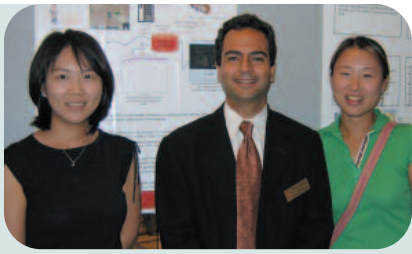
IMSC Hosts Ninth Annual NSF Site Visit

IMSC presented a roadmap leading to self-sufficiency during the Spring Scientific Advisory Board (SAB) meeting and Year 9 National Science Foundation (NSF) site visit, held June 13-15 on the USC campus.

The road map to self-sufficiency details the third phase of IMSC's 11-year NSF funding cycle. Phase Three will involve maximizing interdisciplinary research on and off campus and tapping into new funding sources in media, entertainment and education.

"Our fundamental vision remains that of harnessing engineering research to exploit advances in information technology," said Adam Clayton Powell, III, new IMSC director. "Technology is changing the way people live, learn, work and play, and IMSC has shown that it is a



Hyunjin Yoon, left, Cyrus Shahabi and Minyoung Mun

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Site Visit

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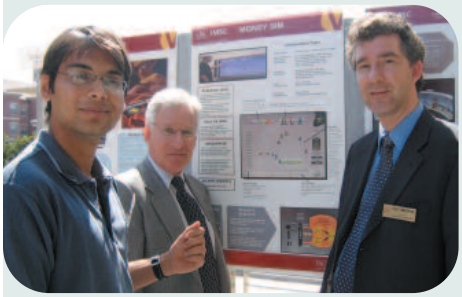
leader in that transformation.

"What was envisioned 11 years ago by Provost C. L. Max Nikias as 'immersive reality' *is,* today, a reality," he continued. "In education, business and communications, the technology now allows people to interact, communicate and collaborate naturally in a 'common space,' even though they are in different physical locations. Now it's time to turn our attention to the many applications that are present in such fields as distance education, job training, scientific visualization, health care, media and entertainment."

IMSC will substantially increase use of testbeds and prototypes and enlist the Viterbi School's new Mark and Mary Stevens Institute for Technology Commercialization (SITeC) to expedite the technology transfer process.



"SITeC will be the bridge between university research and the private sector," said Peter Beerel, Viterbi School associate professor of electrical engineering systems. "The institute will be a virtual incubator for knowledge and expertise in engineering technology commercialization."

IMSC's Scientific Advisory Committee convened a day before the NSF site visit to brainstorm the center's Phase Three strategic plan and develop its annual SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis for NSF. The discussion was led by Scientific Advisory Committee chairman James Baker of Fujii Xerox Palo Alto Lab, and Karl Weiss, chairman of IMSC's Board of Councilors. After the discussion, SAB members toured new IMSC multimedia labs and saw technology demonstrations in Tutor and Powell halls.

The NSF site visit overlapped day two of the SAB meeting so that IMSC representatives could meet with NSF officials. The seven-member NSF panel included Bruce Kramer of NSF; Jerry Bruck, Cooper Bruck Corp.; Carolina Cruz-Neira, Iowa State University; Qiang Ji, Rensselaer Polytechnic Institute; Mari Ostendorf, the University of Washington; Vladimir Pavlovic, Rutgers University; and James West, Johns Hopkins University. In the afternoon, IMSC students presented the panel with a poster session of many ongoing technology projects, then met privately with the NSF panel.

IMSC is the National Science Foundation's sole Engineering Research Center (ERC) for multimedia and Internet research. Since its inception in 1996, the center has had an operating budget of approximately $10 million and worked with many industry program members to support research in software methods, human-computer interfaces, networks, information management, testbeds and immersive applications.

In Phase Three of the 11-year grant, IMSC will shift its attention to four core research thrusts, said Chris Kyriakakis, IMSC associate director. Those areas are decision support; scalable immersive systems; serious games; and human performance engineering.

Each of the areas intersects with IMSC's overarching vision of immersive reality, Kyriakakis said. Selection of the areas was based on several equally important factors: faculty research interests and expertise; interdisciplinary collaboration; current and future funding opportunities from NSF and elsewhere; industry partner interests and guidance.

