
BBVA

The Power of Creative Freedom: Lessons from the MIT Media Lab

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Over its 25-year history, the MIT Media Lab has refined a unique research style that has resulted in some of the most original thinking of the digital revolution. The secret formula for this success–and for the Lab's continued ability to "invent the future"–is a renegade research environment that not only allows, but encourages, researchers to ask the questions that no one else has thought to ask.

We are an organization that is constantly reinventing itself with the most unconventional pairings of disciplines and people. The idea is to bring together the brightest people we can find–from a large number of disparate disciplines–to figure out to how to change the world. Most important, we are simply not afraid of being on the "lunatic fringe" or hitting a dead end. That's because real innovation comes from fostering a research culture where it is not only okay to fail, but where failure is fully expected–and accepted–as part of the creative process. Great ideas don't come from playing safe. They don't come from thinking incrementally. Rather, they come from thinking about things in a way that no else has. And this is the lesson that the Lab offers to the world.

I believe that all organizations, both for-profit and non-profit, can learn from the Lab's unique ethos as long they are willing to take the risk of doing things a bit differently.

SEEDING INVENTION

Drawing on the Media Lab's example, if you were to ask me where you might strengthen an organization's innovation process, I'd say to begin by rethinking how you define innovation. Too often, the early seeds of creativity are undervalued. It is commonly accepted that innovation is the successful *implementation* of creative ideas. But, as we at the Media Lab have demonstrated, true innovation isn't about finding new ways to put existing ideas into new practices. The process needs to start much earlier, and be far more radical. It needs to begin as "pre-innovation"–with crazy, revolutionary ideas that become the fodder for society-changing technologies and products.

Today, too many companies are weak on the front end of the innovation cycle because they are not investing in the seed corn—those hundreds of inventions that result from a free-formed, undirected process.

Think of the kind of innovation that, in the past, came from Bell Labs, IBM, or Xerox PARC. These companies made a conscious decision to invest heavily in seeding new ideas; some would lead to products, but many more would not. However, the entire organization was dedicated to pioneering new ways of thinking about technology. Now, we're seeing more and more organizations delegating "innovation" to smaller, elite teams of creative thinkers who reside in a company's "innovation lab." This is a model that does not take advantage of the power of creative freedom. Innovation should be ubiquitous throughout an organization. Ideas should organically sprout from all different departments in such a way that there is no "wrong way" to think about a problem, or "right way" to solve one.

FOLLOW YOUR PASSION

At the Media Lab, our mantra is "follow your passion." We're not here to answer specific questions for our sponsors or outside funding agencies, but rather to discover the new questions that need to be asked–to focus on how digital technology can help to transform our most basic notions of human capabilities. Most important, we are here to foster a unique culture of *learning by doing.* To do this, we have gathered some 25 research groups working "atelier style" to create the things that conventional wisdom says can't–or shouldn't–be done. There are no boundaries, only possibilities.

REACHING ACROSS TRADITIONAL DISCIPLINES

Central to the Media Lab culture is our disregard for working within the straightjacket of traditional academic disciplines. Here, for example, the Opera of the Future research group, which is expanding the boundaries of music and creativity, shares a lab with the Smart Cities group, which is focused on designing tomorrow's sustainable cities. The Tangible Media group, which focuses on tactile connections between the physical and digital worlds, works alongside researchers in Viral Communications who are exploring radical new concepts for networked systems.

Research disciplines at the Lab range from robotics, to neurobiology, to epistemology. And it is not unusual for any single research project to draw from ongoing work in several seemingly unrelated disciplines: the challenge is to find the connections. Each research group is led by a faculty member or research scientist who directs a team of graduate and undergraduate students. (The undergraduates work at the Lab through MIT's Undergraduate Research Opportunities Program.) All researchers also work within one of the Lab's consortia, which are organized around broad research themes rather than traditional disciplines. For example, Things That Think, the Lab's largest consortium, joins computer scientists with product designers, biomedical engineers, and even architects to focus on inventing the future of digitally augmented objects and environments.

