To develop new ideas, you inevitably must consider numerous “what if” scenarios:
What if we added an extra lane to a thruway?
Would we alleviate the worst of rush-hour traffic?
What if we increased an IP network to include 1,000 more users?
How would network speed be affected?
Would adding another server improve performance?

Now, the Media Lab’s Tangible Media group, headed by Hiroshi Ishii, has created Sensetable, a tabletop workspace capable of taking much of the guesswork out of “what if” scenarios.

The beauty of the Sensetable is that it enables the user to easily explore how one—or several—changes will affect a system by projecting graphic representations of complex computations directly onto the surface of a table. Small, wireless tokens are tracked electromagnetically as the user moves them across the projected image on the tabletop. When a token comes close to an “information point,” it becomes “bound” to that point, as though plugged into a socket, and can be used to change the information represented. The system then displays the ripple effect of that single change across the entire graphical representation. And because the table is not tied to any particular software, it can be used for a variety of applications, from urban planning, to supply-chain visualization, to electronic music performance.

One can, for example, use Sensetable in system-dynamics or discrete-event simulations to address challenges such as optimizing network systems, moving mail efficiently, or planning public transportation services for cities. Ishii has recently completed a three-year collaboration with Intel Corporation and MIT’s Sloan School of Management that explored supply-chain visualization. Now, visiting researchers from NTT Comware are developing an IP Network Design Workbench to operate on the Sensetable platform. This software lets users physically interact with computer network simulations to understand how changing variables such as link rate, cost, or client response time factor into a computer network’s efficiency and profitability.

According to Kazuhiko Tanaka, general manager of NTT Comware, who is working closely with the Tangible Media group on this project, the IP Network Design Workbench should be perfect for helping both senior executives and customers explore complex options. “It allows those who are not involved in the daily task of engineering modeling to immediately grasp the trade-offs involved in system changes,” says Tanaka, who hopes that the software will be commercially viable by next year.

Ishii expects that Sensetable will let people physically grab and manipulate data instead of just watching them on a screen. “This is so much more engaging than looking at PowerPoint slides,” says Ishii. “We’re trying to achieve a tangible interaction that encourages discussion and collaboration—a system whose users won’t even notice the technology.”
A mini refrigerator is a common sight on any college campus, but the one now on display in the Lab’s Aesthetics + Computation group is anything but ordinary.

That’s because Simon Greenwold, a master’s degree candidate studying with John Maeda in the Lab’s Aesthetics + Computation group, has “repurposed” an off-the-shelf mini refrigerator to become EyeBox, a fast, inexpensive 3-D scanner.

The setup is simple: you place an object on a revolving tray inside the refrigerator, close the door, and in about 20 seconds, as the tray rotates, three cameras inside the refrigerator take pictures from eight positions, providing 24 views used to create a “visual hull” of the object. In about one minute, software written by Greenwold refines the information, creating a 3-D model that can be moved to CAD software for manipulation.

Greenwold is quick to point out that the technology for visual-hull 3-D scanning is not his invention, and has been documented in academic papers for decades. But EyeBox takes this long-existing technology a step further, displaying the 3-D rendering as it is being created by the computer on a (not-so-inexpensive) flat screen embedded in the front of the refrigerator.

“High-end 3-D scanners, which cost about $10,000, do a much better job of creating a perfect 3-D image,” explains Greenwold. “And there will always be geometries that EyeBox will miss, like defining the inside space of a cup. But even with its imperfections, I believe there are lots of potential uses for a rough scanner, ranging from engineering design to entertainment.

EyeBox would be a great tool in a design process that goes from a physical object, to digital representation, back to a physical object—for example, a process that would allow an artist to scan a pair of scissors, and twist it in the digital realm to see how it would look as a physical model. I could also see kids using an inexpensive 3-D scanner in a video arcade to get a card with a full-body scan of themselves in less than a minute, and then using the card to place themselves into video games.

“But my interest really goes beyond the scanning. I am intrigued by the idea of spatial interaction—breaking the barrier of the computer screen,” adds Greenwold. With EyeBox, suddenly you’re able to react with the space behind the screen: you have a mini refrigerator that has nothing to do with keeping your milk cold, but everything to do with design.

To learn more about EyeBox, visit http://acg.media.mit.edu/people/simong
Joe Jacobson leads the Molecular Machines group within the Lab’s Center for Bits and Atoms. Much of his, and his group’s, recent research is involved in creating and controlling structures at the molecular scale, and optimizing the complexity-per-unit-volume of engineered structures with vast numbers of parts. In addition, Jacobson is committed to furthering personal fabrication and the reinvention of microelectronics, with projects such as “electronic ink,” “electronic paper,” and “printed electronics.”

Jacobson earned his PhD in physics from MIT, and held a postdoctoral fellowship in physics at Stanford University. As a graduate student researching femtosecond lasers, he set the record for the shortest pulse ever generated by a laser in optical cycles. His postdoctoral work in nonlinear-nonlocal quantum systems was published in the Physical Review and was written up in The New York Times, New Scientist, and Physics Today. The author of many peer-reviewed journal and conference papers, he also has several patents and pending patents in display technology and printed electronics. In 2001, Jacobson received the Discover magazine award for technological innovation, and in 1999 he was named as one of Technology Review’s 100 most influential innovators under the age of 35.