In decision support, IMSC engineers are attempting to overcome a major obstacle — information overload — by developing new software and 3-D technologies that allow users to not only navigate through 3-D models of a specific location but to ask questions and extract information. A project called Geospatial Decision Support System (GeoDec) will eventually provide an information-rich 3-D visualization and/or simulation of a geographical location rapidly and accurately. *(See AIMS, page 4.)*

The development of scalable immersive environments, which focus on reproducing audio and visual realities in extremely high fidelity at remote locations, is the backbone of IMSC research. For the last several years, IMSC has been developing testbeds for various applications, including Immersivision™, panoramic video technology, and immersive audio.

The growth of "serious games" prompted IMSC to establish a research effort in that will look into the fundamental research questions necessary to bring about the next generation of immersive games.

Immersive reality games rely on the development of human performance engineering, the "feeling of presence" that is at the heart of all virtual experiences, from reading a novel to riding an immersive VR simulator. IMSC will support research in modeling and simulation of human emotions, with an eye toward applications in such areas as military and intelligence training, homeland security, emergency response preparedness, and hospital trauma management.

Powell, whose ties to the broadcast industry go back many years, said IMSC will pursue new interdisciplinary projects and funding sources on campus. Collaborators will include the Annenberg School for Communication, the Rossier School of Education, the School of Cinema-Television and the School of Fine Arts.

Top/center column: Adam Powell, left, and Chris Kyriakakis
Top/right: C. L. Max Nikias, left, and Karl Weiss
Middle, left column: Roger Zimmermann, right and Bruce Kramer, center with IMSC student
Bottom/right: Anja Volk, left, and Anna Huang

New Haptics Systems Challenge Stroke Patients to Grasp, Pinch, Squeeze Their Way to Recovery

Stroke patients who face months of tedious rehabilitation to regain the use of impaired limbs may benefit from new haptics systems — interfaces that add the sense of touch to virtual computer environments — in development at the University of Southern California's Integrated Media Systems Center (IMSC).

The new systems, being designed by an interdisciplinary team of researchers from the Viterbi School of Engineering and the Annenberg School for Communications, are challenging stroke patients to grasp, pinch, squeeze, throw and push their way to recovery.

With a $1.8-million grant from the National Institutes of Health (NIH), the team has come up with quite an assortment of new applications. Some are designed to make stroke survivors stack, push or pour liquid out of three-dimensional objects in immersive environments, while others force them to pick up objects and move them through virtual corridors without bumping into walls or falling into booby traps.

Younbo Jung, right, pushes objects in a virtual environment he sees in his goggles, while fellow computer science researcher Shih-Ching Yeh steadies the connection.

"Haptics, which adds the sense of touch to 3-D computing, lets stroke patients interact with virtual worlds by feel," said Margaret McLaughlin, an IMSC investigator and professor of communication at the USC Annenberg School for Communication. "The big advantage is that we can control the environment and design virtual tasks that target each patient's impairment."

McLaughlin, who is a co-editor of Touch in Virtual Environments, works with researchers at the Keck School of Medicine of USC to design the new haptics technologies.

High-End Applications

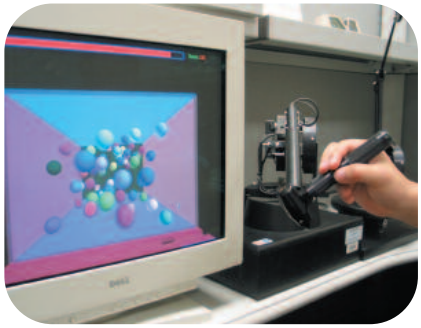
"The technology got its start in commercial gaming, with the debut of inexpensive, non-immersive versions using force-feedback joysticks and steering wheels that vibrated as the driver sped along a video racetrack," she said. "But in university laboratories, the availability of more sensitive, high-end devices that could render touch sensations in three dimensions quickly led to applications in more serious pursuits."

Haptics interfaces began to emerge in such fields as medical and surgical training programs, flight school, teleoperations and scientific visualization. In 2004, NIH saw a need for the technology among stroke survivors, said principal investigator Thomas McNeill, professor of cell and neurobiology, neurology and neurogerontology at the Keck School, and awarded USC and the University of Texas, Austin, a grant to pursue the work.

"More than 700,000 people suffer a stroke each year and nearly 450,000 survive with some form of neurologic impairment or disability," NcNeill said. Those numbers will grow, he added, as the population ages and obesity and heart disease increase, making innovative rehabilitation programs "a national priority" in the next 50 years.

A group of interdisciplinary faculty and computer science Ph.D. students in IMSC's Haptics and Virtual Environments Lab — including McLaughlin , Albert "Skip" Rizzo, Younbo Jung, Wei Peng, Shih-Ching Yeh and Weirong Zhu — went to work on new applications.

