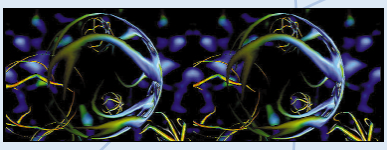
Where digital and human guests reconsider, rework, and reinterpret everyday life in alternative future formats.

Emerging Technologies: The Millennium Motel

Kathryn Saunders
Royal Ontario Museum



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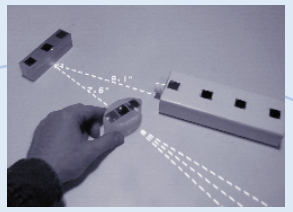
Kathryn Saunders
SIGGRAPH 99 Emerging Technologies Chair



Digital

Welcome to the Millennium Motel, where digital and human guests reconsider, rework, and reinterpret everyday life in alternative future formats.

In this parallel universe, only a quantum leap away from "old" routines, data spawn digital life forms that exchange genetic codes and reproduce in evolving mutations. Guests create 3D surfaces by moving their hands through space, interact with intelligent objects to assemble complex models, and conduct a virtual orchestra. They gather at The Pool to share stories with interactive digital images of their friends, enjoy a smart drink, eavesdrop on distant conversations, and observe Shooting Stars before they check out 21st-century NightLife.

The Pool

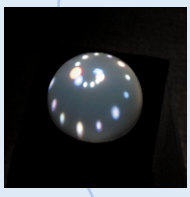
Visions

The occupants of the Millennium Motel include some of the world's most interesting researchers, whose dreams generate surprising departures in music, buildings, sculpture, and storytelling. Although their areas of interest range from ubiquitous computing to augmented reality, immersive displays, and intelligent characters, they all share a deep commitment to creating meaningful experiences and communicating their visions of future realities.

Explorers

We all owe these explorers a debt of gratitude for their imagination, talent, dedication, and willingness to share their achievements in SIGGRAPH 99's Millennium Motel

Committee



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Royal Ontario Museum

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David Ebert
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Linda Jacobson
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Surface Drawing

Drawing

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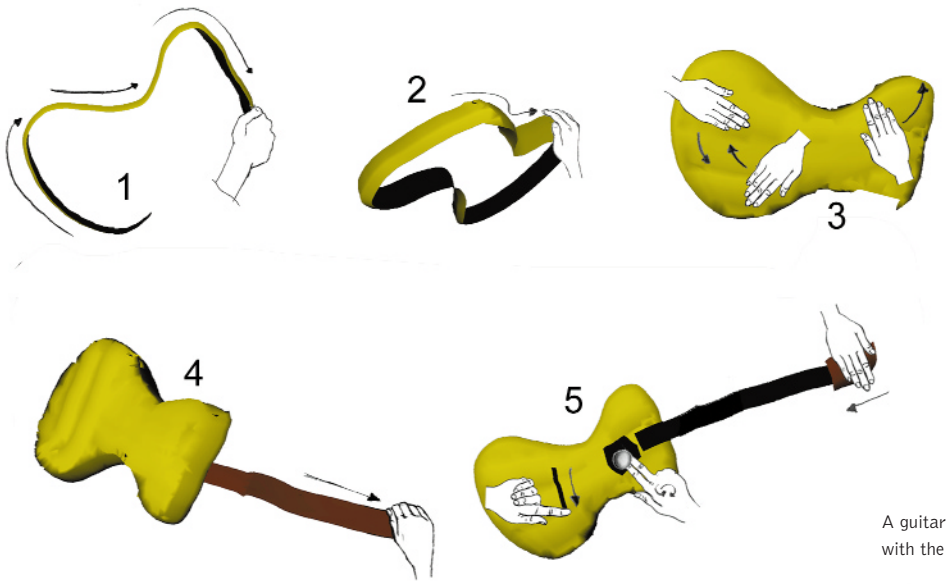
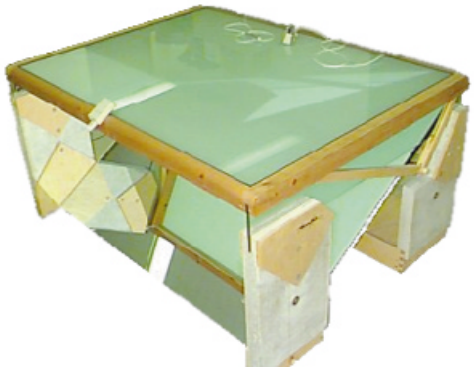
Peter Schroder

Surface Drawing is a medium that enables creation of a wide variety of intricate, organic 3D shapes. Objects are created by moving the hand through space. The path of the hand forms surface pieces that seamlessly merge when they touch. Users can also erase, add details, and manipulate objects with a simple two-handed interface. Freely growing, joining, and erasing surface pieces enables rapid prototyping of freeform shapes.

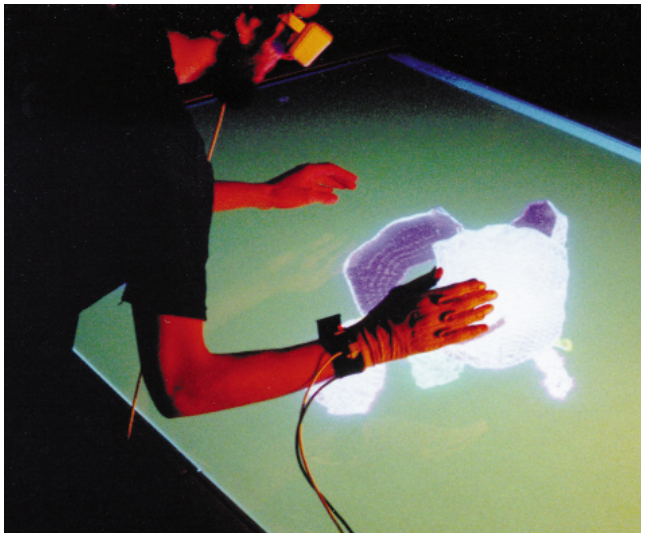
This extension of traditional line drawing to 3D space allows creation of shapes without the creative constraints of a rigid mathematical structure, a large toolset, or a tedious construction process. The system is implemented with the semi-immersive environment of the Responsive Workbench. An 18-sensor CyberGlove measures hand configuration, which controls the shape of surface pieces.



A guitar is drawn in five steps by tracing its shape with the hand.



The Caltech Responsive Workbench.



A Surface Drawing in progress.

