

Media Laboratory

This year, as the Media Lab marks its 20th anniversary, we are reflecting on where we have been—and, of greater importance—where we will be going.

In our first decade, we defined what it meant to be digital, inventing much of the technology that enabled the digital revolution of the 1980s and '90s. The second decade brought about a shift in emphasis toward pervasive, ubiquitous computing: how the bits of the digital realm could interact seamlessly with the atoms of our physical world. This led to pioneering advances in wearable computers, wireless viral communications, machines with common sense, new forms of artistic expression, and innovative approaches to how children learn.

Now, as we enter our third decade, we are adding a new focus on human augmentation—looking for ways to parlay the achievements of our first two decades into new ways to overcome the limitations of human capabilities. We are defining augmentation in its broadest sense, from the development of smart prosthetics that use biological signals to emulate natural movement, to next-generation robots that relate to us in more human terms, to computers that can not only utilize common-sense thinking in assisting us, but also respond to our emotional states. An innovative approach to technology design is key to this process.

While expanding into these new areas, the Media Lab continues to advance its long tradition of innovation in education, both through the development of new tools for learning and through our involvement with programs across the globe that are redefining the meaning of education. True innovation in education is not adding computers to traditional classroom settings, but rather finding ways for children to use computers as freely and creatively as they now use paper and pencil. A number of educational projects throughout the world are focusing on new concepts in project-based education that challenge the underlying precepts of how we learn. As a major step toward this, the lab has initiated a \$100 Laptop research program whose goal is to develop a Linux-based, full-color, full-screen laptop that can be manufactured for less than \$100 and made available through ministries of education to children everywhere. Our goal is to work with a small number of companies of complementary skills to develop a fully working and manufactured laptop in fewer than 12 months, with an eye toward building about 100 million to 200 million units by the following year. Five initial companies who have committed to this project are AMD, Brightstar, Google, News Corp, and Red Hat. The lab will also work with the not-for-profit company One Laptop Per Child, as well as with the 2B1 Foundation.

Research Achievements

A sampling of AY2005 Media Laboratory research initiatives includes:

- *Biohybrid prosthetic limbs* that will perform like biological ones—active knees and ankles controlled by an amputee's own nervous system and powered by muscle-like devices so that they can generate the mechanical force needed to walk and climb without falls or fatigue.

- *bYOB* (Build Your Own Bag), a distributed sensor network ingeniously incorporated into squares of fabric used to create “do-it-yourself,” smart pocketbooks that can tell you when you’ve forgotten your wallet or keys, or a scarf that can remind you not to leave it behind on the subway.
- *DishMaker*, a variable molding machine that brings personal fabrication into your kitchen, allowing you to create and recycle your dishes on demand.
- *Scratch*, a new programming toolkit that makes it easier for kids to manipulate graphics, images, and sounds to create animated stories, video games, and interactive art.
- An *autonomous interactive intermediary* that brings human-like social intelligence to our telephone agents by sending out readable social cues, such as gaze and gesture, to communicate in subtle and non-annoying ways.
- *Pushpin Computing*, a network of small, bottlecap-sized mini processors, each with two thumbtack-like pins that connect to a power-supplying bulletin board to provide a real-world testbed for tomorrow’s extremely high-density sensor networks.
- *Affective learning companions* that will act as intelligent tutors, virtual peers, or a group of virtual friends to help facilitate learning, creativity, and motivation.
- *Collaborative (viral) communication architectures* that use bandwidth and energy far more efficiently than traditional point-to-point wireless technology.
- *I/O Brush*, a special, high-tech drawing tool that can pick up colors, textures, sounds, and even moving patterns directly from the world and transfer them to an electronic canvas.
- *Smart architectural surfaces* constructed with a metal framework into which users snap any number of smart tiles, each of which is equipped with a wireless computer, camera, speaker, microphone, and sensors. These tiles can talk to one another and act individually or in a unified fashion, creating an entire ecosystem of inexpensive and easily scalable devices.
- *Mindful Documentary*, a system that uses commonsense reasoning tools to work in partnership with a videographer and an intelligent camera to generate future shot suggestions and possible story elements.
- A *computational model for expressive, anthropomorphic robots* that enables a robot to demonstrate social-referencing behavior similar to that of a human infant. This work is an important milestone toward social learning in robots.