"Designing one is very much like creating an aircraft simulator to test and train pilots," said Rizzo, who is currently a research scientist at USC's Institute for Creative Technologies. "But now we've created simulations that can assess and rehabilitate a stroke patient under a range of stimulus conditions. These are conditions that aren't easily deliverable or controllable in the real world."



A researcher holds a robotic force-feed device, called a PHANToM, and moves a ball around in a virtual environment. He will feel resistance if his ball bumps into other balls.

The haptics interfaces have descriptive names, such as "space tube," "pincher" or "mutual touch," which tell users what they do. In addition, each virtual task targets specific eye-motor coordination skills and measures the user's movements in real time.

'Pincher'

"Pincher" is designed for two-fingertip contact with virtual objects, said Shih-Ching Yeh and Weirong Zhu, both computer programmers and graduate students in the Annenberg School of Communications.

The interface works like this: The user dons a pair of stereoscopic goggles and puts a thimble on the forefinger; the thimble is connected to a robotic force-feed device, called a PHANToM. The stylus of a second PHANToM is affixed to the thumb. The two PHANToMs provide the sensation of force to the user's fingertips as (s)he tries to pick up a three-dimensional cube and squeeze it small enough to fit through a narrow hole on the computer screen.

Another emerging interface is a "mutual touch" task, which promotes hand-reaching and grasping. This therapeutic environment utilizes a "cyber grasp" exoskeleton, which fits over an instrumented data glove, to measure the position and orientation of the hand in a three-dimensional space.

"The glove allows patients to feel the sensation of a solid object in their palms," said Yeh, who develops some of the "special effects" computer graphics for the interfaces. "Among the tasks they might be able to perform are picking up a glass and inverting it to pour the liquid out or picking up books and stacking them on appropriate shelves."

The interfaces give physical therapists precise control over a stroke patient's exercise program, which is key to recovery, said Younbo Jung, another member of the team and a graduate student in communications.

Custom-Designed Tasks

"We can tailor rehabilitative tasks, like pouring milk out of a glass, to each patient, depending on what level of impairment they have sustained," McLaughlin added. "We also get information on their performance instantly, which helps the therapist to design a rehabilitative program of increasing difficulty. "

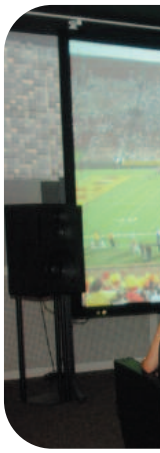
In pilot studies at the USC Keck School — led by Carolee Winstein, professor of biokinesiology and physical therapy and co-principal investigator on the NIH grant, and Ph.D. student Jill Stewart — stroke patients are trying out these prototypes.

So far, they have reported "overall satisfaction" with all of the new cyber tasks, said McLaughlin. In one instance, a volunteer was "extremely enthusiastic about the space tube task and said she wanted to use the system at home."

That is critical to post-stroke recovery. "It's not easy to keep patients motivated and engaged in daily, repetitive exercises," McLaughlin said, "so if they are enjoying the tasks, they're likely to do better during rehabilitation."

Faculty Set Up Shop in New Tutor Hall Multimedia Labs

IMSC's multimedia laboratories moved into state-of-the-art facilities in Tutor Hall this spring. The laboratories, located primarily on the second and third floors of Tutor Hall, will be devoted to a variety of new projects in information technology, data mining, archiving and management, Internet 2, immersive audio and visual environments, games, speech and language analysis, and scientific visualization.



InfoLab

Information Laboratory, also known as InfoLab, is located in RTH-323. Under Cyrus Shahabi's direction, the laboratory currently includes 14 students (eight Ph.Ds, three M.S., and three undergraduates) and one research staff. The facilities cover roughly 900 square feet and include several SUN and Dell Servers, PCs and Workstations, three CyberGloves, several Berkeley Mica Mote sensors, and more than two terabytes of disk storage and RAID devices.

InfoLab's mission is to investigate new approaches to the management of unconventional data types within atypical architectures. Currently, the lab's research emphasizes different aspects of managing multidimensional data streams in peer-to-peer architectures. The main areas of research are multidimensional data analysis, peer-to-peer data management, stream query processing, and spatio-temporal databases.