The Luminous Room: Some of It, Anyway

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Collaborators
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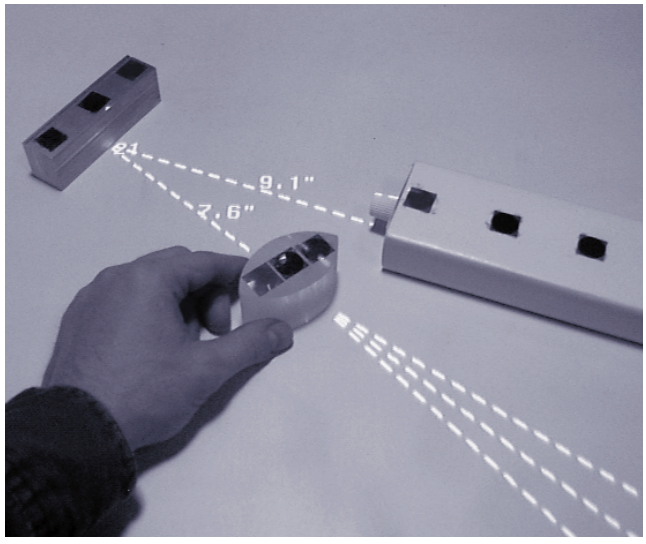
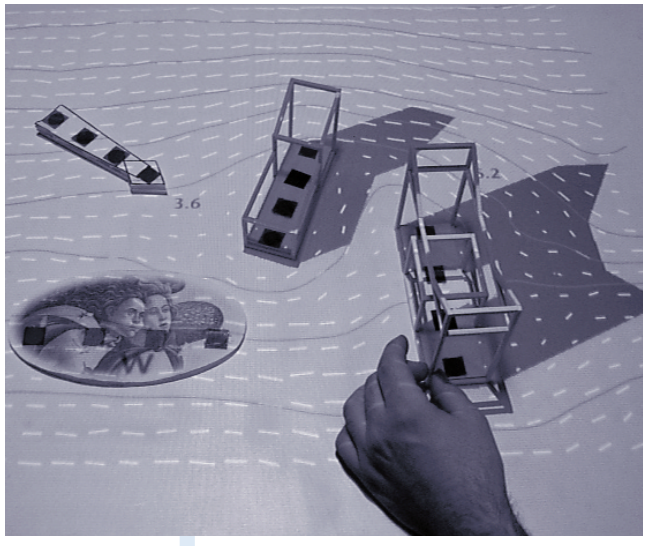
When the CRT breaks open and the pixels inside leak out to stain everything: one of the results can be a *Luminous Room*.

When graphical display is not only free to occur on any surface in the room but can also react to what's happening at those surfaces and within the space, certain kinds of usefulness may ensue.

When the behavior of these environmental pixels accretes especially around physical objects that act, to localize meaning and focus the expression of participants' intent, an interaction style called *luminous-tangible* prevails.

When one conclusion of all this is that a large class of spatially oriented design and experimentation activities can be served by luminous-tangible techniques, real architectural models begin to cast accurate shadows and hydrodynamically divert simulated airflow; cheap little models of lasers and mirrors and lenses begin to emit and bounce and spread visibly simulated beams of light.





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HandSCAPE

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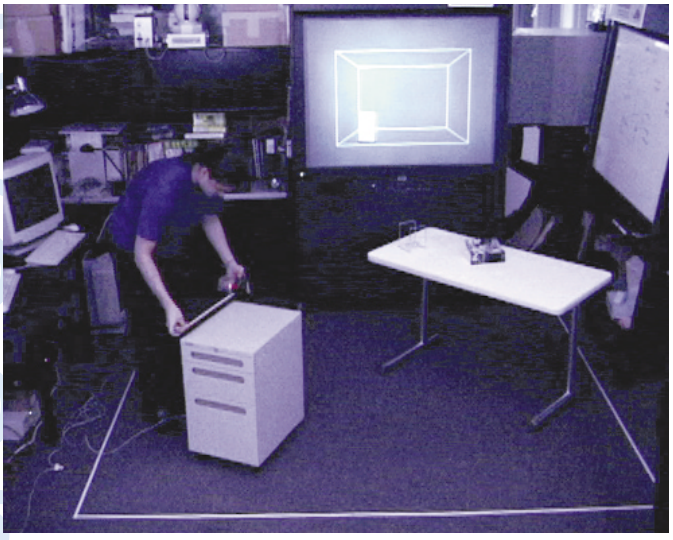
HandSCAPE is an orientation-aware digital measuring tape. While a traditional measuring tape only measures linear distance, the addition of orientation sensors allows a vector measurement of both length and direction, and the tape can serve as an input device to computer drawing and modeling applications.

HandSCAPE provides a simple interface for generating digital models of physical objects. The interaction involves taking measurements of several physical objects and the distances between them. Once the model has been generated, the user can manipulate it in the digital domain. HandSCAPE preserves reliance on human senses and skills by referring to the familiar process of measuring objects and spaces.



(void*): A Cast of Characters

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(void*) is a novel gathering place that unites the physical and the digital, allowing people and a cast of directable and autonomous characters to interact with each other. The interactions focus on movement, groups, and body language. Building on Swamped! (SIGGRAPH 98), this installation continues the MIT Media Labs' work in intentional characters, sympathetic interfaces, and autonomous cinematography, and adds "dynamic music composition" as an integral part of the system. It also introduces a number of novel physical interfaces to allow simultaneous multiple-participant interaction.

Collaborators
Members of the Synthetic Characters Group and the Responsive Environments Group, The Media Lab, Massachusetts Institute of Technology:

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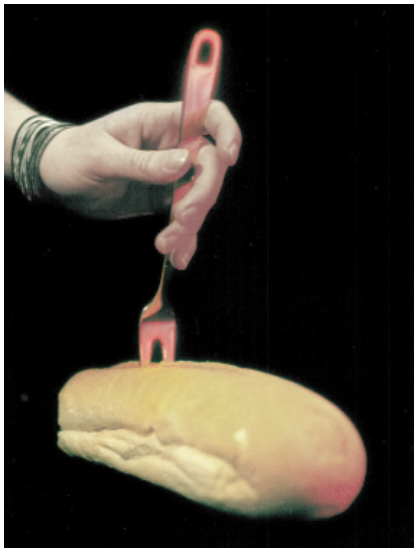
Michael Patrick Johnson
Song-Yee Yoon
Marc Downie
Ari Benbasat
Jed Wahl
Dan Stiehl
Delphine Nain
Joseph Paradiso

(void*)



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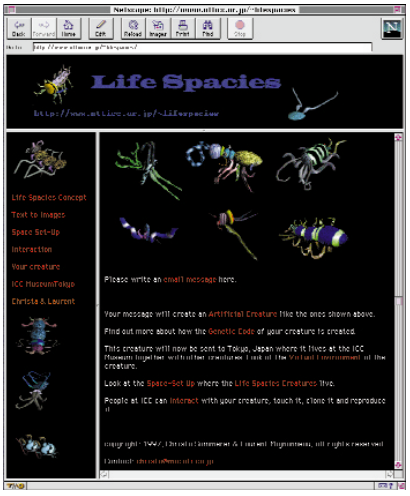
Life Spacies

Life Spacies is an interaction and communication environment where remotely located visitors in a global environment (the Internet) and onsite visitors (in the local environment) interact with each other through artificial creatures.[1]

By simply typing and sending an email message to the Life Spacies Web site (www.ntticc.or.jp/~lifespacies), visitors can create their own artificial creatures and receive their creatures' pictures and curriculum vitae. As soon as the site receives a creature-creation message, the new creature starts to live in the Life Spacies environment. Two independent interaction sites are linked together via a data line, allowing visitors at remote locations to be displayed in the same virtual 3D space.