The Lab's 25 research groups focus on more specific areas, and address a broad scope of projects that range from creating the next generation barcode (Camera Culture), to developing communications systems with an understanding of their content (Object-Based Media), to creating interfaces that allow people to "grasp" and "manipulate" bits by coupling them with everyday objects and architectural surfaces (Tangible Media).

One key feature of this approach involves shunning the standard academic model of directed research. The Lab's funding model gives all corporate sponsors access to *all*

of the Lab's intellectual property during their term of sponsorship, license-fee free and royalty free. This further promotes the intellectual openness and sharing that is essential to the way the Lab functions. Each faculty member or student has total freedom to stray from conventional research paths and collaborate with others in entirely different areas. This way, the Lab becomes an open-ended think tank, with access to cutting-edge research on a wide variety of topics in many different fields.

SERENDIPITY BY DESIGN

When you create the right research culture, some of the best innovation happens through the most serendipitous paths–"accidentally on purpose." For example: in the 1990s, the Lab's Physics and Media group began exploring the interaction between the human body and electrical fields while developing new sensors for a collaboration with world-renowned cellist Yo-Yo Ma. This led to smart furniture that could "see" in 3D, and to the subsequent discovery of a way to send data through the human body, which was incorporated into a Spirit Chair for magicians Penn and Teller (who were appointed as visiting scholars at the Lab). The device literally channeled a field through a performer's body to control music.

One day, while watching Penn and Teller demonstrate the Spirit Chair, a visiting executive from Lab sponsor NEC got the idea that this same technology could be used for a car-seat sensing device. Once its potential use was identified, the Media Lab was instrumental in quickly demonstrating the product's technical viability, and in helping to understand the physics of the problem, as well as in helping with the project's engineering design and rapid prototyping. The executive had a prototype car-seat detector built at the Lab and demonstrated it to customers within the same year. Soon afterward NEC announced the Passenger Sensing System. Armed with this technology, the car's seat could distinguish between a rear-facing or forward-facing baby, and could signal an auto's airbag when–and more importantly when *not*–to deploy, making it a potentially life-saving device for a baby traveling in the front seat of an automobile.

Another example of how an open, creative environment can bring about surprising results involves the Lab's work in affective computing. The initial focus of this work was on developing computers with "emotional intelligence" to detect user frustration in human-machine interaction. Over time, it has grown into two very important, yet totally different research areas: devices used to detect and respond to a customer's level of satisfaction, and tools to help detect and treat autism.

The potential for using affective computing for customer service is significant. Currently, there is no existing system to capture and analyze facial expressions in real-time customer-service interactions and relate these to business outcomes. But consider how important it is to a customer-service oriented business, such as banking, to have real-time techniques to assess the outward appearance of customer interest, confusion, and other cognitive-affective states. This capability could lead to fundamental new understanding of how to improve customer experience in face-to-face interactions, at ATMs, or through online banking services. This technology can also be used for more accurate results from test marketing, where participants are often less than honest when filling out surveys or being interviewed. It can also help take voice emotion out of consumer phone interactions, helping to diffuse

difficult interactions with a customer-service representative.

But this same technology also promises to have an impact in helping people with autism. Specialized tools, including novel, wearable physiological sensors and corresponding software, can help individuals on the autism spectrum communicate cognitive and emotional states, as well as help others–including scientists, therapists, teachers, and caregivers–to better understand those states.

RETHINKING TRADITIONAL RESEARCH BOUNDARIES

Linus Pauling once said, "The best way to have a good idea is to have a lot of ideas." To my mind, no one demonstrated this more than the late William J. Mitchell, former dean of MIT's School of Architecture + Planning and head of the Media Lab's Smart Cities research group. Bill, who sadly passed away a few months ago, was an inspirational thinker and prolific writer who challenged conventional concepts about sustainable cities, design, and urban transportation by bringing together the most unlikely team of researchers. His Smart Cities research group continues to design the CityCar, a light-weight, electric, shared vehicle that folds and stacks like a supermarket shopping cart and would be placed at convenient locations throughout urban areas. The CityCar project totally rethinks the design of an automobile, as it has all essential mechanical systems housed in the car's wheels. The car itself is amazing. But even more amazing is the fact that the CityCar team does not include one researcher who had a background in automobile design.