CiSoft's RTDM

With the current advances in sensor technology, it is now economically viable to deploy many sensors in both oil production and water injection wells to monitor gas, water, and oil production rate and pressure. The objective of the RTDM project at CiSoft is to enable real-time and automatic storage and analysis of the large amount of data generated by these sensors in order to "understand" the workings of an oil reservoir.

Yima-P2P

Leveraging on their research contributions in RMI's Yima streaming architecture, researchers are developing a peer-to-peer (P2P) streaming system, called Kerena. Kerena is a Gnutella-like unstructured P2P network of autonomous users that share continuous media, such as data stream, audio, and video, among themselves. Unlike other unstructured P2P networks that handle file-sharing, Kerena is designed for stream-sharing. The real-time delivery constraints and specific workload characteristics of continuous media differentiate the Kerena technology from that of other P2P networks.

As a real-world application for Kerena, researchers intend to upgrade the one-to-many architecture of the content delivery network used by USC's Distance Education Network (DEN) to a many-to-many P2P architecture. With the new architecture, students could join Kerena using the on-campus computers or their personal computers to access the course webcasts. Once the content is injected to Kerena by the DEN server, it is naturally cached and distributed within the network as users access and share the content. This is a cost-effective solution for the overloaded centralized DEN servers, deploying the underutilized campus and user computers.

InfoLab

AIMS — An Immersidata Management System

This project focuses on immersive environments, in which a user is immersed in an augmented or virtual reality environment in order to interact with people, objects, places, and databases. The users in typical immersive environments are traced and monitored through various sensory devices. These range from tracking devices on their heads, hands, and legs to video cameras and haptic devices. These devices facilitate a natural interaction, beyond what they would experience with a keyboard and mouse.

The main objective of the AIMS project is to address the challenges involved in managing the multidimensional sensor data streams generated within immersive environments. This data type, which is acquired from a user's interactions with an immersive environment, is known as immersidata.

Research in this area is pressing. Management of immersidata has become crucial as the number of immersive applications grows and as they become more common. Due to specific characteristics of the immersidata, its management requires database expertise combined with signal processing and continuous math flavors. Immersive applications have ample common data management needs, justifying the design of a general purpose system for management of immersidata.

InfoDec/GeoDec

InfoDec is a new initiative within IMSC. Its co-project leaders are Cyrus Shahabi and Craig Knoblock. Its goal is to address one of the main problems confronting decision makers: information overload.

People struggle with too much information in a number of situations. An intelligence analyst generating a briefing report, a crisis manager coordinating activities after a plane crash, an engineer planning oilfield operations, or even an earth scientist simulating global warming scenarios—all of these people deal with information overload. They acquire data from a variety of sources—such as sensors, satellites, databases, the Internet and private intranets—and the data are in various formats, including video, audio, images, sensor data streams, semi-structured, and structured data. Often, significant insights depend on the fusion or integration of these sources.

Research in this area will lead to the effective presentation of the information to an expert. This may be through an interactive visualization or via a dynamic interactive template. Ultimately, researchers hope to achieve effective human comprehension and an insightful course of action.

GeoDec will be developed as an instantiation of InfoDec's research ideas. This tangible example will help InfoDec focus its reseach efforts as it gets off the ground, and will be used to attract funding from different government agencies and corporations.

InfoDec's researchers envision GeoDec rapidly and accurately enabling an information-rich and realistic three-dimensional visualization of a geographical location, such as a city. They don't want to simply navigate through a 3-D model; they want to be able to ask queries and get information about the area seamlessly and effortlessly.

Speech Analysis and Interpretation Laboratory (SAIL)

Directed by Shrikanth Narayanan, the SAIL lab currently supports over twenty Ph.D. students, five undergraduate research students and three post-doctoral scientists. The lab frequently hosts international research scholars, from countries such as Spain, Italy, and Germany. The lab has contributed to numerous publications and other research products, and has gained national and international notoriety.

The work in the SAIL lab is externally supported by grants from a variety of federal and industry sources, including DARPA, the United States Army, NSF, NIH, ONR, and major industry partners, such as Lockheed Martin, Lucent, Intel, AT&T, HRL, and Sandia Labs.

SAIL will become a hub for interdisciplinary research and education in the broad area of human-like sensory machine intelligence. The research and education program at SAIL focuses on the science and technology of human speech, language, and gestures. It aims to bridge multimedia signal processing with a variety of other engineering and non-engineering fields, including computer science, biomedical engineering, linguistics, psychology, and cognitive and social communication sciences.