Onsite visitors can directly interact with the creatures by touching and catching them. When a creature is caught by a visitor, it creates a perfect copy of itself. However, if two remotely located visitors are in the same virtual space, they can each catch a creature with their hands, which causes the creatures to mate and create an offspring by genetically exchanging their code. A special text-to-form editor enables translation of text into genetic code. The characters, syntax, and sequencing of the text are used to code specific parameters in the creature's design. Form, shape, color, texture, and the number of limbs are influenced by the text's parameters.[2]



References

1. Life Spacies was produced for the ICC InterCommunication Museum, Tokyo, as part of its permanent collection.

2. C. Sommerer and L. Mignonneau, Life Spacies: a genetic text-to-form editor on the Internet. Proceedings AROB 4th'99, Beppu, Oita, pp. 73-77, 1999.

LEON

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Lurking in the shadows of the Millennium Motel are some familiar faces (to anyone who attended the SIGGRAPH 98 Electronic Theater). Leon, last seen in Mitch Butler's "The Smell of Horror," and other mysterious characters have checked into the Motel, where they're checking out the guests who are checking out the fantastic array of emerging technologies.

"Leon in the Millennium Motel" is a joint project of IMPROV Technologies, Inc. and the Mitch Butler Company, and was created using the IMPROV Real-Time Animation System developed at New York University's Media Research Laboratory.

Executive Producers
Brian Blau and Athomas Goldberg

Artistic Director
Mitch Butler

Production support provided by students in the graduate animation program of New York University's Tisch School of the Arts.

LEON

Collaborators

Magritte's Cow is interested in the transformation of ideas. We look at the Web and see it as a place. We think about machines and envision them as bugs. We play with concepts and turn them into projects.

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When I was a little boy, my mother told me not to mix water with electricity. I have been doing it excitedly ever since.

I would like to thank Kathryn Saunders and Daniel Szecket, for giving me the opportunity to participate in SIGGRAPH 99, and my sister, Jennifer Holly, for perpetually working her mojo to inspire creativeness in our family. Also, thanks to Wendi-Mae Camara and Jerry Casilli for permission to use their Neon Fountain sculptures.

Neon Fountain, Liquid Light Sculpture Series, Cascading water, acrylic, liquid polymer, neon and electronics.

Portal to the Millennium Motel, Space Design, Spandex, lasers, intelligent light, high-voltage electronic devices

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Jennifer Prentiss has been working in glass and light media for six years. She designs and constructs autonomous stained-glass panels, doors and entryways, lamps and lighting fixtures, mixed-media work, screens and room dividers, windows, wall pieces, 3D sculpture, and portraiture. She uses sandblasting, acid etching, mosaic, neon, copper foiling (Tiffany), and lead came techniques to create her art. Primarily, she is a commission artist specializing in architectural stained glass.

Her work at The Millennium Motel is stained-glass furniture. It was built with streaky and water glasses, using lead and zinc came.

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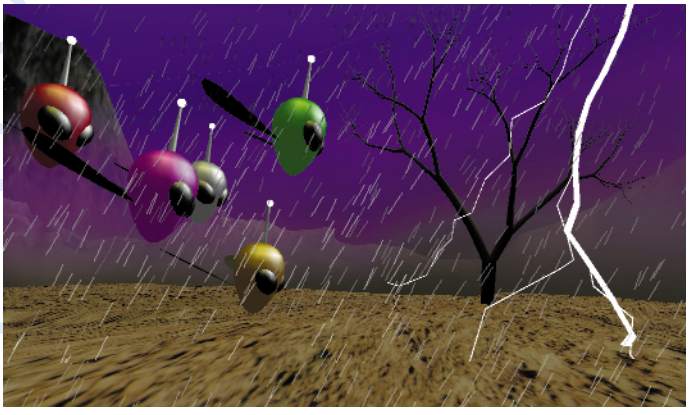
ROUTE66

ROUTE66 is a live, interactive, MIDI-driven, 3D world created for The Millennium Motel. It is the world outside the motel, an ever-changing environment that can be transformed by visitors using MIDI interfaces linked to SideEffects Houdini software and driven by Intergraph workstations.

The main display, located at the motel's entrance, is composed of five side-by-side projected screens that create a surreal panoramic desert landscape.

Some of the interactions include:
- A panoramic environment with a full 360 degrees of navigation
- Animated interactive elements such as UFOs, wildlife, etc.
- Changing landscapes
- Seasonal changes
- Eclipses
- Comets
- Weather changes (rain, snow, fog, lightning)
- Day/night
- Interactive trees (shedding and growing elements)
- Sound effects
- Overlay graphics

The ROUTE66 landscape is interspersed with "windows" to video feeds. When visitors open the "windows," they reveal video loops, cameras pointing at other locations in the space (live video feeds of The Millennium Motel and other areas of SIGGRAPH 99), and typical motel TV. Fog machines create a 3D element in the foreground, allowing for 3D projected effects.



Curlybot

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Collaborators
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Recent trends of embedding digital technology in toys have led to greater possibilities for manipulation and interaction. Curlybot is a two-wheeled toy with embedded electronics that can record and play back motion. It remembers its change in position and replays its movements with all the intricacies of the original gesture. Every pause, and even the shaking in the user's hand, is recorded.

In this presentation, the interaction experience is augmented by projecting trails behind each toy to give participants a chance to compose a movement or a dance and create graphical patterns out of simple gestures.

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musicBottles

Music

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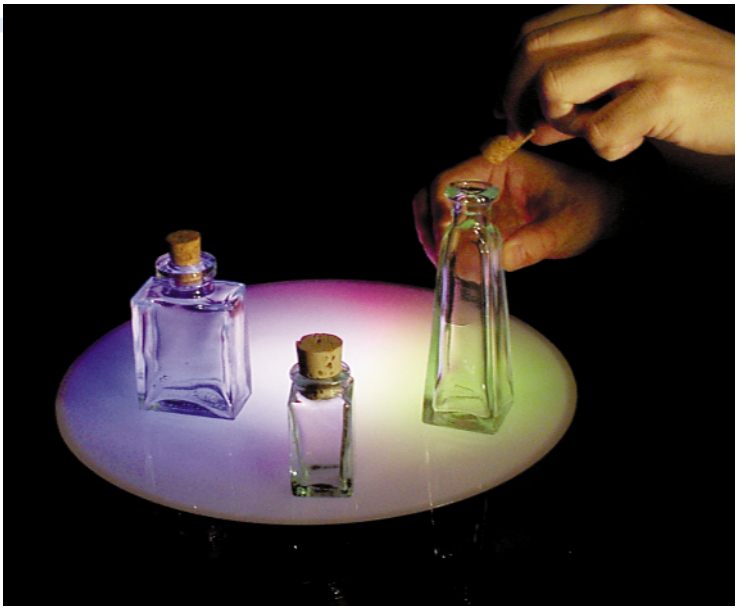
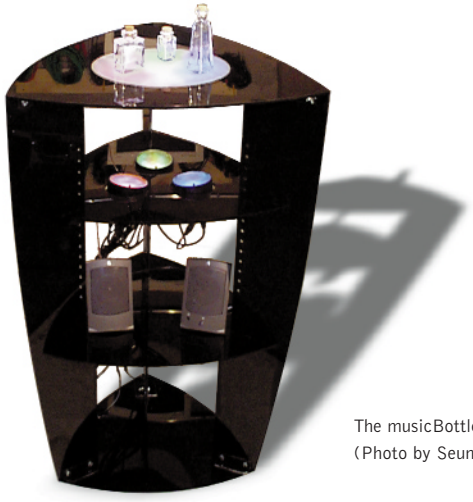
Joanna Berzowska
Craig Wisneski
Charlie Cano
Andres Hernandez
Colin Bulthaup

