Things to think with

by M. Resnick

There is an old saying that goes something like this: "Give a person a hammer, and the whole world looks like a nail." Indeed, the ways in which we see the world are deeply influenced by the tools and media at our disposal. If we are given new tools and media, not only can we accomplish new tasks, but we begin to view the world in new ways.

Often, we hardly recognize how our tools and media are influencing our ways of viewing the world. For several centuries now, scientists have described the world in terms of differential equations. Is that because differential equations are the best way to represent and describe the world? Or is it because the common media of the era (paper and pencil) are well suited to manipulations of differential equations? Could we say: "Give a scientist paper and pencil, and the whole world looks like a set of differential equations?"

New computational media are now radically reshaping how people think about the world. Because of new computational tools and ideas, cognitive scientists now think about the mind differently, management researchers think about organizations differently, and entomologists think about ant colonies differently. And these new ways of thinking are starting to seep out of the scientific community and into the general culture. The Internet, for example, is not only providing people with new access to information; it is providing them with new insight into the nature of decentralized systems, giving them a new framework for understanding the workings of other decentralized systems in the world (from bird flocks to traffic jams to economic markets).

Computing with everyday objects

The papers in this section relate to a new MIT Media Laboratory initiative called Things That Think. In this initiative, Media Lab researchers are shifting away from virtual objects on computer screens and focusing instead on physical "things," embedding computational capabilities into everyday objects such as toys, clothing, furniture, and even balloons. The goal is not simply to create "neat gadgets" or time-saving conveniences. Rather, the goal is to create "thinking things" that change not only what we do, but how we think, what we think about, and who we think with. We believe that Things That Think will have their greatest influence when they also serve as Things to Think With. In short, thinking things can help us think too.

The first paper, "Programmable Bricks: Toys to Think With" by Resnick et al., proposes new ways to introduce computational things and ideas to children. It describes an experimental LEGO** brick with an embedded microcontroller, capable of controlling motors and getting information from sensors. Using these Programmable Bricks, precollege students have created robotic creatures, programmed light switches to turn on automatically, and equipped their bicycles to record data. In the process, they have learned important scientific and engineering ideas.

The second paper, "Using Acoustic Structure in a Hand-Held Audio Playback Device" by Schmandt and Roy, describes a device that looks like the Programmable Brick. But instead of manipulating motor and sensor data, it manipulates audio clips, providing interactive access to structured audio recordings. The device, called NewsComm, enables users to skim, skip, and randomly access digitized speech clips. The paper argues that digitized

speech has been underused as a data type, and it describes a set of design prototypes that explore the space of possibilities for interacting with digitized speech.

The next paper, "The Interactive Balloon: Sensing, Actuation, and Behavior in a Common Object" by Paradiso, presents a more whimsical computational object: a balloon that talks and listens. Although this object might seem frivolous, the underlying technology most certainly is not. The balloons are based on a piezoelectric foil that works as both an acoustic pickup and speaker, and they point toward a future in which many of the common (even disposable) objects in our environment will have some degree of sensing, communication, and processing. The talking balloons made their debut at the tenth anniversary celebration of the Media Lab in October 1995.

Also debuting at the tenth anniversary were "Thinking Tags," described in the final paper of this section, "Things That Blink: Computationally Augmented Name Tags" by Borovoy et al. Like the traditional name tags that people wear at conferences, Thinking Tags display the wearer's name. But each Thinking Tag also "knows" something about the wearer's interests and opinions. When two people meet each other, their tags exchange information (via infrared communication) and turn on colored LEDs (light-emitting diodes) to indicate how much the two people have in common. Although the tags communicate with one another, their true purpose is to facilitate communication and conversation among people—and to encourage people to think about communication in new ways.

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Dr. Resnick, an associate professor at the MIT Media Laboratory, studies the role of new technological tools in learning and education. He has helped develop a variety of "computational construction kits" (including LEGO/Logo and StarLogo), and he cofounded the Computer Clubhouse, an afterschool learning center for youth from under-served communities. He earned a B.A. in physics at Princeton University, and M.S. and Ph.D. degrees in computer science at MIT. He won a National Science Foundation Young Investigator Award in 1993, and he is author of the book *Turtles, Termites, and Traffic Jams*, published by MIT Press.

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