SAIL aims to synthesize and leverage interdisciplinary scientific knowledge from linguistics, psychology, and communication to develop cutting-edge multilingual communication technologies for applications ranging from national security to education and training. It also aims to use engineering advances and techniques to motivate and advance people's understanding of the physical, cognitive, and social bases of human speech and language, and contribute to creating and validating theories on spoken language communication.

Immersive Audio Laboratory (RTH 213-215)

Run by Professors Kyriakakis and Holman, the IMSC Immersive Audio Lab recently moved to its new home in Tutor Hall. Kyriakakis and Holman designed the facility for high noise isolation. It consists of a "room within a room," including a floating concrete floor, special air handling considerations, and custom-made acoustically-sealed doors. This gives the room an NC-15 noise criterion rating, which means it is most likely the quietest space on the USC campus. They designed the acoustics of the room to provide a controlled environment for audio research. This lab required a 17-foot slab-to-slab spacing from floor to ceiling, which led to the construction of the entire second floor with a higher ceiling than the rest of the building.

The experimental facility houses audio rendering systems that range from single-channel mono to 10.2 channel immersive audio. The facility is equipped with multi-channel mixing and editing capabilities, HD picture editing, and equipment for research in binaural acquisition and rendering, simulation of acoustic spaces, and high fidelity multi-channel audio streaming over high-bandwidth networks.

Immersive Entertainment Laboratory (RTH 217)

IMSC uses this facility to perform research in scalable immersive environments. It was designed with the same acoustical and noise considerations as the Immersive Audio Lab. It can seat up to 20 people who may be participating in remote media immersion experiments with musical performance in distributed spaces, high-presence remote learning, immersive teleconferencing, and immersive entertainment.

SAIL

What's Happening at SAIL?

In a world of rapid advances in information technology, two critical speech and language application needs stand out in particular.

The first is the creation of natural interfaces that enable people to interact freely with one another, and with the information systems of the future regardless of their age, skills, linguistic or socioeconomic backgrounds. Researchers at SAIL believe that technologies that facilitate interaction using natural modalities of human communication, such as spoken language and gestures, provide the most effective solution. This technology can be applied to create games for education and training, as well as interactive interfaces for communication.

The second is information mining from multimodal sources—such as speech, audio, video, and text—that automatically and rapidly determines who is saying what to whom and how from vast amounts of data generated by different people and on different topics.

Researchers advocate a synergistic approach, in which basic scientific knowledge can help algorithm development, while tools and results of rapid information acquisition and interpretation can help advance communication scholarship.

This asks researchers to bring together the various facets of human speech communication. This is a challenging undertaking, but successful research might lead to a number of advances.

For example, automatic multilingual speech-to-speech translation would become a possibility. It would allow an officer on a peace-keeping mission in a foreign land or a medical doctor in an urban hospital in Los Angeles to communicate freely with someone who speaks a different language.

Also, this research would advance multimedia spoken language interaction technologies. This would enable young children in schools to freely interact with information systems that educate and entertain. It would also lead to the building of immersive training systems to train next-generation soldiers, surgeons, and engineers.

This research might also lead to information technology tools that rapidly coalesce and mine broadcast, audio, and video data and facilitate dissemination of critical information.

Let the Games Begin!

Anthony Borquez, IMSC's New Associate Director of Education, Says Video Game Minors Already Popular Among Students Across Disciplines

Anthony Borquez, new associate director of education at IMSC, has a flair for the fast-moving environment of educational programs in video game technologies and interactive media.

Last fall, in his previous position as director of the Viterbi School's Information Technology Program (ITP), he launched two video games minors, which proved to be popular among students. More than 700 students have already taken courses in these interdisciplinary programs, which are also part of the computer science and School of Cinema curricula. Borquez also initiated a minor program with the USC School of Law, which allows students to specialize in Internet law.

Borquez's own education has Trojan roots: he received his undergraduate, master's, and doctorate degrees at USC. His undergraduate degree is from the Marshall School of Business, while his master's degree is in information technology. He earned a Ph.D. in education psychology from the Rossier School of Education and is an alumnus of the Harvard Internet Law Program.

Borquez said he intends to "continue to look for new opportunities to expose IMSC's cutting-edge research across educational initiatives." He will remain particularly focused on the burgeoning area of video gaming.

He's already spent time with educators at local middle schools and high schools, discussing ways to enhance their curriculum using IMSC research.