musicBottles introduces a tangible interface that deploys bottles as containers and controls for digital information. The system consists of a specially designed table and three corked bottles that "contain" the sounds of the violin, the cello, and the piano in Édouard Lalo's Piano Trio in C Minor, Op. 7. Custom-designed electromagnetic tags embedded in the bottles enable each one to be wirelessly identified. When a bottle is placed onto the stage area of the table and the cork is removed, the corresponding instrument becomes audible. A pattern of colored light is rear-projected onto the table's translucent surface to reflect changes in pitch and volume. The interface allows users to structure the experience of the musical composition by physically manipulating the different sound tracks.



Opening a bottle to release the sound of the cello.(Photo by Joanna Berzowska)



The musicBottles table
(Photo by Seungho Choo)

Ensphered Vision

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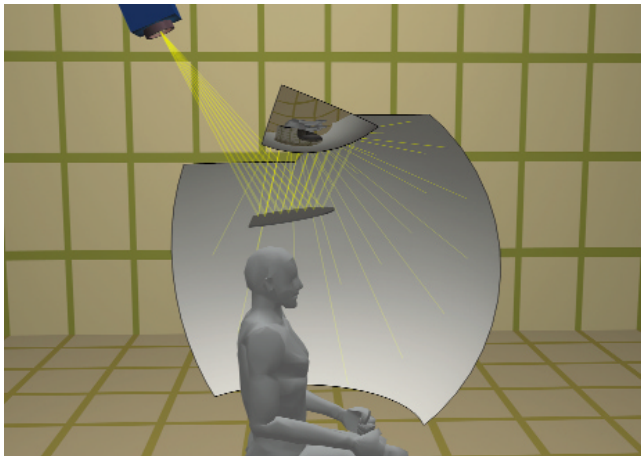
Visual immersion plays an important role in virtual environments. Head-mounted displays (HMDs) provide a full solid-angle view of virtual spaces, but their optical systems limit their fields of view.

In this image display system, a large screen is used as an alternative to HMDs. The sphere is an ideal shape for a screen that encompasses the human visual field because it maintains a constant distance between the eyes and the screen as the viewer's head rotates. Ensphered Vision uses a single projector and a convex mirror to display seamless images. The optical system employs two mirrors: a plain mirror, which bends the light so that the viewer can see the image from the center of the spherical screen, and a spherical convex mirror, which diverges the light from the projector in the spherical screen. This optical configuration provides a seamless wide-angle image in a very limited space. The screen's field of view is 270 degrees horizontally and 100 degrees vertically. The image totally surrounds the viewer. The image viewing angle is much larger than a dome screen displaying a fish-eye-lens image.



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Touchable 3D Display

Team
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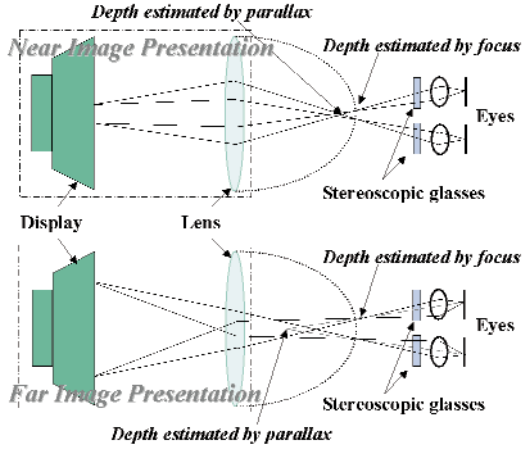
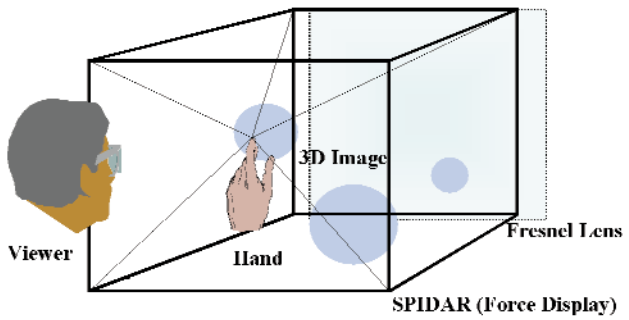
In this reality-enhanced 3D display, Fresnel lenses are set so that parallax adds a sense of depth to a "real" image. Three-dimensional images appear very close to viewers (an effect that is difficult to achieve with conventional 3D displays), so viewers feel that their bodies are included in the 3D space. When a force-display SPIDAR is combined with the display system, users experience a reality-enhanced virtual environment with 3D images and force feedback. They interact with the images as if they were a part of the virtual environment.

Combination of Real Image and Parallax Presentation



Principle
A near object is presented with almost-normal parallax and focus, both of which are used to sense the depth of near objects. A far object is presented with proper parallax, which is mainly used to sense the depth of far objects.

Combination of 3D Display and SPIDAR



Appearance
Viewers can see, touch, and interact with 3D images in front of them.