In addition to crossing traditional disciplinary lines, innovation also involves breaking out of conventional thinking about what kind of researchers should be approaching a particular problem. What would have happened if we had depended on typewriter companies to come up with word processing? Or if we didn't look beyond landlines for the next breakthrough in telephony?

Health care offers another good example. At the Media Lab, engineers, scientists, and designers, unencumbered by current industry and academic biases, are exploring a myriad of health-related issues. With "out-of-the-box" thinking, Lab researchers have already made major strides in developing new "smart" prostheses for amputees, memory aids, and even an ingenious new technology for analyzing and precisely controlling any neural circuit, including those in the brain. This new work in neuroengineering offers the possibility of controlling the firing of specific neurons in the brain to within a millisecond, very precisely targeting cells so that neighboring healthy cells remain untouched. This work has implications for developing radically new medical technologies to treat brain disorders such as Parkinson's disease, or even blindness, and for changing mental and emotional states, such as severe depression.

Lab researchers are also focusing on a new area we call New Media Medicine, where we seek to shift the health-care paradigm. We believe that to have a truly meaningful impact on society, health must be approached in a far broader context—a context in which an individual's physical, mental, and social well-being are so closely integrated that they cannot be distinguished. Toward this end, the Media Lab is designing new platforms and applications that will become intimate yet unobtrusive parts of a person's everyday life. These range from next-generation smart phones and personal sensing networks to help their users become more self-aware and understand how to adapt better behaviors

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for healthier lifestyles, to technologies for “personal collective intelligence,” where people can contribute to, and learn from, the collective knowledge and experience of their peers. We are also developing digital tools for helping patients become equal partners with their physicians–allowing them to share and interpret their health information to positively change their lives for the better.

HARD FUN

Many years ago, the Lab adopted its now iconic motto of “demo or die.” Another expression we use to describe our unique culture is “imagine and realize.” Our students are constantly challenged to build, and build again, and then to demonstrate their work at scale. We are a Lab of tinkerers. It would not be unusual for a visitor to see a sewing machine or a soldering iron sitting next to a state-of-the-art digital display. One day a student is busily cutting out a cardboard model; the next day that same student is writing complex code.

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In fact, one of the Media Lab’s research groups is called Lifelong Kindergarten. A great name, but an even greater approach. Here, researchers develop new technologies that, in the spirit of the blocks and finger-paint of kindergarten, expand the range of what people design, create, and invent–and what they learn in the process. Their ultimate goal is a world full of playfully creative people who are constantly inventing new possibilities for themselves and their communities. One recent innovation that has come out of the group is Scratch, a programming language and online community that makes it easy to create interactive stories, games, animations, and simulations–and share these creations online. Scratch is designed to enhance the technological fluency of young people (ages eight and up), helping them learn to express themselves creatively with new technologies. As they create and share Scratch projects, young people learn to think creatively, reason systematically, and work collaboratively. Available at no cost through the Internet, Scratch has reached a broad, worldwide audience with more than 500,000 users who have uploaded more than one million projects.

A UNIQUE PHYSICAL ENVIRONMENT

In March 2010, the Media Lab expanded into a spectacular new building designed by Fumihiko Maki, who like I. M. Pei (designer of the original 1985 Media Lab building), is a Pritzker Prize-winning architect. This new space is a model for how physical space can be fully integrated with a research program

and serve not just as a place to work, but also as a catalyst for creativity. The entire complex functions as an evolving research platform, seamlessly connecting the real and virtual worlds.

The building offers new levels of transparency, where all the researchers can view each other from various vantage points, supporting the unfettered exchange of ideas. The goal is a space that functions as a single, massively interconnected unit, with seven labs facing one another across a central atrium in a staggered configuration. Through a series of interactive information displays placed throughout the Media Lab complex, the Lab expands collaboration beyond our walls to visitors, sponsors, colleagues, and the public at large. It delivers on our unique vision of how to conduct society-changing research—no boundaries, no walls—just a flow of interdisciplinary ideas, and plenty of open space to invent just about anything.