"At Kennedy High, there's a group called the Academy of Game Entertainment Technology (AGET)," he said, referring to a program at Kennedy High School in the San Fernando Valley. "We visited them and looked at ways for IMSC to get involved in educational after-school programs. IMSC is a good match for these types of collaborative opportunities."

Borquez also mentioned a middle school in south central Los Angeles. "At John Muir, we met with sixth and seventh grade math and science teachers and looked at ways that IMSC could boost their curriculum. After all, there is a huge mathematical component to creating games—a lot of linear algebra and geometry go into the process."

The students' work with video gaming would complement their existing curriculum. "We hope to create supplemental exercises and equip the teacher with lesson plans that can be used in the classroom," Borquez explained. "We've found that students are more motivated and excited about the curriculum when it relates back to something like gaming."

Borquez speaks from experience. He and his team have done their homework, so to speak. "When I go out to visit schools and speak to students, I have 100 percent attention and I get a variety of questions," he explained. "There are hands raised in the air and inquisitive faces all over the place."

Borquez found that the curriculum IMSC helps educators create appeals to a wide array of students. "All of the students—as different as they are—have the ability to learn something important when they work on a game," Borquez said, adding that both male and female students show keen interest in what IMSC has to offer. "When you create a game, you draw on so many different skills and talents."

Borquez identified some of the different roles students might play in developing a video game from scratch. "One person might be responsible for creative storytelling, while another might focus on traditional art sketching. Others might be responsible for the 3-D animation and modeling. These are varied skills, at which different students excel."

And these skills represent only part of the process. "Creating a video game also requires a number of technical skills," Borquez added. "There might be someone who focuses just on graphics and someone who focuses just on physics." Artificial intelligence is another area that needs attention. "Someone can work on making the enemies and characters smarter," he pointed out.

But Borquez believes that designing a video game is an excellent way for students to hone a number of skills. "The process requires thinking that is creative and artistic, as well as functional," Borquez said, smiling. "There is a little bit of something for everyone."

2004 Presidential Early Career Award continued from page 1

"We are absolutely delighted to hear of this award," said USC Viterbi School Dean Yannis Yortsos. "Elaine's pioneering work in combining analytical modeling with musical analysis is truly groundbreaking. I think it underscores the importance of collaborative research in many fields today, and shows that creativity can lead to important breakthroughs."

In addition to her engineering pursuits, Chew is a classical pianist who performs at concerts and recitals around the world. She believes music is the ideal domain in which to study communication, creativity, human perception and cognition.

According to Chew, "A performance is the result of a series of decisions, either conscious or subconscious. Understand music and you begin to understand how the human mind works."

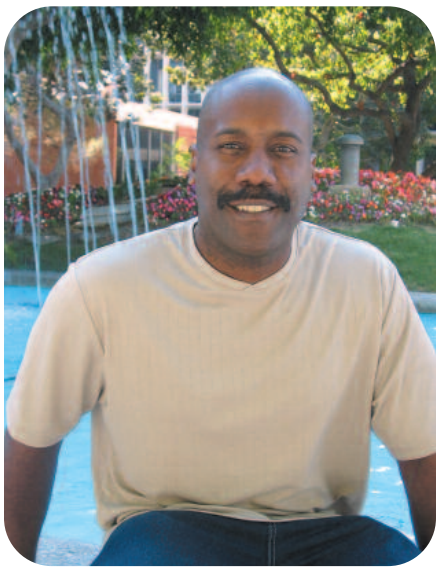
Presidential recognition of this work "reflects a maturing of the music research community and suggests that the arts have an important place, even in our technologically oriented society," Chew said. "Not only does the award recognize the research and teaching that I have been conducting, but it recognizes the work of my illustrious mentors, including Jeanne Bamberger, George Dantzig and Georgia Perakis."

Chew, who oversees IMSC's research area in human performance engineering, became the seventh USC engineer to receive the award. In 2004, she won a five-year, $500,000 NSF CAREER award, which usually precedes the PECASE award, to develop computer tools for generating and analyzing expressive musical performances. The Expression Synthesis Project (see page 8) is a primary project funded by this grant.

The MIT graduate is best known for inventing the "spiral array" model for tonality. She is also leading user studies in IMSC's Distributed Immersive Performance (DIP) project. The DIP system, developed in collaboration with IMSC colleagues Roger Zimmermann, Alexander Sawchuk, Christos Papadopoulos and Chris Kyriakakis will one day allow musicians to perform together in real time over the Internet.