Hologram/Head-Mounted Display

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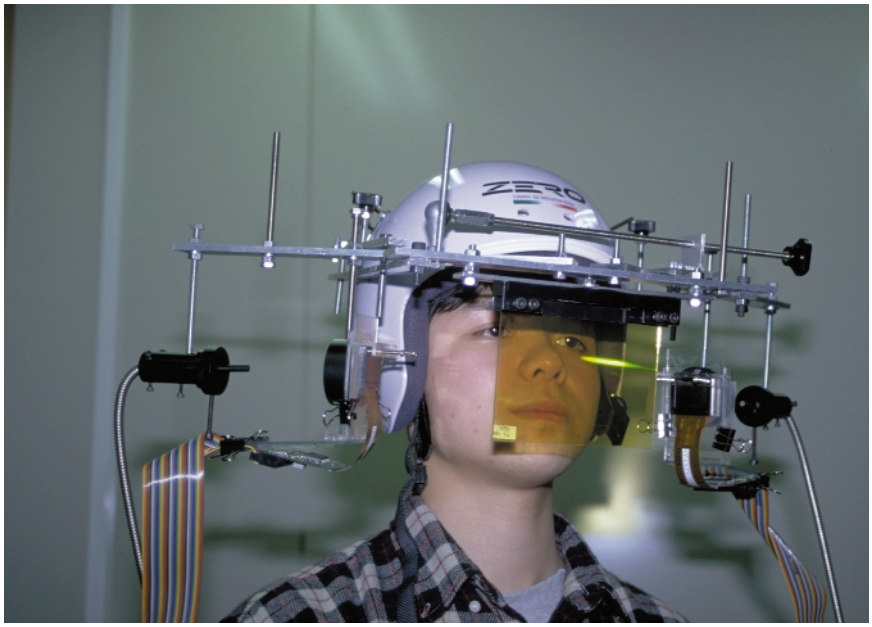
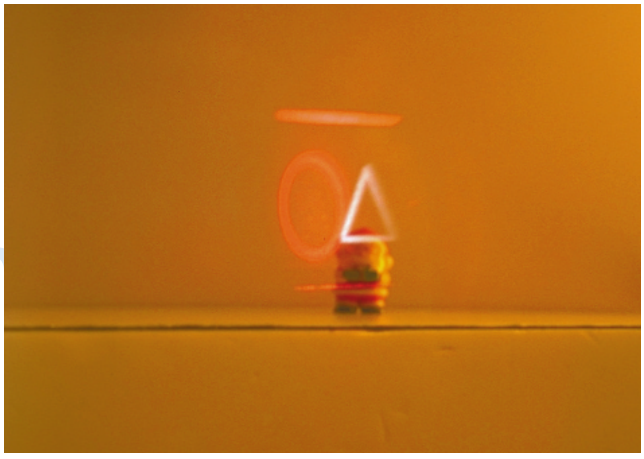
This experimental see-through HMD (head-mounted display) uses holographic optical elements (HOE) instead of the half mirror that is usually used in conventional HMDs. Because it is grated, the system can produce images by diffraction, and it behaves like a heads-up display. It delivers the left and right images into both eyes, so users experience binocular parallax (stereoscopic) images.

When the system is used in interactive augmented-reality environments, its laser-illuminated LCD display mixes virtual and real worlds. Users see clear laser-illuminated images floating within wide, bright real environments.



Prototype of HMD using holographic optical elements.



View through a holographic optical element.

Hologram

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Shared Space; Collaborative Augmented Reality

Collaborators
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Shared Space merges real and virtual worlds in a way that can radically enhance face-to-face and remote collaboration. By wearing a lightweight, see-through head-mounted display, users see 3D virtual images overlaid on the real world and attached to real-world objects.

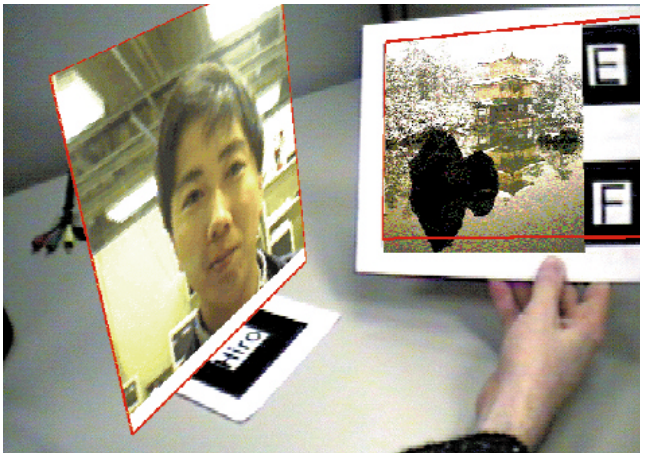
For face-to-face collaboration, this allows users to see each other at the same time as the virtual images between them, which supports natural communication between users and intuitive manipulation of virtual objects. For remote collaboration, Shared Space overlays life-sized live virtual video images of remote collaborators on the local real environment, supporting spatial cues and removing the need to be physically present at a desktop machine to conference. In both cases, computer vision techniques are used to precisely register virtual images with physical objects, extending the "tangible interface" metaphor.

At SIGGRAPH 99, Shared Space allows face-to-face and remote users to create interactive art together using virtual animated characters and props in a real tabletop environment.

The view through the head-mounted display in a face-to-face setting. Users can see their collaborators and virtual objects between them.

View from outside the interface. The virtual objects are only visible to those wearing the head-mounted displays.

A virtual video window of a remote collaborator.



A virtual video window of a remote collaborator and shared virtual image attached to a real-world object.

Head-Mounted Projector

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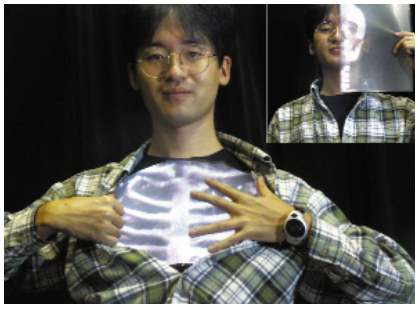
This project proposes a head-mounted projector (HMP) using the X'tal Vision (Crystal Vision) technology that was demonstrated in Enhanced Realities at SIGGRAPH 98. With X'tal Vision (a projector with a small iris and a retroreflective screen), users can observe stereoscopic images with an almost-correct occlusion relationship between the virtual and the real environment.

AT SIGGRAPH 99, the HMP is demonstrated in three applications.

1. Virtual images of a skeleton that make a patient's body appear to be transparent.
2. A paper-type display.
3. Optical camouflage suitable for visuo-haptic integrated display.

Collaborators
Naoki Kawakami
Dairoku Sekiguchi
Taro Maeda
Susumu Tachi

This work is supported by the Telecommunications Advancement Organization of Japan and JSPS's Research for the Future Program.



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Visual Conductor

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Joshua Gluckman
Eowyn Cenek
Bell Labs

Fred Bianchi
Richard Campbell
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A "live" conductor directs a complex electronic orchestra with natural expressions of hands and baton. No sensors or wires impede the conductor's movements, which are sensed with video cameras. The system detects beat events and gestures related to rhythm patterns and dynamics, and uses this information to control the tempo and volume. Participants in this interactive display conduct a large live-sounding orchestra. For ballet segments, the experience is enhanced by an animated dancer whose movements are synchronized to the music.

Dancing to Visual Conductor's beat.

Visual Conductor with Virtual Orchestra

Microworlds, Sirens, and Argonauts

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Microworlds, Sirens, and Argonauts is a fantastic journey through multiscale microscopic worlds that grow and transform as users interact with them, revealing new patterns, structures, and sounds. It introduces the concept of "living narrative landscapes:" virtual spaces that allow users to successfully construct their own navigational maps and build their own representational models that can coexist with the narrative of the environments. Thus, the virtual space becomes a living narrative landscape as the Argonauts (users) navigate along time and space, taking part in the complex visual and aural behaviors of the environments.

