2005 Spring

# HOME2020

School of Architecture | Carnegie Mellon University

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### Vision

The agenda set at the start of the class was as follows:

For decades, science fiction—from The Jetsons to Blade Runner— projected the intelligent building, the smart home, the responsive house. Today these visions are on this verge of reality. With technologies in play and more on the way—sensors, microprocessors, wireless networking, flat displays, now we ask: Can we design our built environment, blending physical and virtual worlds, to make life better?

The Home 2020 Studio X will propose a vision for digital life in the near future. We'll create a prototype to illustrate this vision. We'll operate as a design/build studio: our full-scale building will demonstrate the ideas we develop.

### Class

Home2020 | Class

Home 2020 was an interdisciplinary class, open to anyone willing to meet the challenges of sculpting a vision of tomorrow. The course consisted of studio time, lectures, class discussions and meetings. Students were encouraged to share their thoughts and feelings about course projects in a constructive, supportive environment. Together the students and the professors set the pace and the objectives of the class.

#### Assignment

Progress in the class was dictated by weekly assignments. Some assignments required students to build a project from start to finish in one week's time. The demanding assignments forced students to work under strict deadlines and improvise to the best of their abilities to create projects as affordable and functional as possible. There was no shame in dumpster-diving for supplies – the more materials a team could find, the more money they could save. These activities and assignments prepared students for the challenges of funding and building full-scale prototypes for the final project.

#### Scenario



On the first day of class, after a few rounds of name games and icebreakers, students assembled into groups from different majors to complete the first assignment. Each team was asked to write a scenario that would take place in the home-of-the-future. Students were encouraged to make the scenario as fantastic as possible, ignoring financial and technological limitations.

Teams focused on different activities and areas of the home, from the kitchen to the bedroom and everywhere in between. Most of the teams envisioned modular urban housing, anticipating population trends over the next 15 years. Many scenarios revolved around optimizing storage space and creating multifunctional rooms. Each team predicted that the home itself would do more to accommodate the needs of its residents.

### **Cardboard Furniture**

With one week, teams of students were expected to decide on a piece of furniture, scavenge for materials and create a functional prototype. This was the first opportunity for members of the class to see the different visions, skills and backgrounds present in this highly interdisciplinary course. The furniture was displayed in a gallery space as if it were priceless (recycled) modern art. There were lamps and chairs, sofas and tables and even a clothing valet. Everyone took turns testing and using each piece; some furniture withstood the rough play, while others folded under the pressure. Despite a few cracks and tears, the entire project was a success.



**Cardboard Funiture gallery room**: furniture was displayed in a gallery space. There were lamps and chairs, sofas, tables and a clothing valet.

#### Phase I



**PIMP Couch (Plush Interactive Multi-media Pimpin' Couch)**: it is designed to enhance any evening at home, either alone or with guests.

Students were asked to design a working prototype of something found in the home-of-the-future. The class produced a "Pimp Couch," smart cook top, weather-sensitive windows, ceiling storage units, and a sensor-loaded kid's play cube, to name a few. With only a week to plan and assemble materials, the projects brought to class involved a lot of "magic." In order to deliver a good demonstration in time, some of the teams had to resort to "Wizard of Oz" tactics to create the illusion of high-tech gadgetry.

#### make it work

In the second phase of this assignment the teams were asked to take some of the "magic" out of the projects and create genuine working prototypes. The smart features became smarter, and the moving parts began to move without human hands pulling the strings. This assignment gave students a chance to test their ingenuity and learn new skills to produce sophisticated products on a tight deadline.

### Phase II



**lucky7 blinds:** it is a voice controlled barrier. Commands such as "open all the way" and "close a little" control the position of the blades to allow more or less light, air, or visibility.

#### the Booth

Carnegie Mellon's Spring Carnival was the launching pad for our home-of-the-future. Each year a major part of the spring festival is Booth, a competition where different campus organizations construct full-scale structures that house games and prizes for visitors to enjoy.

Although the class elected not to compete, the Home 2020 booth was still judged and required to meet all the guidelines. The restrictions and deadlines of the Booth competition imposed a rigorous schedule as well as a number of specific building constraints. However, the forum of Carnival allowed the class to showcase its vision to an audience of over a thousand people in three days.



the Booth: our Home2020 booth in Carnegie Mellon's Spring Carnical

#### the Structure



A small team composed primarily of architecture students designed a versatile space that could be constructed mostly off-site. The structure was fabricated from uncut, untreated lumber and nylon-reinforced plastic. The booth had a front entrance ramp and a rear-side exit, providing a clear path through the space. Although the outer envelope of the booth was a cube, the interior featured a boat hull-like cage that hung from the ceiling as an architectural feature. There were no windows because the plastic skin allowed a surprising amount of light into the structure.