SYMBIOSIS

The Media Lab model offers enormous freedom to pursue the most far-out research directions without concern for the accepted conventional approach in either academia or industry. At the same time, the Lab's close connections to the corporate community (both through sponsor visits to the Lab and faculty and student visits to sponsors' research facilities), help keep research grounded in real-world concerns.

The Lab and its sponsors have a symbiotic relationship: the Lab's open research approach enables companies to ask questions they would not have otherwise asked. The goal is for collaboration with the Media Lab to help widen the front end of a company's R&D pipeline and spur innovative thinking about entirely new directions. At the same time, the Lab's interaction with industry helps it stay connected with real-world needs.

It is important to note that the Lab does *not* focus on specific, technology-based projects for our sponsors, but rather looks to create an environment for companies to improve *their own* innovation processes. If a sponsor is using the Lab correctly, it will come in looking for a single solution and walk away with ideas that relate to five entirely different areas of product development. The goal is to fuel the imagination–to encourage thinking outside the box; for companies to become visionary about their research direction.

This is not just academic theory; the Media Lab has lived this for 25 years. Today the same Lab that predicted the convergence of multimedia and technology, and paved the way for the digital revolution in 1985, continues to break new ground with society-changing advances. More than 80 spin-off companies have come out of the Lab, and Lab-based commercial products range from electronic ink (the basis of the Kindle), to LEGO Mindstorms, to Guitar Hero. We have some 60 sponsors that include a number of the largest and most prestigious companies in the world, including Audi-Volkswagen, AOL, BT, BBVA, Bank of America, Google, IBM, Intel, LEGO, Samsung, Sun Microsystems, and Toshiba.

MAKING A DIFFERENCE

For years, technologists digitized almost everything, but *transformed* almost nothing. Now we are moving away from merely building more sophisticated digital tools, and are looking to create technologies that will be truly intelligent and helpful participants in the world.

Like the Media Lab's past work, today's research remains clearly focused on human

experience. But more than ever before, it emphasizes the strong link between business, society, and the individual. A few examples of some current projects that are "making a difference" include:

- HealthMap's Outbreaks Near Me iPhone and Android application, which provides real-time disease outbreak information.
- Mobility on Demand (MoD) systems–lightweight, electric vehicles placed at electrical charging stations strategically distributed throughout a city. MoD systems provide mobility from transit stations to and from a final destination. Three MoD vehicles have been developed: the CityCar, RoboScooter, and GreenWheel bicycle.
- CollaboRhythm, a speech- and touch-controlled collaborative interface that facilitates improved doctor-patient interaction. Patients can actively engage with their data, allowing for a more collaborative relationship with their doctors.
- Konbit, a mobile phone-based system that helps communities rebuild themselves by soliciting skill sets of local residents. The system, which does not require participants to be literate, indexes the skills of all those who phone in, translates the responses to English, and makes them searchable by NGOs via natural language processing and visualization techniques.
- Sourcemap, a volunteer-driven, social-networking Web application that presents easy-to-understand map visualizations of the environmental impact of consumer products—information that is almost never available to the public.
- NETRA (Near-Eye Tool for Refractive Assessment), a quick, simple, and inexpensive way for people in the developing world to use mobile phones to give themselves eye exams. A small plastic device–which currently can be produced for less than US$2–is easily clipped onto a mobile phone screen. To use it, one simply holds the device up to the eye, looks into it, and uses the phone's keypad until two patterns overlap. This is repeated several times per eye, with the patterns at different angles. The whole process takes about two minutes, during which time software loaded onto the phone provides the data needed to create a prescription.

The Lab offers us all an outstanding model for how much an organization can accomplish when it fosters an environment where people can create at will, follow their passion, and think beyond the boundaries set by conventional thinking. The sky is the limit when no one tells you that "it can't be done." We *can* invent our own future.

Noted Accomplishments from the MIT Media Lab

E-ink, opening up the possibility of a one-book library.