The environments mirror reality by containing rich experiences at multiple scales. Sometimes, we do not perceive diminutive worlds that could have existed, now exist, or will exist, because of their very small resolution. As in nature, users can explore the essence of these structures and patterns.

"Attractors" help users navigate, like the Sirens in Jason's famous Greek voyage. In this case, however, the Sirens facilitate navigation with their songs and magnetism. Their songs are spatialized so users can follow virtual "musical maps" that change as the melodies evolve with the users' behavior. To improve navigation and interaction with virtual objects, the Sirens can modify various environment parameters such as sensor sensitivity and interocular distance, among others.

Collaborators

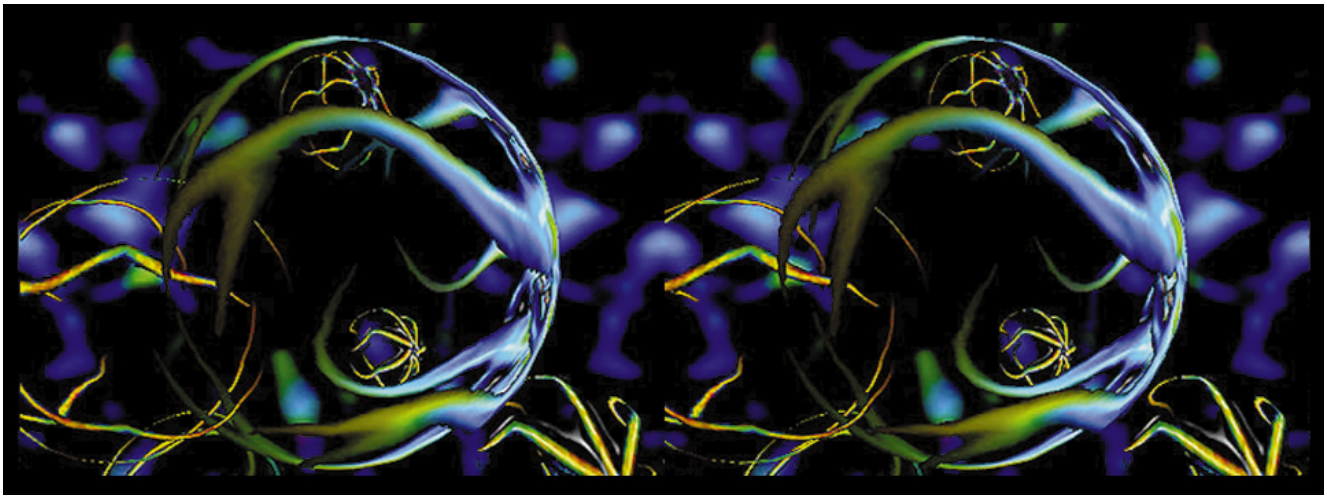
Music
Eve Tramullas

Soprano Voices
Eva Peng
Kristina Valcarce

Programming
Juan Francisco López
Yu Uny Cao

Spatial Audio Server (SAS), donated by Fraunhofer Institut für Graphische Datenverarbeitung

Acknowledgements
The Labyrinth Project
Robotiker



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Emergence

Emergence is a PC-based, real-time 3D software system that explores the role of human presence in a world of artificial life. A unique interface system utilizes voice input and a haptic device for tactile feedback. Novel forms of communication between human participants and artificial life forms include symbolic and expressive sounds, gestures, and movements.

A proprietary 3D engine handles rendering and display of 3D, texture-mapped characters and environments, and a physics-based behavior system that enables complex behaviors and interactions between all objects in the environment. A high-level behavior scripting language allows for specification of behaviors and relationships between characters. Sounds are linked to objects and characters to enhance the sense of life and space.

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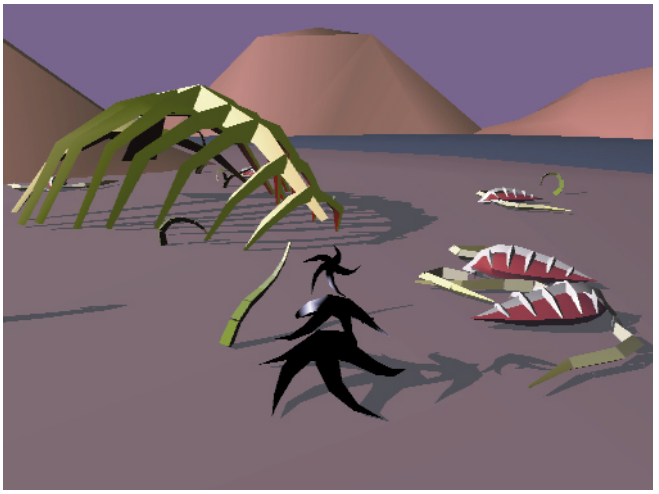

Water Display

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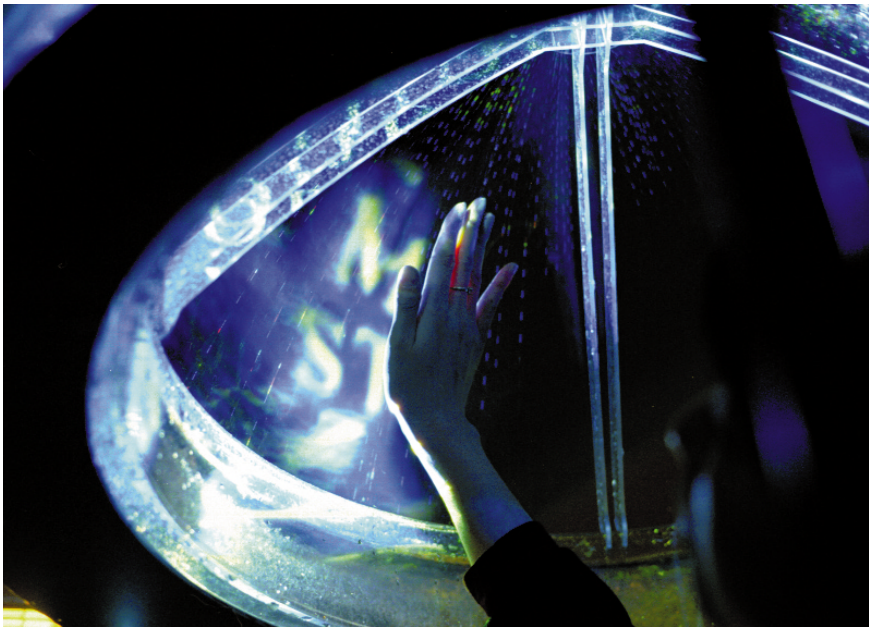
This hemispheric, see-through display reveals images, sounds, and movement in a head-mounted system. Its hemispheric virtual immersion gives users a transparent sensation of being covered with water without getting wet.