Born in Buffalo, N.Y., Chew lived in Singapore most of her childhood, where she received conservatory-level music training and diplomas, before returning to the United States to study music, mathematics and engineering. She majored in music and computational mathematics as an undergraduate at Stanford and earned her master's degree and Ph.D. in operations research at MIT.

Howard University Gets Serious About IMSC's Expertise in Interactive Entertainment



IMSC visiting scholar Todd Shurn

Most universities recognize the potential of interactive entertainment — serious games and simulations for non-entertainment domains, such as education, health, public policy, defense and training — but few currently have the technical and academic resources to initiate formal R&D programs in games development.

In April, USC Integrated Media Systems Center Director Adam Powell and USC Information Sciences Institute games expert Michael Zyda traveled to Howard University for a workshop — "Serious About Games" — to introduce faculty, students and the Wash., D.C. community to serious games applications. The event was organized by IMSC visiting scholar Todd Shurn, who is an associate professor of systems and computer science at Howard University.

Zyda characterized the impact of the games industry, a $9.4-billion industry that is expected to surpass total movie box office revenues in a few years.

Zyda is creator of "America's Army," an enormously popular online game in which players train for and carry out virtual missions. He discussed the U.S. Army's program of game play and how it has led to increased knowledge about military rank, weapons systems and training techniques. The program has had an important impact on teenage boys, its target audience, he said.

"America's Army" game is so realistic that basic training officers have used it to improve the skills of its trainees, Zyda pointed out. The military game demonstrates that game play can be effective in training and educating personnel in other application domains.

Zyda also presented workshop participants with USC's proposed undergraduate and graduate game curricula, which will include many new courses never offered before.

After his presentation, Powell moderated a lively discussion among panelists and attendees about how to introduce game creation in the collegiate curriculum. The panel included Zyda, John Buchanan, Electronic Arts University liaison, and John Nordlinger, Microsoft Games evangelist.

By the end of the discussion, participants for the most part seemed convinced that faculty should relate game development concepts to specific instructional topics. They felt that this approach would provide students with topical comprehension and stimulate creative thinking.

The audience also felt that instructors should emphasize game aspects that are appropriate to specific topics in a manner that will open the doors to a critical assessment of student projects. Faculty without game expertise were encouraged to review the USC curriculum and the Microsoft Developers Network as a starting point.

Students seeking preparation for gaming careers without majoring in games development were encouraged to participate in the international game developers association, various games creation competitions, and attend game workshops, conferences and conventions.

The workshop was very effective in establishing contacts among attendees representing IMSC, Howard University, Electronic Arts, Spelman/Morehouse College, Microsoft, Public Broadcasting Service, Black Entertainment Television, the International Game Developers Association and others.

Everyone who attended left with excitement about the prospects for integrating game development into university programs to improve students' interest and academic performance. Workshop attendees came from diverse backgrounds, including business, graphic arts, programming, linguistics and education.

What's Ahead at IMSC? continued from page 1

and with the Annenberg School," he said. "In more recent years, we've started some exciting projects with Thornton School of Music. Some of our researchers have been involved with ICT (Institute for Creative Technologies) since it began, and that will increase. We're working more closely with ISI (Information Sciences Institute), and I certainly see productive partnerships with many other USC units."

Powell intends to strengthen these cross-disciplinary collaborations. He said they will be particularly important in advancing IMSC's work with video games.

"Southern California is the world center of the video game industry, and USC has all of the ingredients that go into video games," he said. "But (this work) is spread all around the university in many different units. This is a real opportunity for all of us to form great cross-disciplinary collaborations and leverage our individual strengths. And the industry really needs this kind of support."

Powell foresees significant changes in the video game industry.

"In the near future, hit games are going to come from engineers with M.S. degrees who understand AI (artificial intelligence) and who can use it to create rich characters and compelling interactive stories," he said. "They'll have to work very closely with storytellers and artists to be successful. IMSC has been oriented to such collaborations since its inception, so I think we are in a great position to provide leadership in this area."

Meanwhile, Powell sees IMSC branching out in other directions, too. He said he hopes to expand IMSC's outreach to K-12 educators, low-income and traditionally disadvantaged communities, as well as disabled users. He also sees IMSC strengthening its ties with international partners in places where high technology is typically less accessible, such as rural Africa.

"We want to forge partnerships with institutions that can use the unique set of tools IMSC has developed and is developing," Powell said. "We already know there are applications in education, in health care, in arts and culture and museums. But we are also being approached by prospective partners with applications that we had not considered for immersive and augmented realities."

IMSC's research is web-based, making its outreach efforts easier.