Exhibitions, Performances, Milestones

In June, Tod Machover premiered his new concerto, *Jeux Deux for HyperPiano and Orchestra*, at Tech Night at the Boston Pops. Commissioned by Pops conductor Keith Lockhart, the composition represents a new phase in Machover’s hyperinstrument work, as both piano and orchestra are purely acoustic, with no amplification or electronic enhancement. It was accompanied by large, projected, interactive images by Media Lab doctoral student Marc Downie.

Benesse assistant professor Chris Csikszentmihályi's *Skin & Control* exhibit ran at the Location One gallery in New York City from September through December 2004. The exhibit consisted of two large-scale installations, *Skin* and *Control*, which explored the central technologies of industrial society: the airplane and the control panel.

The Computer Clubhouse, cofounded by LEGO Papert associate professor Mitchel Resnick in 1993, opened its 100th clubhouse in May 2005. Aided by a \$32 million grant by Intel in 2000, the Computer Clubhouse project has grown from a single after-school center for teens in inner-city Boston to serve more than 50,000 youths worldwide.

The Tangible Media group's PingPongPlus project went on display at London's Victoria and Albert Museum in June 2005. The group's music bottles project was displayed at the National Museum of Fine Arts in Taiwan, and its I/O Brush and Topobo projects are displayed at the Ars Electronica Center in Linz, Austria.

Collaborations

The Media Lab's research agenda is synergistic with work going on across the MIT campus and involves numerous interdisciplinary collaborations, particularly with researchers in brain and cognitive sciences, bioengineering, management, mechanical engineering, computer science, artificial intelligence, and urban planning. These collaborations are in the form of joint academic appointments, teaching efforts, and research programs. Currently, 30 percent of the lab's senior faculty members have joint appointments, and 25 percent of our graduate students and 100 percent of our approximately 150 Undergraduate Research Opportunity Program students are enrolled in degree programs outside the lab's academic program in Media Arts and Sciences. In addition, 18 students are enrolled in the alternative freshman program, which completed its sixth year.

Tod Machover collaborated with Media Lab sponsor Fisher-Price on the release of Symphony Painter in November 2004. Based on the lab's Hyperscore program, this handheld music-composition tool is being sold as an add-on cartridge to Pixter Color, the company's hand-held digital drawing platform. Future applications for Hyperscore technology are being developed by a new Media Lab spinoff company, Harmony Line, Inc.

The Communications Futures Program, a collaborative effort with the MIT Computer Science and Artificial Intelligence Laboratory and Sloan School of Management, has teamed up with the Cambridge-MIT Institute to launch a Communications Innovation Institute to promote innovation across the entire communications industry. The initiative was launched at a two-day event at the University of Cambridge in June 2005.

Ted Selker, head of the lab's Context-Aware Computing group and principal in the Caltech/MIT Voting Technology Project, cohosted a two-day symposium, Voting Technology: Innovation for Today and Tomorrow, in October 2005.

Taiwan's Industrial Technology Research Institute (ITRI) and the Media Lab are collaborating on NEXT, a lab consortium that explores new approaches to innovation. Its members include commercial enterprises, research organizations, and governments.

Media Lab Europe

In January 2005, Media Lab Europe's Board of Directors announced its closing, citing insufficient levels of external funding. Over its four years of operation, MLE launched a number of groundbreaking research initiatives, filed for 14 patents, and participated in a number of European Union-funded research collaborations.

Sponsors

During FY2005, the Media Lab gained a number of new sponsors for its consortia and research programs, with several existing sponsors upgrading their level of sponsorship:

Consumer Electronics Laboratory

NEW: AMD, Best Buy*, Corning Inc., Display Group, Seagate Technology, and VEIL Interactive Technologies*

Digital Life

NEW: Brightstar Corporation, Cisco Systems Inc., Google, News Corporation, QUALCOMM Incorporated, and Rodale Inc.

UPGRADED: France Telecom/Orange and ITRI

Communications Futures Program

NEW: Comcast and Deutsche Telekom.