SixthSense, a gestural, pendant-like interface that projects digital information onto any surface, and allows the user to interact with that information using natural hand gestures. It seamlessly integrates information with the user's physical surroundings, making the entire world a computer.

Scratch, an open-source programming language for kids that allows them to create their own interactive stories, games, music, and animations for the Web.

CityCar, a shared, foldable, electric, two-passenger vehicle for urban areas.

The world's first powered ankle-foot prosthesis, an important advance for lower-limb amputees. The device propels users forward using tendon-like springs and an electric motor, reducing fatigue, improving balance, and providing a more fluid gait.

Nexi, a social robot that possesses a novel combination of mobility, moderate dexterity, and human-centric communication and interaction abilities.

The world's first real-time, moving synthetic hologram.

Bokode, a next-generation barcode that uses a new optical solution for encoding information, allowing barcodes to be shrunk to fewer than 3mm, read by ordinary cameras, and offer different information from different angles.

Csound, a pioneering computer programming language for transmitting music over the web. It is one of the most widely used software sound systems.

The first Web-based, on-demand, personalized electronic newspaper.

The first "programmable brick" that led to the LEGO Mindstorms robotics kits, now used by millions of people around the world.

The XO machine, known worldwide as the "$100 Laptop," which offers connectivity to children throughout the developing world.

Sensors that can detect a user's actions by measuring a body's influence on an electric field.

Audio Spotlight, that generates audible sound that can be directed to one specific location.

The MIT Media Lab's Innovative Evolution

In 1985, MIT Professor Nicholas Negroponte and former MIT President Jerome Wiesner co-founded the Media Lab, which grew out of work of MIT's Architecture Machine Group. Cross-disciplinary in nature, the Lab housed researchers in fields ranging from holography, to documentary film making, to epistemology and learning. Not only encouraged to think "at the lunatic fringe," Lab researchers were also encouraged to build prototypes of their ideas. Rather than the standard academic theme of "publish or perish", the Lab's motto was "demo or die".

The physical environment of the Lab supported this unconventional thinking. Housed in a building designed by Pritzker Prize-winning architect I.M. Pei, the Lab pioneered the concept of open computer gardens, with personal computing on every desk and an eclectic range of ongoing projects on display. Glass-fronted offices ringed the perimeter of each floor. One lab would be full of LEGOs, while another contained the most sophisticated equipment for holography. Lab visitors came not only to see what Lab researchers did, but also *how* they did it.

The Lab's initial research focus was often represented as a Venn diagram representing publishing, cinema, and computers. From its first days, there was a focus on computing for people during a time when no one was thinking in terms of "user-friendly" machines or why our machines needed to be adapted to human ways.

During its second decade, the Lab's research foci morphed into a revised Venn diagram showing the convergence of perceptual computing, learning and common sense, and information and entertainment. The overlapping segments were labeled interact, play, and express, and the Media Lab was shown in the center of this convergence.

For the first time, the idea of user-friendly was greatly expanded. The Lab extended its interests to focus more broadly on pervasive, ubiquitous computing. The Lab began looking at merging the virtual and physical worlds—initiating work to integrate emerging digital technologies into everyday objects. The Lab began to present such seemingly outlandish concepts as a refrigerator that could tell you when you were low on milk, or a car that could give you directions, or point out a good restaurant that you'd pass on your way home. During this time, the Lab also pioneered wearable computing–the idea that we could actually wear our bits on our clothing or carry them in our bags. It also conducted groundbreaking research in sociable and tangible media, further enhancing individual and community expression and social connection.

Now in our third decade, the Lab has added human augmentation as a major research theme. At some point in our lives, almost all of us will be marked by a fundamental disability, from dementia, to the loss of a limb, to a debilitating disease such as Parkinson's. Indeed, serious physical and mental challenges are inherent to the human condition. But the Lab does not believe that we need to accept the current definition of disability. Instead we are asking, "What if, through the invention of novel technologies, we could profoundly improve the quality of life for those afflicted with physical, cognitive, or emotional disabilities, while significantly reducing health-care costs? What if natural ability was a baseline, and enhanced ability became the norm?"