Water



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VisiPhone

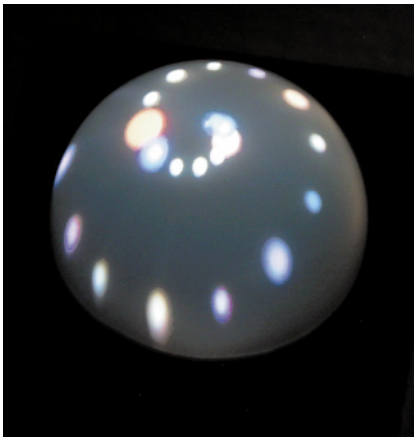
VisiPhone

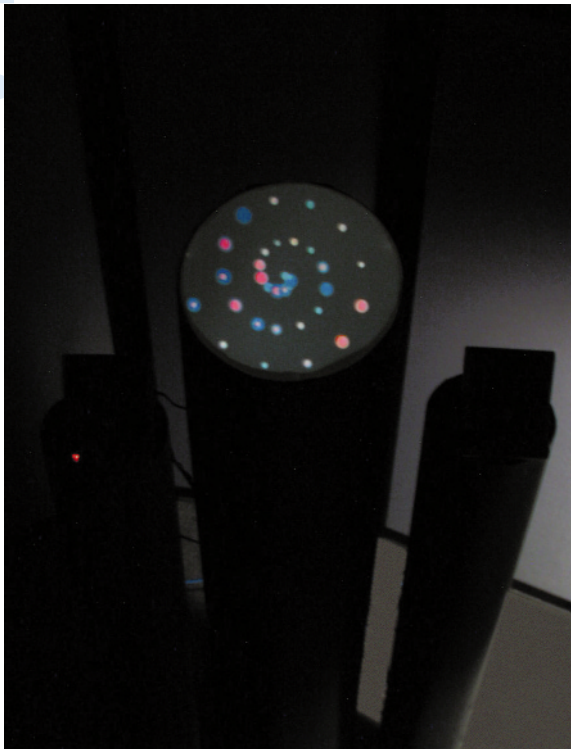
Visiphone is a communication object that opens a visual and auditory portal through space by visualizing the sounds flowing between two places. A continuous audio connection between two distant locations brings the inhabitants closer, allowing them to talk informally and easily. Yet using audio alone has disadvantages. It is difficult in a noisy environment, to know if one's voice has carried or if others are speaking at the other end. Furthermore, long periods of silence make it easy to forget the device, which then takes on a quality of covert surveillance.

VisiPhone's graphical rendering of the audio brings greater continuity and expressiveness to this connection. It portrays the existence of the connection even in moments of silence and it expresses the dynamics and inflections of conversation originating in both locations.

This rendering is evocative rather than technical; our goal in building the VisiPhone has been to create an aesthetic object that enhances sociable awareness.

More information about our research can be found at:
www.media.mit.edu/~fviegas/visiphone.html





Two different experimental VisiPhone interfaces: podium display (left) and dome display (right).

The abstract graphics convey incoming as well as outgoing audio messages on both ends of the connection.

metaField Maze

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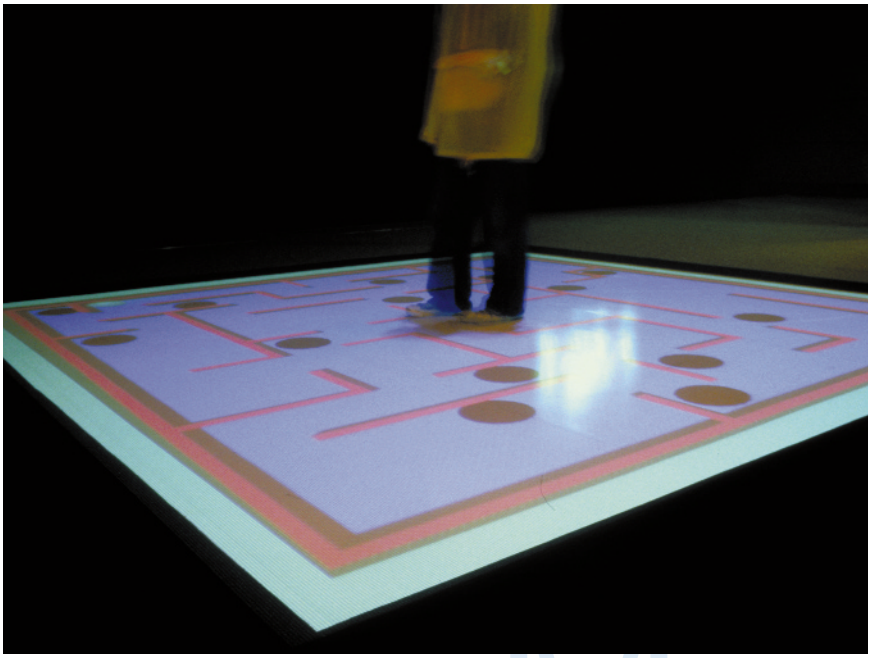
In this familiar maze game, a marble rolls on a flat surface, its direction determined by two knobs that control the level on perpendicular axes. The surface is crisscrossed with a network of passages separated by shallow barriers and is accented here and there with the dreaded holes that swallow the marble and end the game. The conventional version of this game, which sits on a table top or precariously on your lap, prompts the question: What are the ideal dimensions and controls for engaging in this activity?

A 3D model of the maze is projected onto a human-scale interactive projection floor with an imaginary pivot point at the center. The model tilts, seemingly under the weight of the players, according to where they stand on the game surface. As the projected surface tilts, the marble moves through the maze and appears to obey the laws of gravity.

Human-scaled interactive systems succeed when a tight feedback loop is established between the actions of the player and computer-generated images and sounds. The metaField Maze achieves this by providing a fast-paced, continuous activity that demands skillful initiative. A game strategy is developed intuitively, and the player's entire body is used to express it by moving frenetically over the full surface without any specific orientation. This ambi-directional, kinetic quality hints at the elusive feeling of being inside a computer application and is enhanced by the slight tilting of the computer-generated model. The uncanny effect of challenging the player's sense of balance further contributes to a heightened sense of immersion.