UPGRADED: Cisco Systems, France Telecom/Orange, Nokia, and Nortel Networks

NEXT

NEW: Chi Lin Optronics Co. Inc., HCG (Hocheng Corporation), Hiwin Technologies Corp. Sanyang Industry, VIA Technologies Inc., and Yang, Chang & Newworkshop Co.

SIMPLICITY

UPGRADED: Toshiba

Things That Think

NEW: Canon Inc., Fujitsu, Highlands and Islands Enterprises*, Honda Research Institute Japan Co. Ltd.*, Hitachi Ltd.†, and Schlumberger Technology Corporation

*Affiliate member

†Consortium sponsor with resident researcher

Research Sponsors

In FY2005, the Media Lab submitted 61 proposals for new and continuing directed research projects. Twenty-seven of these proposals remain under consideration, and 17 have resulted in awards. Nearly 90 percent of the proposals submitted were in response to government solicitations (the National Science Foundation, the Defense Advanced Research Projects Agency, the Department of Defense, the Department of Homeland Security, and the National Institutes of Health), with additional interest in directed sponsorship from foundations and other nongovernmental sources. The proposals ranged in size from \$12K to \$12M, spanning one to five years; grants that were awarded ranged from \$12K to \$589K, with an average award of \$120K per year for two years.

Special Funds

Ten corporate sponsors—AOL, BT, LEGO, MasterCard, Motorola, NEXT, Nortel Networks, Samsung, Telmex, and Warner Brothers—funded student fellows. Additional fellows sponsors included the family and friends of the late Steven R. Holtzman, who established an endowed fellowship in his memory, and Media Lab Europe. The following were named fellows during FY2005:

AOL	Ashwani Kumar
BT	Hugo Liu, Jason Nawyn, Dimitris Vyzovitis
Steven R. Holtzman Fellowship for Digital Expression	Noah Fields
LEGO	Hayes Raffle, Carlos Rocha, Oren Zukerman
MasterCard	Alexander Faaborg, James Patten, Kristina Shamp'an'er
Media Lab Europe	Ari Benbasat, Andrea Chew, Enrico Costanza, Kai-yuh Hsiao, David Merrill, Bo Morgan
Motorola	Fulu Li, Amanda Parkes
NEXT	Roberto Aimi, Burak Arikan, Jamie Cooley, Phil Davis, Cory Kidd, Hyun-Yeul Lee, Jackie Lee, Kimiko Ryokai, Noah Vawter, Scotty Vercoe
Nortel Networks	Aggelos Bletsas
Samsung	Ryan Aylward, Kwan Hong Lee, Nikolaos Mavridis, Ali Mazalek, Kelly Norton, Richard Whitney
Telmex	Victor Adán, Ernesto Arroyo, Geraldo Barroeta Pérez, José Espinosa, Ernesto Carlos Martínez-Villalpando, Emmanuel Munguía Tapia, Héctor Yuen
Warner Brothers	Barbara Barry, Andrea Lockerd Thomaz

Human Resources/Administration

Several new staff members were welcomed to the Media Lab in AY2005. These included Sarah Page, who came from Resource Development to join the lab as director of development, and Geoff Wilson, who came from OpenCourseWare to become the lab's IP and contracts coordinator.

Walter Bender

Executive Director

Senior Research Scientist

More information about the Media Laboratory can be found on the web at <http://www.media.mit.edu/>.

Media Laboratory Sponsors

Corporate and Strategic Research Partners

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ICU*
The LEGO Group*
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Research Consortia and Joint Programs

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UPM-Kymmene

Communications Futures Program (CFP)

Cisco Systems, Inc.
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France Telecom/Orange
Intel
Nokia Corporation
Nortel Networks

Consumer Electronics Lab

AMD
Best Buy
Corning Inc., Display Group
Seagate Technology
VEIL Interactive Technologies

Digital Life (DL)

Bertelsmann AG
Brightstar Corporation
Cisco Systems, Inc.
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Google
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Philip Morris USA
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Stan Winston Studio, Inc.

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Industrial Technology Research Institute†
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VIA Technologies, Inc.
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Things That Think (TTT)

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Schlumberger Technology Corporation
Sensormatic Electronics Corp.

*Members of all consortia and special interest groups, with resident researchers.

†Consortium sponsors with resident researchers.

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Special Interest Groups

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 University of Wisconsin/US Air Force
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