Real Meets Virtual: Blending Real-World Artifacts with Computational Media

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ABSTRACT
Panelists in this session will defend a variety of distinct visions for integrating "real-world" and computational media. Our aim is to explore the ways in which computers, and computer interfaces, can lend themselves to new and enriched interactions with objects and to new paradigms of handicrafts—with particular emphasis on the role of crafts and real-world objects in education.

KEYWORDS
Real-world computation, physical multimedia, crafts, educational computing, programmable brick.

INTRODUCTION
The current intellectual climate in human-computer interaction is increasingly hospitable to "virtual" (implying non-physical) artifacts. Friends meet in virtual "chat rooms"; children are educated in virtual classrooms; academics attend virtual conferences. The products of computer-based work and education—spreadsheet models, educational simulations, Web-based art galleries—likewise have an almost relentlessly intangible nature.

Such innovations are intended to overcome the putative limitations of physical space. But they have a less benign side as well, one that appears especially disturbing to those whose tastes run to the creation, use, and enjoyment of tangible, "real-world" artifacts. For people of this cast of mind, the pervasiveness of virtual worlds and objects is the hallmark of an increasingly remote and ephemeral culture.

This panel will focus on the ways in which computational media can enhance the creation, dissemination, and appreciation of various types of real-world artifacts. Rather than viewing computers as the mediators of an inherently non-tangible world, we will seek in the course of this discussion to find strategies for integrating the "culture of information" with the values of handicrafts—by using personal computers in the design of new types of objects; by embedding computation within material objects to create "physical multimedia"; by making real-world artifacts programmable by their users.

Panelists will use their own widespread professional experiences in the integration of computers and real-world objects to frame a vision of "crafts and creative handiwork for the 21st century," with particular emphasis on the role of real-world objects in education. They will be encouraged to bring models, blueprints, or mockups of the types of objects that they envision for the future.

PANELIST POSITION STATEMENTS
Allison Druin
In the future, children's multimedia environments need not live in hard plastic boxes that sit on desktops with keyboards, mice or the occasional joystick. Multimedia environments in the future may look like any familiar room, stuffed-animal, or toy block. However, these multimedia environments will be responsive to a child's movement, touch, sound, or even gesture. By lifting an object, touching a wall, or walking in a particular direction, a child might turn lights on or off, make video appear, or perhaps trigger a sound. These multimedia environments will not replace a child's familiar physical surroundings: rather they will become a seamless part of them, enhancing what is already there.

For over three decades there have been many such examples of what I have come to call *physical multimedia.* These places have redefined where computers and children meet. People so often forget that children meet a computer from the moment they see it to the moment they touch it—not just from the moment they interact with the software.

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For the past ten years—at the MIT Media Lab, the NYU Media Research Lab, and now the University of New Mexico—I have been involved in developing physical multimedia environments, focusing on the design and development of alternative multimedia experiences for children. I began my research thinking about simply replacing the keyboard and mouse with a stuffed animal. This eventually became NOOBIE (short for new beast). From there I began to focus on designing entire room-sized environments that offer alternative physical input and output. At NYU we called these experiences "Immersive Enivornments". Today at UNM we have begun to ask how these alternative environments can offer children a new type of learning experience. Can these environments offer new ways for language aquisition? Multimedia literacy? Authoring competency?

Where these ideas and inventions may lead to in our future is difficult to say. You can be sure however, that these ideas and inventions will not hide within boxes, under mice, or behind glass. They will be rich physical spaces in which our children might live, learn and play.

Sheila Lehman

We live in a world where most physical artifacts are mass-produced, not handmade: our clothes, our books, our cars, our food. "Handmade" today implies either a luxury object, or an inferior, make-do one. Many of our experiences are also mass-produced, mediated. So the way computer technology is being understood, developed, and used is shaped by these pre-existent social and economic conditions.

At some point some of us began to direct our efforts to the user-centered (and use-centered) design of computer environments, but the physical context of use has generally been conceptualized very narrowly, as "ergonomics". Now we have virtual reality, the World Wide Web—technologies that challenge us to revise perceptions of physical reality, and relationships to space and place, just as earlier technologies have done. Space is more and more plastic, and it is beginning to be understood as a human construct, in part because we can create virtual environments to suit our needs and adapt ourselves to the new behavioral settings they afford. Howard Rheingold suggests that we need "virtual communities" because the informal public meeting places which once fostered social life are disappearing from our "real lives." When he says that "real" and "virtual" spaces have begun to overlap and intertwine, I think he is really suggesting that we need to redefine both.

Redefining and remaking human interactions—not just with computational artifacts, but within the social and physical settings of their use—is what I think we are about. How do we build systems that respect and integrate the primacy of the physical world, and of our own lived experience as embodied creatures? What can "crafts" mean in an informated world? How does a fisherman *know* a fish which he skillfully catches and then holds in his hands—shiny, wet, cool, slippery, silvery, struggling, smelling like the sea, fish-eyed, beautiful, another living thing, soon to be scaled, cooked, tasted, swallowed, or perhaps thrown back to swim away? This is poetic, to be sure, but it suggests some critically important questions. What can we do with this fish and learn from this fish, as compared with a virtual fish? How many useful possibilities and engaging experiences does each fish afford? Who will teach us how to fish? How can we have our fish and eat it too?

Mitchel Resnick

In many educational-computing projects, students control and manipulate virtual worlds in the computer. But instead of controlling *worlds in the computer*, what if students could control *computers in the world*? That is, what if students could spread computation throughout their own personal worlds, embedding computation in their toys, furniture, and even their clothes? As a first step in that direction, a group of us at the MIT Media Lab has been developing the Programmable Brick: a tiny, portable computer embedded inside of a LEGO brick, about the size of a deck of cards. It can interact with the physical world by controlling motors and lights, and by gathering information from sensors. Pre-college students are already using Programmable Bricks in several different types of projects:

•*Active Environments.* Two 11-year-old students created an "automatic light switch": when sensors detected someone entering the room, the Programmable Brick turned on a motor that mechanically flipped the switch.
• *Personal Science Experiments.* A 12-year-old connected a sensor to the wheel of his bicycle, attached a Programmable Brick to the handlebars, and programmed the Brick to collect data about his ride.
•*Robot Design.* A group of fourth-grade students built and programmed a collection of "robotic creatures" modeled after real-world animals.

In the future, we see Programmable Bricks forming the foundation for a new type of handicraft, in which children (and adults) use computationally-active building blocks to construct artifacts that sense the world and respond dynamically. With these new construction kits, children will be able to construct *real* 3D animations—physical objects that interact with one another. The point is not simply to fill the world with computationally-active objects (as in many "ubiquitous computing" projects), but rather to let children become the *designers* and *inventors* (not just the users) of those computational objects. These design experiences could open up new learning opportunities, providing children with a *concrete* introduction to scientific and engineering concepts that are currently accessible only through more abstract methods. Indeed, as children construct computationally-active artifacts, we expect that they will develop frameworks for thinking about many ideas (such as feedback and homeostasis) that are currently taught only at the college level.