Maze

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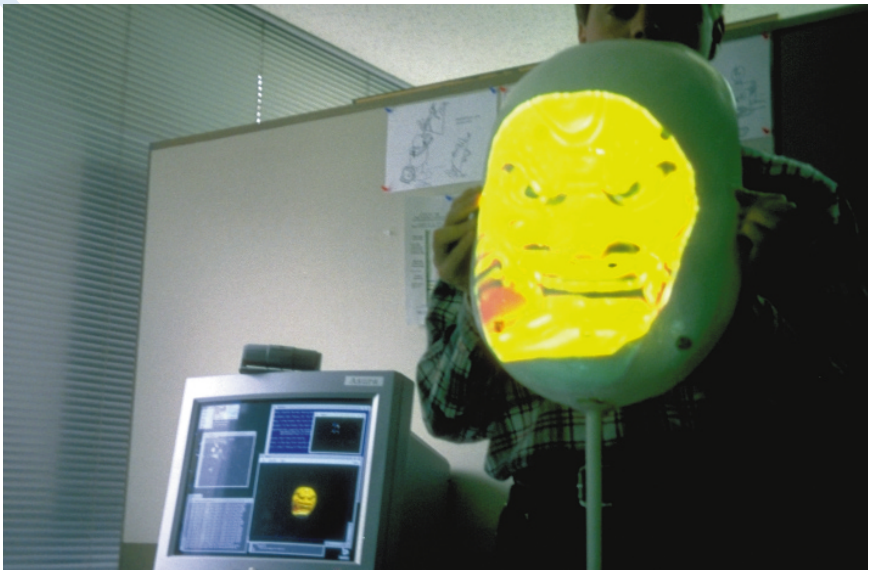
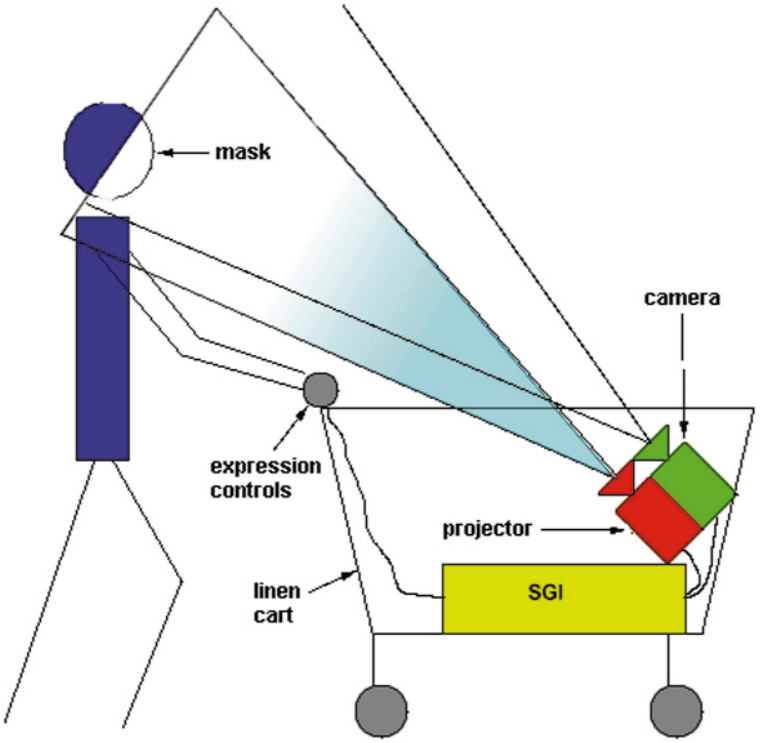
HyperMask: Virtual Reactive Faces for Storytelling

HyperMask projects an animated face onto a physical mask that is worn by an actor. As the mask moves within a prescribed area (the stage), its position and orientation are detected by a camera, and the computed projected image moves accordingly. If the orientation of the mask changes, the projected image changes with respect to the viewpoint of the audience. The lips of the projected face are automatically synchronized in real time with the voice of the actor, who also controls the face's expressions.

As a theatrical tool, HyperMask enables a new style of storytelling. In the Millennium Motel, a self-contained system in a linen cart projects onto the mask worn. The actor pushes the cart and portrays a chambermaid ("Millie") who tells amusing stories set in the motel.



The prototype HyperMask system, as used in a live performance of Mujina, a Japanese ghost story.



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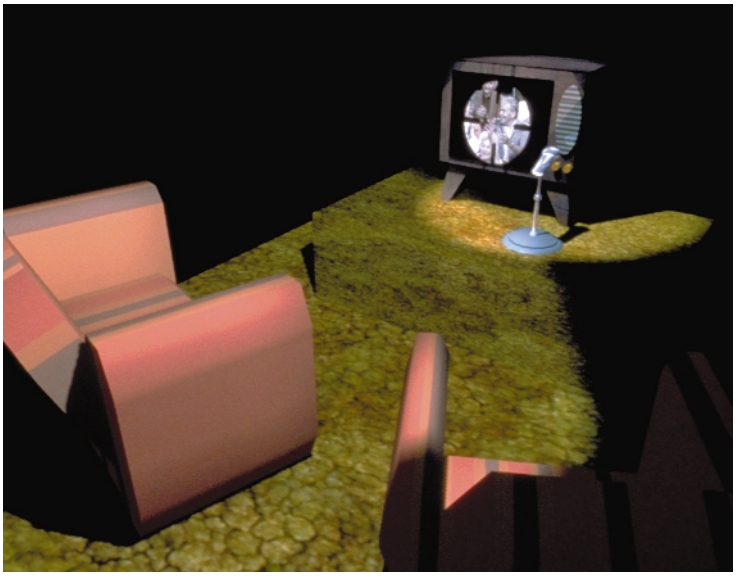
"...TV has, some feel, introduced a kind of rigor mortis into the body politic."
Marshall McLuhan(Understanding Media, 1964)

Viewers confront a living room environment that contains a video display playing live-broadcast programs. The television imagery is overlaid with cross hairs within a circle, giving the impression that viewers are separated from the programs by a viewing scope When viewers move within the installation, the audio and video fade out, and the cross hairs recede into a black screen followed by text that requests viewers to remain still. The television imagery and sound resume only after all viewers within the installation have remained motionless for at least five seconds. Each time the television program is switched off in response to viewers' movements, different text messages are provided on the screen, such as "Please Remain Still" or "Just Relax."



TV

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Digital Cloning System

The Digital Clone is a 3D, realistic "human" digital character that appears on screen with the look and feel of a live actor. A state-of-the-art facial tracking and animation system tracks the motion of an actor on a live set (without a cumbersome motion capture suit) and drives the movement of a 3D digital character. The Digital Clone is then composited into the live action.

Digital W.C. Fields

Digital Marlene Dietrich

Cloning

City of News

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This immersive, interactive, and dynamically growing 3D web browser fetches and displays URLs to form skyscrapers and alleys of text and images that participants visit as if they were exploring an urban landscape of information. The system starts with a wireframe floor map of a chosen city or area. As participants follows paths, a virtual 3D Web-based world of information is built dynamically. *City of News* takes advantage of human abilities to remember the surrounding 3D spatial layout, helps participants recall and group information. And it invites them to create mental associations between information and geography as if they were living in a customized memory palace.

City of News is presented with two technologies:

1. A projected map of the chosen location. Participants walk on the map and trigger dynamic growth of a 3D Web World by walking along areas of interest. The sensing system is an untethered, wireless, real-time computer vision system that tracks position and gesture.

2. A wearable computer that allows participants to physically wander through the Millennium Motel. Based on their location, the wearable computer uses a combination of micro display, wireless spread spectrum, and embedded RISC processors to deliver text, graphics, sound, and video information.

The entire system is fabricated using soft modular packaging bonded with flexible interconnections. The electronic systems are highly integrated into a comfortable lining for use with a vest or jacket. They convert the wearer into a mobile internet node.