#### the Environmental Award

This eco-friendly, budget-conscious design won Home 2020 the Environmental Award in the Booth Competition. Virtually all of the materials used in the booth were preserved for future construction projects.

## Lighting

Home2020 | Lighting

The plastic skin around the structure was intended to allow light into the booth during the day and act as a lantern at night. The evening lighting effects were created by a team of students who used strategicallyplaced LED lamps to create a vibrant and colorful ambiance at night. While other booths were hidden in shadows, Home 2020's glowed with soft, changing colors.



Lighting; lighting with plastic skin of the booth at night

### **Ceiling Wings**

Home2020 | Ceiling Wings

One feature of the booth that never really got off the ground was a trio of gossamer wings affixed to the ceiling of the booth. The wings were designed to rise and fall as visitors passed through the space to create a dynamic interior. Although the team behind the wings couldn't resolve technical difficulties before the end of Carnival, children used the unintended manual override and flapped the wings with all their might.



**Ceiling Wings:** the wings were designed to rise and fall as visitors passed through the space to create a dynamic interior

#### **The Photo-Finger-Painting Station**

One of the most successful projects was a digital finger-painting exhibit that utilized a touch screen monitor, courtesy of 3M, and a wall-mounted digital camera. As visitors touched the screen with tentative tapping or rapid, sweeping strokes, they uncovered a stylized image of themselves. Over the course of Carnival the installation captured over a thousand images of curious kids and surprised adults.



The Photo-Finger-Painting Station: as visitors touched the screen with tentative tapping or rapid, sweeping strokes, they uncovered a stylized image of themselves

#### **The Furniture**



Hoberman Chair: Visitors could adjust the height by turning a crank on its side.

Not everything in the booth involved electronics. Two of the most successful and inviting installations were the Hoberman Chair and the Mooove Stoools. Both projects used fundamental concepts of design to create seating that inspired interaction. Visitors could adjust the height of the Hoberman Chair by turning a crank on its side. As the crank turned the Hoberman Sphere surrounding the base of the chair would expand and collapse to demonstrate the movement of the structure. The Mooove Stoools, four stools tied together, could move in different directions to encourage conversation with different visitors along the row of seats. Children loved pushing the stools around the floor and spinning the tops. The stools did not often lend themselves to seated conversation, but they were in constant motion.



**Mocove Stoools:** four stools tied together, could move in different directions to encourage conversation with different visitors along the row of seats.

#### The Intelligent Light

Another highly interactive installation in the booth was the intelligent light mounted on the wall adjacent to a 15" LCD touch screen. Visitors could control the robotic light fixture by moving their fingers across the display. With precise direction, they could change the color, pattern and position of a beam of halogen or laser light in real-time. Visitors could also tap buttons on the display to activate a strobe effect or a green laser spirograph. This project was a favorite for high school and college students who enjoyed seeing their movements on the touch screen translate into moving light in physical space.



**Intelligent Light:** Visitors could control the robotic light fixture by moving their fingers across the display.

#### The Tele-presence tables

Home2020 | Tables

In an effort to think outside the box an ambitious group of students created a pair of matching tables with a matrix of lights and sensors on the tops. Any shadows cast on one table would be generated as a fuzzy warm glow on the other. The tables operated wirelessly and could be placed at opposite ends of the booth, allowing for long-distance non-verbal communication.



The Tele-presence tables: any shadows cast on one table would be generated as a fuzzy warm glow on the other.

#### **The Smart Countertop**

Home2020 | Countertop

Everyone's home-of-the-future must have a smart kitchen to make domestic chores easier and Home 2020 met that expectation with a smart countertop. When visitors placed RFID tagged food items on the designated readers, the countertop would provide recipes that included those ingredients. This exhibit was popular with parents who were looking for ways to cook a wider variety of meals while spending less time in the kitchen.



**The Smart Countertop:** When visitors placed RFID tagged food items on the designated readers, the countertop would provide recipes that included those ingredients.