"It is accessible wherever we have decent Internet connections, which nowadays is almost anywhere," Powell said. "In my technology work, I've been to remote towns in places ranging from the Andes to the middle of the Sahara, and it's been years since I have found any location that is not connected, sometimes in novel and surprisingly effective ways, to the Internet."

Baby, You Can Drive My Song

ESP Interface Puts Non-Musicians On a Digital Road to Performance and Interpretation

A new University of Southern California computer system lets a user drive a piece of music, using a wheel and foot controls.

The Expression Synthesis Project (ESP) interface, devised by a team led by Elaine Chew of the USC Viterbi School of Engineering, may be in the hands of consumers within two years.

Chew presented ESP May 28 at the New Interfaces for Musical Expression (NIME) 2005 conference at the University of British Columbia in Vancouver, Canada.

Chew is a pianist who carries on a continuing schedule of concert appearances in addition to her work at the Viterbi School's Daniel J. Epstein department of industrial and systems engineering. She says the system "allows everyone a chance to experience what it's like to perform. It lets them appreciate the decisions made by a musician in interpreting the music."

ESP "attempts to provide a driving interface for musical expression," according to Chew's published description. "The premise of ESP is that driving serves as an effective metaphor for expressive music performance. Not everyone can play an instrument but almost anyone can drive a car. By using a familiar interface, ESP aims to provide a compelling metaphor for expressive performance so as to make high-level expressive decisions accessible to non-experts."

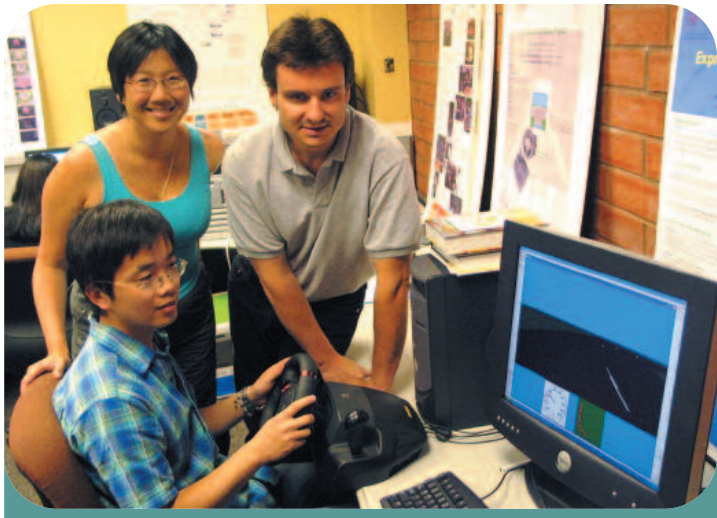
Created by Chew, Viterbi research professor Alexandre R.J. François and graduate students Jie Liu and Aaron Yang, ESP starts from a neutral conversion of the printed score of a piece into the Musical Instrument Digital Interface (MIDI) format, the standard control language for driving musical synthesizers or other devices. François' Software Architecture for Immersipresence and accompanying Modular Flow Scheduling Middleware, devised in 2001, are important enabling elements in the design of the system.

The score used as the test case in the development of ESP is the Hungarian Dance No. 5 in G-minor by Johannes Brahms. The piece was selected because it contains numerous moments of extreme speed ups and slow downs. To guide the musical performance, Chew and her colleagues used information from the score to create a "road" that corresponds to the structure of the piece. This is necessary, says Chew, because crucial cues from the score and its analysis, necessary for an informed performance, are not captured in the MIDI file.

The group is building tools to automate the process of creating such roads, applying artificial intelligence techniques to the analysis of the score. "Having the road build itself will be the most difficult part," says François.

The road's turns suggest to the driver when to slow down and speed up. However, the ultimate decision on what to do at each turn is entirely in the driver's hands (or feet). The foot pedals control both tempo and volume of the music. Additionally, buttons mounted on the wheel act as the equivalent of the pedals on the piano, making the notes either sustain or cut off crisply.

Chew has carried on the ESP research at the Viterbi School's Integrated Media Systems Center, where she is Research Area Director for Human Performance Engineering. She is the winner of an Early Career Development Award from the National Science Foundation and a Presidential Early Career Award in Science and Engineering.



Chew says ESP "allows everyone a chance to experience what it's like to perform."

She hopes ESP will open new doors into music for non-musicians, a chance "to try making and evaluating musical decisions themselves, to see what it's like to perform."

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