John Maeda, who heads the Lab’s Aesthetics + Computation group, has been recognized worldwide for his visionary role in shifting visual design from print to the digital realm, and for finding new ways to merge artistic human expression with digital technology. Toward this end, one focus of his current work is the creation of a virtual, online design studio, which will provide high-quality, free software to the public—and especially to children—for use in creating digital painting, drawing, writing, and music.

Maeda, who received both his BS and MS degrees from MIT, was recently named to a professorship established in memory of Muriel Cooper, who founded the Lab’s Visible Language Workshop and with whom Maeda studied before leaving MIT for Japan. In Japan, he earned his PhD from Tsukuba University Institute of Art and Design.

A recipient of some of the world’s most prestigious design awards, Maeda has most recently been honored with the National Design Award and Japan’s Mainichi Design Prize. In 1999 he was included in Esquire magazine’s list of the 21 most important people for the twenty-first century. Maeda’s publications include Design By Numbers and the 480-page retrospective of his work, MAEDA@MEDIA. In May, he received an honorary doctorate of fine arts from the Maryland Institute College of Art.
Earlier this year, approximately 30 educators, technologists, scientists, and policymakers from Mexico, Brazil, Panama, and Costa Rica gathered in Puebla, Mexico to explore how adaptable, low-cost, digital technology can be combined with a project-based “constructionist” approach to learning to improve people’s lives. The five-day workshop was hosted by Telmex (a corporate research partner of the Media Lab), the Media Lab’s Digital Nations consortium, and the government of Puebla.

A prime focus of the workshop, “Rapid Prototyping and Development,” was a hands-on exploration of “tower” technology—a powerful, extendible, and inexpensive “snap-together” modular system for designing and prototyping computational devices. Developed by Bakhtiar Mikhak, who heads the Media Lab’s Grassroots Invention group, and two recent graduates from the group, Christopher Lyon and Tim Gorton, tower technology, (for which Lyon won the 2003 Ernst A. Guillemin Award for best master’s thesis in electrical engineering at MIT), has a broad range of uses for both educational and community-development initiatives.

“The existing modules allow users to develop prototypes of electronic systems rapidly and efficiently,” says Lyons, “but the real beauty of this system doesn’t lie in the functionality that it already has, but rather in the functionality that it is capable of attaining. Our goal is to enable anyone to easily and inexpensively adapt the system to a particular need, often in a single afternoon.”

Workshop participants were asked to form teams and put the tower technology to the test. The result? Projects that ranged from a tabletop greenhouse, complete with sensors that monitored humidity, light, and temperature, and the capability to regulate water flow, shield sunlight, and increase airflow as needed, to a livestock feeding system, designed to monitor the eating habits of each farm animal and then dispense food as needed, to a low-cost 3-D scanner, to help people create models of objects for digital manipulation.

In July, building on the success of this first workshop, a group of policymakers, technologists, community developers, and educators from Mexico will again gather in Puebla to form a Learning Independence Network, modeled after the Esperanza Network in Costa Rica, to focus on enabling individuals from local communities and institutions to combine simple, low-cost computation and fabrication technologies with innovative ideas to help children learn, and to advance the social and economic well-being of their communities.


For more information on Telmex’s Center for Digital Culture and Puebla initiatives (in Spanish), visit http://www.centrodeculturadigital.org and http://www.puebla.gob.mx.
Three Media Lab projects—representing the work of Professor Cynthia Breazeal, Professor Tod Machover, and graduate student Ben Fry—have been included in the 2003 National Design Triennial at the Smithsonian’s Cooper-Hewitt, National Design Museum in New York City. The exhibit, which features the work of 80 designers in the United States who have contributed to the “artistic evolution and cultural impact of design,” will run through January 25, 2004.

Developed by Breazeal, LG Career Development Professor, and members of the Lab’s Robotic Life group, Cyberflora is a robotic floral garden comprising unique robotic flowers that combine animal-like behavior with flower-like characteristics, communicating a future vision of robots that will be sensual and life-like in their responsiveness to humans. Four species of Cyberflora sense and react to people in distinct ways: Chroma-fant Blossoms gracefully sway and glow in bright colors in response to the movement of a nearby hand; Dragon Irises and the serpentine-like Cobra Orchids orient themselves toward the warmth of a human body, and Violet Oscillies, inspired by the movement of tall grasses, bob and ripple as a hand passes over them. A soft melody subtly changes as people interact with the flowers.

Machover and the Lab’s Opera of the Future group are well represented at the exhibit by a collection of musical toys and instruments developed for the Toy Symphony, which had its United States premiere in Boston in April, and performances in New York in May. On display are: Music Shapers (squeezable fabric interfaces for translating physical gestures into sound), Beatbugs (clear plastic rhythm instruments for networked percussion playing), and the Hyperbow (a violin bow outfitted with sensors to measure virtuosic expression). Visitors to the exhibit also have the opportunity to experiment firsthand with Hyperscore, a software system that enables children to compose by using lines and colors.

Genomic Cartography is the creation of Ben Fry, Steven Holtzman Fellow for Digital Expression. Studying with John Maeda in the Lab’s Aesthetics + Computation group, Fry is pioneering new ways to graphically represent complex information from very large data sets through dynamic, 3-D representations. For Genomic Cartography, he uses color, typography, and 3-D graphics to render dynamic images of the billions of letters representing the DNA bases of the human genome.

For more information, visit the Cooper-Hewitt’s site http://ndm.si.edu/exhibitions/index.html.
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