#### The Glow-stick art

Home2020 | Glow-stick

Another curious interactive art piece in the booth combined glow-sticks and motion capture software to create an ever-changing image on a textured canvas. The bright colors of the glow-sticks were tracked by a camera and represented with blotches of colors and solid lines on the opposite wall of the booth. Though this exhibit was less than intuitive because patrons struggled to find the camera in relation to the image, everyone loved the glow-sticks. This take-away item provided visitors with a souvenir and free advertising for the booth.



The Glow-stick art: The bright colors of the glow-sticks were tracked by a camera and represented with blotches of colors and solid lines on the opposite wall of the booth.

#### **The Retrospective Video**

Home2020 | Video

The booth also featured film montage titled Yesterday's Visions of Tomorrow. The video contained clips from the 40s, 50s, and 60s that demonstrated the future projections of those decades. There were four categories: transportation, communication, home and robots. Many of the visions captured in the films have become features of everyday life, like phones with speed-dialing and cars with automatic transmissions. Other visions haven't quite made it into the home, but they may not be too far off. For instance, one of the videos showed a smart kitchen that could do all the cooking for you as well as a robot that took care of the housework.



**Yesterday's Visions of Tomorrow:** the video contained clips from the 40s, 50s, and 60s that demonstrated the future projections of those decades.

Some of the clips were very serious, while others were highly entertaining. By far the most popular clip featured a woman singing and dancing in her kitchen-of-tomorrow, where she was "free to have fun around the clock." The combination of music, color and fantastic innovation always drew a smile from the visitors.

#### **Opening Day**

Home2020 | Opening Day

Opening day arrived while the Home 2020 booth was still *in medias res*. Nothing was working: the plastic wall covering let in too much light, creating glare on the digital screens inside the booth. Several of the projects were not yet installed, and the majority of installed projects were not ready for public viewing. It looked as though the booth would never be open to the public, but after special allowances from the Carnival Committee and several gallons of midnight oil burned by the professors and students, the projects and the booth slowly came together. By Friday morning, the glare had been reduced by shifting the location of various projects and most were working and ready for the public.



Inside Booth in Opening Day

#### Reactions

But the public was not entirely ready for the booth. Visitors were often intimidated by the technology and didn't know what to make of several of the exhibits. Compared to the other booths, Home 2020 was an odd duck, to say the least. Although everything displayed was meant to be played with, there wasn't a specific game, as there was in every other booth. Also, the booth did not intentionally follow that year's Carnival theme: How Things Work, yet the highly technical and mechanical nature of the exhibits turned out to be a perfect fit.



Children played with Mooove Stoools

Students staffing the booth transformed in to liaisons between the outside world and our unexpected world of tomorrow. Once visitors got the proper introduction, the booth became a major success. Guests lingered inside to play with each feature of the booth, even those that were not fully functioning. Soon comfortable patrons were showing new visitors how different projects worked.



People played with The Photo-Finger-Painting Station.

#### The Aftermath

Home2020 | Aftermath

When the dust settled and the booth had been torn down there was still more to do. Many of the projects including the structure itself had not met all of their intended goals. Each team was asked to showcase their project and explain its strengths and weakness and the improvements that should be done, were the project to continue. The final projects were presented before a guest panel of architecture and HCI professors who gave insight and guidance to further develop the students' ideas. The course ended with stronger visions for the home-of-the-future (or at least the booth-of-the-future).

#### The Future: Home 2021?

Although Home 2020 did not achieve the vision illustrated in the introduction of the course, the students and professors did manage to create a built environment that showcased futuristic applications of technology and design. The booth became a pavilion of gadgets and architectural oddities. However, every decision that went into, on or around the booth was prompted by a present-day need.

In 15 years technology will no doubt have an even greater presence in our lives and in our homes. Who knows, we may have smart countertops and undulating ceilings. Regardless of what the future holds for 2020, the visions of the class will remain in the memories of hundreds of imaginative children and confused adults. Was the class a success? Yes, because it challenged students to expand their conception of the "world of tomorrow" and take action to shape that world for the better.

### **Thank Yous**

3M Touch Systems CMU Carnival Committee CMU School of Architecture CMU School of Drama (Lighting, Todd Brown) Enkeboll Foundation National Science Foundation ITR Grant: Computational Construction Kits and Craft LumiLEDs

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#### http://code.arc.cmu.edu/home-2020

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